UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
KURUKSHETRA UNIVERSITY, KURUKSHETRA
('A+' Grade, NAAC Accredited)

SCHEME OF EXAMINATIONS FOR
MASTER OF TECHNOLOGY IN
ELECTRONICS & COMMUNICATION ENGINEERING

(W. E. F. SESSION: 2018-19)

SEMESTER- I

S. No.	Course Code	SUBJECT	L	T	P	Total	Minor Test	Major Test	Cr.	Dur. of Exam (Hrs.)
1	MTEC-101	RF and Microwave Circuit Design	3	-	-	3	40	60	3	3
2	MTEC-103	Wireless & Mobile Communications	3	-	-	3	40	60	3	3
3	*	Program Elective –I	3	-	-	3	40	60	3	3
4	**	Program Elective-II	3	-	-	3	40	60	3	3
5	MTEC-117	RF and Microwave Circuit Design(Lab.)	-	-	4	4	40	60	2	3
6	MTEC-119	Wireless & Mobile Communications (Lab.)	-	-	4	4	40	60	2	3
7	MTRM-111	Research Methodology and IPR	2	-	-	2	40	60	2	3
8	***	Audit Course-I	2	-	-	2	100	-	0	3
	TOTAL		**16**	**0**	**8**	**24**	**280**	**420**	**18**	
							700			

*Program Elective - I		**Program Elective- II	
MTEC-105	Advanced Communication Networks	MTEC-111	Cognitive Radio
MTEC-107	Pattern Recognition and Machine Learning	MTEC-113	Wireless Sensor Networks
MTEC-109	Statistical Information Processing	MTEC-115	High Performance Networks

*** Audit Course-I	
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*** **Note2:**Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

SEMESTER-II

S. No.	Course code	Subject	L	T	P	Total	Minor Test	Major Test	Cr.	Dur. of Exam (Hrs.)
1	MTEC-102	Antennas and Radiating Systems	3	-	-	3	40	60	3	3
2	MTEC-104	Advanced Digital Signal Processing	3	-	-	3	40	60	3	3
3	*	Program Elective-III	3	-	-	3	40	60	3	3
4	**	Program Elective-IV	3	-	-	3	40	60	3	3
5	MTEC-118	Antennas and Radiating Systems Lab		-	4	4	40	60	2	3
6	MTEC-120	Advanced Digital Signal Processing Lab	-	-	4	4	40	60	2	3
7	# MTEC-122	Mini Project	-	-	4	4	100	-	2	3
8	***	Audit Course-II	2			2	100	-	0	3
	TOTAL		**14**		**12**	**26**	**340**	**360**	**18**	
							700			

*Program Elective - III		**Program Elective - IV	
MTEC-106	Satellite Communication	MTEC-112	Optimization Techniques
MTEC-108	Internet of Things	MTEC-114	MIMO System
MTEC-110	Voice and Data networks	MTEC-116	Programmable Networks – SDN, NFV

*** Audit Course - II	
MTAD-102	Constitution of India
MTAD-104	Pedagogy Studies
MTAD-106	Stress Management by Yoga
MTAD-108	Personality Development through Life Enlightenment Skills.

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*****Note2:**Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

#Note3: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

SEMESTER-III

S. No.	Course Code	Subject	L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	*	Program Elective-V	3	-	-	3	40	60	3	3
2	**	Open Elective	3	-	-	3	40	60	3	3
3	MTEC-207	Dissertation Part-I	-	-	20	20	100	-	10	3
		TOTAL	**6**		**20**	**26**	**180**	**120**	**16**	
							300			

*Program Elective - V	
MTEC-201	Adaptive Filter Theory
MTEC-203	Optical Networks
MTEC-205	Remote Sensing

**Open Elective		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER-IV

S. No.	Course Code		L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	MTEC-202	Dissertation Part-II	-	-	32	32	100	200	16	3
	TOTAL						**300**		**16**	

Total credits of all four semesters – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTEC-101	RF and Microwave Circuit Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand the behavior of RF passive components and model active components. Perform transmission line analysis and demonstrate use of Smith Chart for high frequency circuit design.*						
CO2	*Able to analyze the microwave resonators, filters, couplers etc.*						
CO3	*Analyze the microwave solid state devices such as diodes and Transistors.*						
CO4	*Able to design and analyze the microwave amplifiers.*						

Unit 1

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning. Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 2

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.Nonlinearity and Time Variance, Inter-symbol interference, random process &noise,definition of sensitivity and dynamic range, conversion gain and distortion.

Unit 3

Microwave Semiconductor Devices and Modeling: PIN diode, Tunnel diodes, Varactordiode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

Unit 4

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain andnoise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

References:

1) Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", Author House, 2009.
2) D.M.Pozar, " Microwave Engineering" ,Wiley, 4th edition, 2011.
3) R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
4) G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.
5) S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987. Radmanesh, "RF and Microwave Electronics Illustrated" , Pearson Education, 2004.

MTEC-103	Wireless & Mobile Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques*						
CO2	*Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.*						
CO3	*Analyze path loss and interference for wireless telephony and their influences on a mobile-communication system's performance.*						
CO4	*Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology, understanding upcoming technologies like 3G, 4G etc.*						

Unit 1

Cellular Communication Fundamentals:Cellular system design, Frequency reuse, cellsplitting, handover concepts, Co channel and adjacent channel interference, interference reductiontechniques and methods to improve cell coverage, Frequency management and channel assignment.GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE,

Unit 2

Spectral efficiency analysis based on calculations for Multiple access technologies:TDMA,FDMA and CDMA,Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas.Wireless network planning (Link budget and power spectrum calculations)

Unit 3

Mobile Radio Propagation:Large Scale Path Loss, Free Space Propagation Model,Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.Equalization, Diversity:Equalizers in a communications receiver, Algorithms for adaptiveequalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Unit 4

Code Division Multiple Access:Introduction to CDMA technology, IS 95 systemArchitecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4Gstandard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

References:

1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
2. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
3. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
4. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
5. AshaMehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997.

MTEC-105	Advanced Communication Networks						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	*Understand advanced concepts in Communication Networking.*						
CO2	*Design and develop protocols for Communication Networks.*						
CO3	*Optimize the Network Design.*						
CO4	*Understand the different versions of Internet Protocol*						

Unit 1

Overview of Internet-Concepts, challenges and history.Overview of -ATM. TCP/IPCongestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.Real Time Communications over Internet. Adaptive applications.Latency and throughputissues.Integrated Services Model (intServ).Resource reservation in Internet.RSVP.Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP).Leaky bucket algorithm and its properties.

Unit 2

Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed serviceconnections. GPS, WFQ and Rate proportional algorithms.High speed scheduler design.Theoryof Latency Rate servers and delay bounds in packet switched networks for LBAP traffic;Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of activequeue management.

Unit 3

IP address lookup-challenges. Packet classification algorithms and Flow Identification-Grid of Tries, Cross producting and controlled prefix expansion algorithms.Admission control in Internet.Concept of Effective bandwidth.Measurement basedadmission control.Differentiated Services in Internet (Diff Serv).Diff Serv architecture and framework.

Unit 4

IPV4, IPV6, IP tunnelling, IP switching and MPLS, Overview of IP over ATM and itsevolution to IP switching.MPLS architecture and framework.MPLS Protocols. Traffic engineering issues in MPLS.

References:

1. Jean Wairand and PravinVaraiya, "High Performance Communications Networks", 2nd edition, 2000.

2. Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Veriag, 2001.

3. Zhang Wang, "Internet QoS", Morgan Kaufman, 2001.

4. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach" , Morgan Kaufman Publishers, 2004.

5. George Kesidis, "ATM Network Performance", Kluwer Academic, Research Papers, 2005.

MTEC-107	Pattern Recognition and Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Study the parametric and linear models for classification Design neural network and SVM for classification.						
CO2	Develop machine independent and unsupervised learning techniques.						
CO3	Understand programming algorithms						
CO4	Understand machine learning and clustering						

Unit 1

Introduction to Pattern Recognition: Problems, applications, design cycle, learning andadaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis**Linear models:** Linear Models for Regression, linear regression, logistic regression LinearModels for Classification

Unit 2

Neural Network: perceptron, multi-layer perceptron, backpropagation algorithm, error surfaces,practical techniques for improving backpropagation, additional networks and training methods, Adaboost, Deep Learning

Unit 3

Linear discriminant functions - decision surfaces, two-category, multi-category, minimum-squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Unit 4

Algorithm independent machine learning – lack of inherent superiority of any classifier, biasand variance, re-sampling for classifier design, combining classifiers
Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering,hierar
chical clustering

References:

1) Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & Sons, 2001.
2) Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

MTEC-109	Statistical Information Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.						
CO2	Demonstrate mathematical modelling and problem solving using such models.						
CO3	Comparatively evolve key results developed in this course for applications to signal processing, communications systems.						
CO4	Develop frameworks based in probabilistic and stochastic themes for modelling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.						

Unit 1

Review of random variables: Probability Concepts, distribution and density functions,moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete &Continuous Random Variables.
Random process: Expectations, Moments,Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Unit 2

Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model &its applications ,Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-aryHypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing.Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test ,Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate , Multiple Parameter Estimation Best Linear Unbiased Estimator ,Least-Square Estimation Recursive Least-Square Estimator.

Unit 3

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging theperiodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.
Information Theory and Source Coding: Introduction, Uncertainty, Information andEntropy, Source coding theorem, Huffman, ShanonFano , Arithmetic , Adaptive coding , RLE , LZW Data compaction, , LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Unit 4

Application of Information Theory: Group, Ring & Field, Vector, GF addition,multiplication rules. Introduction to BCH codes, Primitive elements ,Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes,& Decoder, Reed- Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.

References:

1) Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes",4th Edition, McGraw-Hill, 2002.
2) D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
3) MouradBarkat , "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
4) R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968. . J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New
5) York, North-Holland, 1977.

6) Rosen K.H, “Elementary Number Theory”, Addison-Wesley, 6th edition, 2010.

MTEC-111	Cognitive Radio						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand the fundamental concepts of cognitive radio networks.*						
CO2	*Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.*						
CO3	*Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.*						
CO4	*Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimisation techniques for better spectrum exploitation.*						

Unit 1

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture,functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit 2

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborativesensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convexprogramming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit 3

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radioarchitectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit 4

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading,radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross-layer design for cognitive radio networks.

References:

1) EkramHossain, DusitNiyato, Zhu Han, “Dynamic Spectrum Access and Management in Cognitive Radio Networks”, Cambridge University Press, 2009.
2) Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & Sons Ltd., 2009.
3) Bruce Fette, “Cognitive radio technology”, Elsevier, 2nd edition, 2009.
4) HuseyinArslan, “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2007.
5) Francisco Rodrigo Porto Cavalcanti, SorenAndersson, “Optimizing Wireless Communication Systems” Springer, 2009.
6) Linda Doyle, “Essentials of Cognitive Radio”, Cambridge University Press, 2009.

MTEC-113	Wireless Sensor Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Design wireless sensor network system for different applications under consideration.*						
CO2	*Understand the hardware details of different types of sensors and select right type of sensor for various applications.*						
CO3	*Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.*						
CO4	*Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms and able to handle special issues related to sensors like energy conservation and security challenges.*						

Unit 1

Introduction and overview of sensor network architecture and its applications, sensornetwork comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun

SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit 2

Programming tools: C, nesC. Performance comparison of wireless sensor networkssimulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit 3

Overview of sensor network protocols (details of atleast 2 important protocol per layer):Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Unit 4

Data dissemination and processing; differences compared with other database managementsystems, data storage; query processing.Specialized features: Energy preservation and efficiency; security challenges; fault-tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

References:

1) H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.
2) C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1st Indian reprint, 2010.
3) F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1st Indian reprint, 2013.
4) YingshuLi, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology, 2008.

MTEC-115	High Performance Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.*						
CO2	*Design, implement, and analyze computer networks.*						
CO3	*Identify, formulate, and solve network engineering problems.*						
CO4	*Show knowledge of contemporary issues in high performance computer networks. Use techniques, skills, and modern networking tools necessary for engineering practice*						

Unit 1

Types of Networks, Network design issues, Data in support of network design. Networkdesign tools, protocols and architecture. Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, and RSVP-differentiated services.

Unit 2

VoIP system architecture, protocol hierarchy, Structure of a voice endpoint, Protocols forthe transport of voice media over IP networks.Providing IP quality of service for voice, signaling protocols for VoIP, PSTN gateways, VoIP applications.VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Unit 3

Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poissonmodels, Network performance evaluation.Network Security and Management: Principles of cryptography, Authentication, integrity,key distribution and certification, Access control and fire walls, attacks and counter measures, security in many layers.

Unit 4

Infrastructure for network management, The internet standard management framework –SMI, MIB, SNMP, Security and administration, ASN.1.

References:

1) Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill, 1993.
2) Larry Peterson & Bruce David, "Computer Networks: A System Approach", Morgan Kaufmann, 2003.
3) Douskalis B., "IP Telephony: The Integration of Robust VoIP Services", Pearson Ed. Asia, 2000.
4) Warland J., Varaiya P., "High-Performance Communication Networks", Morgan Kaufmann, 1996.
5) Stallings W., "High-Speed Networks: TCP/IP and ATM Design Principles", Prentice Hall, 1998.
6) Leon Garcia, Widjaja, "Communication networks", TMH 7threprint 2002.
7) William Stalling, "Network security, essentials", Pearson education Asia publication, 4th Edition, 2011.

MTEC-117	RF and Microwave Circuit Design (Lab.)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Learn to use HFSS (High Frequency Structural Simulator) to simulate, verify, and optimize their design.						
CO2	Learn to fabricate RF and Microwave circuits and then measure, and evaluate their prototype of Network Analyzer.						

List of Experiments:

1. To learn through demonstration the Radio-Frequency Characteristics of Components.
2. To Design, Characterize, fabricate and test the Microstrip Line.
3. To Design, Characterize,fabricate and test Wilkinson Power Divider.
4. To Design, Characterize, fabricate and test Hybrid Network.
5. To Design, Characterize, fabricate and test Phase Shifter.
6. To Design, Characterize, fabricate and test Microwave Filters.
7. To Design and Characterize Coaxial Cavity Resonator.
8. To study Impedance Matching and Tuning Techniques for microwave circuits.
9. To design and characterize Directional Coupler.
10. To study Characteristics of Gunn Diode.

MTEC-119	Wireless & Mobile Communications(Lab.)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Understanding Cellular concepts, GSM and CDMA networks						
CO2	To study GSM handset by experimentation and fault insertion techniques						
CO3	Understating of 3G communication system by means of various AT commands usage inGSM						
CO4	Understanding CDMA concept using DSSS kit						

List of Experiments:

1. Introduction to LabVIEW/MATLAB/SciLab with its basic functions and study of modulation toolkit.
2. Learn how to Perform Basic Arithmetic and Boolean operations, Maximum and Minimum of an Array, Flat and Stacked sequence, Bundle and Unbundle cluster.
3. Design and verify the MSK modulator.
4. Design and verify the MSK demodulator
5. Design and verify the FSK modulator.
6. Design and verify the FSK demodulator.
7. Design and verify the BPSK modulator.
8. Design and verify the BPSK demodulator.
9. Design and verify the QPSK modulator.
10. Design and verify the QPSK demodulator
11. Design and verify the QAM modulator.
12. Design and verify the QAM demodulator.

MTRM-111	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and databases.Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTEC-102	Antennas and Radiating Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Compute the far field distance, radiation pattern and gain of an antenna for given current distribution and study antenna parameters.*						
CO2	*Design and analyze linear wire and linear array antennas.*						
CO3	*Design antennas and antenna arrays for various desired radiation pattern characteristics.*						
CO4	*Able to design and analyze different types of Microstrip antenna.*						

Unit 1

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Arrayantennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna.
Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Unit 2

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite lengthdipole, half wave dipole, Ground effects.Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non-uniform current.LinearArrays: Two element array, N Element array: Uniform Amplitude and spacing,Broadside and End fire array, Super directivity, Planar array, Design consideration.

Unit 3

Aperture Antennas: Huygen's Field Equivalence principle, radiation equations,Rectangular Aperture, Circular Aperture.Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introductionto MIMO.

Unit 4

Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis,Rectangular Patch, Circular Patch.

References:

1) Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2) John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.
3) R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

MTEC-104	Advanced Digital Signal Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To understand theory of different filters and algorithms						
CO2	To understand theory of multirate DSP, solve numerical problems and write algorithms						
CO3	To understand theory of prediction and solution of normal equations						
CO4	To know applications of DSP at block level.						

Unit-1

Review of Filter concepts- Review of design techniques and structures for FIR and IIR filters, representation of numbers, quantization of filter coefficients, round-off effects in digital filters.

Unit-2

Multirate Digital Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, sampling rate conversion by rational factor I/D, implementation of sampling rate conversion, multistage implementation of sampling rate conversion, sampling rate conversion of band pass signals, sampling rate conversion by an arbitrary factor, application of Multirate signal processing, digital filter bank, two-channel quadrature-mirror filter bank, M-channel QMF bank.

Unit-3

Wavelet Transform: Introduction to wavelet transform- Short Time Fourier Transform (STFT), Wavelet transform, Haar wavelet and Multirate resolution analysis, Daubechies wavelet, some other standard wavelets, applications of wavelet transform.

Unit-4

Power Spectrum Estimation: Estimation of spectra from finite-duration observation of signals, non-parametric methods for power spectrum estimation, parametric methods for power spectrum estimation, filter bank methods, Eigen analysis algorithms for spectrum estimation.

Text Books:

1. Digital Signal Processing : Principles, Algorithms, and Applications, 4/e, Authors : John G. ProakisDimitris G Manolakis Imprint : Pearson Education
2. Digital Signal Processing, Authors, Oppenheim, Alan V, Schafer, Ronald W., PHI

Reference Books:

1. Advanced Digital Signal Processing, Authors: Dr. Shaila D. Apte, Imprint: Wiley
2. Digital Signal Processing, 3/e, Authors: S.K.Mitra, Imprint : McGraw Hill
3. Digital Signal Processing and Applications with the TMS 320C6713 and TMS 320C6416 DSK, 2/e,Authors: RulphChassaing,DonaldReay, Imprint : Wiley
4. Digital Signal Processing, Authors: Tarun Kumar Rawat, Imprint: Oxford
5. Digital Signal Processing, Spectral Computation and Filter Design, Authors:CHI-Tsong Chen, Indian Edition, Imprint: Oxford
6. Theory and Applications of Digital Signal Processing,Authors: Lawrence R. Rabiner, Bernard Gold,Imprint:Prentice- Hall
7. Digital Signal Processing, Authors:Thomas J. Cavicchi, Imprint: Wiley
8. Modern Digital Signal Processing,Authors:V.Udayshankar,Imprint:PHI
9. Digital Signal Processing using MAT and Wavelets,2/e,Authors:MichaelWeeks,Imprint: Jones & Bartlett Publishers.

MTEC-106	Satellite Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Visualize the architecture of satellite systems as a means of high speed, high range communication system.						
CO2	State various aspects related to satellite systems such as orbital equations,						
CO3	Understand sub-systems in a satellite, link budget, modulation and multiple access schemes.						
CO4	Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.						

Unit 1

Architecture of Satellite Communication System: Principles and architecture of satelliteCommunication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Unit 2

Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee andPerigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

Unit 3

Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite systemsuch as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub-system.Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects,remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Unit 4

Satellite link budget: Flux density and received signal power equations, Calculation ofSystem noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.Modulation and Multiple Access Schemes used in satellite communication.Typicalcasestudies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.

References:

1. S. K. Raman, "Fundamentals of Satellite Communication", PearsonEducation India, 2011. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.
2. Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

MTEC-108	Internet of Things						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand what IoT technologies are used for today, and what is required in certain scenarios.*						
CO2	*Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.*						
CO3	*Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.*						
CO4	*Understand operating system requirements of IOT.*						

Unit 1

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networkingconcepts, Ipv4 and IPV6.Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoTcommunications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

Unit 2

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edgeresource pooling and caching, client side control and configuration.

Unit 3

Smart objects as building blocks for IoT, Open source hardware and Embedded systemsplatforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.

Unit 4

Operating systems requirement of IoT environment, study of mbed, RIoT, andContikioperating systems, Introductory concepts of big data for IoTapplications.Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectorsusingIoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

References:

1) A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
2) CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011. Samuel Greenguard, "Internet of things", MIT Press, 2015.

Web resources:

1) http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html
2) https://developer.mbed.org/handbook/AnalogIn
3) http://www.libelium.com/50_sensor_applications
4) M2MLabs Mainspring http://www.m2mlabs.com/framework Node-RED http://nodered.org/

MTEC-110	Voice and Data Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Protocol, algorithms, trade-offs rationale.*						
CO2	*Routing, transport, DNS resolutions*						
CO3	*Understand different Queuing models of Networks*						
CO4	*Network extensions and next generation architectures.*						

Unit 1

Network Design Issues, Network Performance Issues, Network Terminology, centralizedand distributed approaches for networks design, Issues in design of voice and data networks.Layered and Layer less Communication, Cross layer design of Networks, Voice Networks(wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit 2

Data Networks and their Design, Link layer design- Link adaptation, Link LayerProtocols, Retransmission.Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Unit 3

Queuing Models of Networks, Traffic Models , Little's Theorem, Markov chains, M/M/1and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks.

Unit 4

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting ,Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery,Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in PacketNetworks. Network Calculus, Packet Scheduling Algorithms.

References:

1) D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
2) L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.
3) Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.
4) Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
5) Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.
6) Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, 1993.
7) Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

MTEC-112	Optimization Techniques						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand importance of optimization*						
CO2	*Apply basic concepts of mathematics to formulate an optimization problem*						
CO3	*Analyze and appreciate variety of performance measures for various optimization problems*						
CO4	*Understand Genetic algorithm and particle swarm Optimization.*						

Unit 1

Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers. Linear Programming Problem, Simplex method, Two-phase method, Big-M method, Duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

Unit 2

Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.

Unit 3

Multi Variable and Constrained Optimization Technique, Optimality criteria, Direct search Method, Simplex search methods, Hooke-Jeeve'spatternsearch method, Powell's conjugate direction method, Gradient based method, Cauchy's Steepest descent method, Newton's method, Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method.

Unit 4

Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) – Example Problems

References:

1) S. S. Rao, "Engineering Optimization: Theory and Practice", Wiley, 2008.
2) K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall, 2005.
3) Mohan, C. and Deep, K.: "Optimization Techniques", New Age India Pvt. Ltd., 2009
4) Belegundu, A. D. and Chandrupatla, T. R. "Optimization Concepts and Applicationsin Engineering", Pearson Education Pvt. Ltd., 2002
5) D. E. Goldberg, "Genetic algorithms in Search, Optimization, and Machine learning", Addison-Wesley Longman Publishing, 1989.

MTEC-114	MIMO Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Understand channel modelling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems, multi-user communications, multi-user MIMO and diversity techniques.						
CO2	Understand equalising MIMO systems and pre-distortion in MIMO system						
CO3	Understand cooperative and coordinated multi-cell MIMO, introduction to MIMO in 4G (LTE, LTE-Advanced, WiMAX).						
CO4	Perform Mathematical modelling and analysis of MIMO systems.						

Unit 1

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems,MIMO vs. multi-antenna systems.Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, TheAlamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation.

Unit 2

The generic MIMO problem, Singular Value Decomposition, Eigenvalues andeigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Pre-distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre-coding and combining, Channel state information.

Codebooks for MIMO, Beamforming, Beamforming principles, Increasedspectrumefficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer

Unit 3

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatialmultiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

Unit 4

Channel Estimation, Channel estimation techniques, Estimation and tracking, Trainingbased channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

References:

1) Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design",Academic Press, 1st edition, 2010.
2) MohinderJanakiraman, “Space - Time Codes and MIMO Systems”, Artech House Publishers, 2004.

MTEC-116	Programmable Networks - SDN, NFV						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand advanced concepts in Programmable Networks.*						
CO2	*Understand Software Defined Networking, an emerging Internet architectural framework. Implement the main concepts, architectures, algorithms, protocols and applications in SDN and NFV.*						
CO3	*Understand Programming for SDNs.*						
CO4	*Understand Network topologies.*						

Unit 1

Introduction to Programmable Networks, History and Evolution of Software DefinedNetworking (SDN), Fundamental Characteristics of SDN, Separation of Control Plane and Data Plane, Active Networking.Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basicsofOpenFlow protocol.

Unit 2

Network Virtualization: Concepts, Applications, Existing Network VirtualizationFramework, Mininet A simulation environment for SDN.Control Plane: Overview, ExistingSDN Controllers including Floodlight andOpenDaylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts. Data Plane: Software-based and Hadrware-based; Programmable Network Hardware.

Unit 3

Programming SDNs: Northbound Application Programming Interface, Current Languagesand Tools, Composition of SDNs. Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

Unit 4

Data Center Networks: Packet, Optical and Wireless Architectures, NetworkTopologies.Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

References:

1) Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", O'Reilly Media, August 2013.
2) Paul Goransson, Chuck Black, Timothy Culver. "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Publishers, 2016.
3) Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, 2014.
4) Vivek Tiwari, "SDN and OpenFlow for Beginners", Amazon Digital Services, Inc., ASIN: , 2013.
5) Nick Feamster, Jennifer Rexford and Ellen Zegura, "The Road to SDN: An Intellectual History of Programmable Networks" ACM CCR April 2014.
6) Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015. OpenFlow standards, http://www.openflow.org, 2015.

MTEC-118	Antennas and Radiating Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Determine specifications, design, construct and test antenna.						
CO2	Explore and use tools for designing, analyzing and testing antennas. These tools include Antenna design and analysis software, network analyzers, spectrum analyzers, and antenna pattern measurement techniques.						

List of Experiments:

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Simulation of Microstrip Antenna.
10. Case study.

MTEC-120	Advanced Digital Signal Processing Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Design different digital filters in software*						
CO2	*Apply various transforms in time and frequency Perform decimation and interpolation*						

List ofExperiments:

1. Write a program for cascade and parallel realization of an FIR transfer function.
2. Write a program for cascade and parallel realization of an IIR transfer function.
3. Write a program to design a Butterworth IIR Band Pass Filter.
4. Write a program to design an FIR filter using various window functions.
5. Write a program to implement the interpolation and decimation.
6. Write a program to design two channels QMF Bank.
7. Write a program to compute the CWT.
8. Write a program to compute the DWT.
9. Write a program to design a wavelet filter.
10. Write a program to find the magnitude response of a wavelet.

MTEC-201	Adaptive Filter Theory						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	To understand the concepts of estimation, normal equations and linear models.						
CO2	To understand Stochastic-Gradient Algorithms and Steady-State Performance of Adaptive Filters.						
CO3	To analyze the tracking and transient performance od adaptive filters.						
CO4	Understanding of RLS and various QR Algorithms.						

Unit-1

Introduction:-Variance of a random variable, Estimation: Given No Observations, Given Dependent Observations, Complex and Vector Cases, Normal Equations, Design Examples, Linear Models and applications. Minimum-Variance Unbiased Estimation and applications.

Steepest-Descent Algorithms:- Steepest-Descent Method, Transient Behavior, Iteration-Dependent Step-Sizes, Newton's Method.

Unit-2

Stochastic-Gradient Algorithms:- LMS Algorithm and applications, Normalized LMS Algorithm, Non-Blind Algorithms, Blind Algorithms and properties, Affine Projection Algorithms, Ensemble-Average Learning Curves.

Steady-State Performance of Adaptive Filters:- Performance Measures, Stationary Data Model, Fundamental Energy-Conservation Relation, Fundamental Variance Relation, Mean-Square Performance of LMS and ε-NLMS.

Unit-3

Tracking Performance of Adaptive Filters:-Non-stationary Data Model, Fundamental Energy-Conservation Relation, Fundamental Variance Relation, Tracking Performance of LMS and ε-NLMS.

Transient Performance of Adaptive Filters:-Data Model, Data-Normalized Adaptive Filters, Weighted Energy-Conservation Relation, Weighted Variance Relation, Transient Performance of LMS and ε-NLMS.

Unit-4

Recursive Least-Squares:-RLS Algorithm, Exponentially-Weighted RLS Algorithm, RLS Array Algorithms: Square-Root Factors, Norm and Angle Preservation, Motivation for Array Methods, RLS Algorithm, Inverse QR Algorithm, QR Algorithm, Extended QR Algorithm.

Text Books

1) "Fundamentals of Adaptive Filtering" by Ali H. Sayed, John Wiley and Sons.
2) "Adaptive Filter Theory" by S. Haykin, Pearson India.

Reference Books

1) "Adaptive Filters Theory and Applications", by B. Farhang-Boroujeny, John Wiley and Sons.
2) "Linear Estimation" by Kailath&Sayed, PHI
3) "Adaptive Filters" by Ali H. Sayed, John Wiley and Sons.

MTEC-203	Optical Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Contribute in the areas of optical network and WDM network design.*						
CO2	*Implement simple optical network and understand further technology developments for future enhanced network.*						
CO3	*Able to understand the importance of Network Survivability in modern age*						
CO4	*Understand the Network access techniques*						

Unit- 1

SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol labelswitching.

WDM network elements: optical line terminals and amplifiers, optical add/dropmultiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

Unit- 2

Control and management: network management functions, optical layer services andinterfacing, performance and fault management, configuration management, optical safety.

Unit -3

Network Survivability: protection in SONET/SDH & client layer, optical layer protectionschemes, WDM network design: LTD and RWA problems, dimensioning wavelength routingnetworks, statistical dimensioning models.

Unit- 4

Access networks: Optical time division multiplexing, synchronization, header processing,buffering, burst switching, test beds, Introduction to PON, GPON, AON.

References:

1) Rajiv Ramaswami, Sivarajan, Sasaki, “Optical Networks: A Practical Perspective”, MK, Elsevier, 3 rd edition, 2010.

2) C. Siva Ram Murthy and Mohan Gurusamy, “WDM Optical Networks: Concepts Design, and Algorithms”, PHI, EEE, 2001.

MTEC-205	Remote Sensing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles;*						
CO2	*Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.*						
CO3	*Understand Microwave Scattering and Imaging System*						
CO4	*Understand Concepts of Thermal and Hyper Spectral Remote Sensing*						

Unit 1

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmannedspacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT,SPOT,IRS,INSAT,IKONOS,QUICKBIRD etc.

Unit 2

Photographic products, B/W, color, color IR film and their characteristics –resolvingpower of lens and film -Opto mechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery -calibration of thermal scanners.

Unit 3

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 4

Thermal and Hyper Spectral Remote Sensing: Sensors characteristics-principle ofspectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications.Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signalto noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification– Principles of LiDAR, Aerial Laser Terrain Mapping.

References:

1) Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition
2) John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 2nd Edition, 1995.
3) John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999.
   Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.
4) Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.
5) Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman& Co, 1978.

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost.Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment.Strategies for Survival.Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation.Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep&Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes.Work ethics, Indian vision of humanism.Moral and non- moral valuation.Standards and principles.Value judgements.

Unit 2

Importance of cultivation of values.Sense of duty.Devotion, Self-reliance.Confidence, Concentration.Truthfulness, Cleanliness.Honesty, Humanity.Power of faith, National Unity.Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude.Positive Thinking.Integrity and discipline.Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith.Self-management and Good health.Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development.*						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.Strength and nature of the body of evidence for effective pedagogical practices.Pedagogic theory and pedagogical approaches.Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	**Stress Management by Yoga**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yogasan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; ShrimadBhagwadGeeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; ShrimadBhagwadGeeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; ShrimadBhagwadGeeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Dissertation Part – I and Dissertation Part - II

	Dissertation Part-I (MTEC-207) and Dissertation Part-II (MTEC-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:
The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:
Relevance to social needs of society
Relevance to value addition to existing facilities in the institute
Relevance to industry need
Problems of national importance
Research and development in various domain

The student should complete the following:
Literature survey Problem Definition
Motivation for study and Objectives
Preliminary design / feasibility / modular approaches
Implementation and Verification
Report and presentation
The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:
Experimental verification / Proof of concept.
The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part - II
As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.
The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.
The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.
Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.
Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.
During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.
Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
KURUKSHETRA UNIVERSITY, KURUKSHETRA

('A+' Grade, NAAC Accredited)

SCHEME OF EXAMINATIONS FOR
MASTER OF TECHNOLOGY IN
ELECTRICAL ENGINEERING (w. e. f. 2018-19)

SEMESTER-I										
Sr. No.	**Course Code**	**SUBJECT**	L	T	P	**Total**	**Minor Test**	**Major Test**	**Cr.**	**Duration of Exam (Hrs.)**
1	MTEL-101	Advanced Power System Analysis	3	-	-	3	40	60	3	3
2	MTEL-103	Advanced Instrumentation & Control	3	-	-	3	40	60	3	3
3	*	Program Elective-I	3	-	-	3	40	60	3	3
4	**	Program Elective-II	3	-	-	3	40	60	3	3
5	MTEL-117	Instrumentation & Control Lab	-	-	4	4	40	60	2	3
6	MTEL-119	Advanced Power System Lab-I	-	-	4	4	40	60	2	3
7	MTRM-111	Research Methodology and IPR	2	-	-	2	40	60	2	3
8	***	Audit Course-I	2	-	-	2	100	-	-	-
		Total	**16**		**8**	**24**	**280**	**420**	**18**	

SEMESTER-I

* PROGRAM ELECTIVE – I		
1.	MTEL-105	Renewable Energy Resources
2.	MTEL-107	Power Electronics Applications in Renewable Energy
3.	MTEL-109	Smart Grid
**** PROGRAM ELECTIVE - II**		
1.	MTEL-111	Bio-Medical Signal & Image Processing
2.	MTEL-113	Advanced Digital Signal Processing
3.	MTEL-115	Bio-Medical Instrumentation

*** AUDIT COURSE – I		
1.	MTAD-101	English for Research Paper Writing
2.	MTAD-103	Disaster Management
3.	MTAD-105	Sanskrit for Technical Knowledge
4.	MTAD-107	Value Education

Note: 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

2. *** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

SEMESTER-II

Sr. No.	Course Code	Subject	L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	MTEL-102	Advanced Power System Protection	3	-	-	3	40	60	3	3
2	MTEL-104	Intelligent Control	3	-	-	3	40	60	3	3
3	*	Program Elective-III	3	-	-	3	40	60	3	3
4	**	Program Elective-IV	3	-	-	3	40	60	3	3
5	MTEL-118	Modeling & Simulation Lab	-	-	4	4	40	60	2	3
6	MTEL-120	Advanced Power System Lab-II	-	-	4	4	40	60	2	3
7	#MTEL-122	Mini Project	-	-	4	4	100	-	2	3
8	***	Audit Course-II	2	-	-	-	100	-	-	-
		Total	**14**		**12**	**26**	**340**	**360**	**18**	

***PROGRAM ELECTIVE - III**		
1.	MTEL-106	HVDC Transmission & FACTS Devices
2.	MTEL-108	Transients in Power System
3.	MTEL-110	Advanced Power Distribution & Automation

****PROGRAM ELECTIVE – IV**		
1.	MTEL-112	Digital Control System
2.	MTEL-114	Advanced Microprocessors
3.	MTEL-116	Reliability Engineering

***** AUDIT COURSE–II**		
1.	MTAD-102	Constitution of India
2.	MTAD-104	Pedagogy Studies
3.	MTAD-106	Stress Management by Yoga
4.	MTAD-108	Personality Development through Life Enlightenment Skills

Note 1**:**.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

Note 2: *** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

#Note3: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/ information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

SEMESTER-III

Sr. No.	Course Code	Subject	L	T	P	Total	Minor* Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	*	Program Elective-V	3	-	-	3	40	60	3	3
2	**	Open Elective	3	-	-	3	40	60	3	3
3	MTEL-207	Dissertation Part-I	-	-	20	20	100	-	10	--
		Total	**6**		**20**	**26**	**180**	**120**	**16**	

*** PROGRAM ELECTIVE - V**		
1.	MTEL-201	Distributed Generation
2.	MTEL-203	Advanced Electric Drives & Control
3.	MTEL-205	Power System Restructuring & Deregulation

**** OPEN ELECTIVE**		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operation Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER-IV

Sr. No.	Course Code		L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	MTEL-202	Dissertation Part-II	-	-	32	-	100	200	16	--
						Total	**100**	**200**	**16**	

Total Credits – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTEL-101	Advanced Power System Analysis						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	To enable students to analyse power system networks, various faults, load flow study, security and contingency analysis.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand matrices related to power system and its formation with different methods.						
CO2	Understand how to analyze various types of faults in power system						
CO3	Study various methods of load flow and their advantages and disadvantages						
CO4	Understand need of power system security, state estimation and contingency analysis						

UNIT1

Network Modelling: System graph, loop, cut set and Incidence matrices, Primitive network and matrix, Formation of various network matrices by singular transformation.
Bus Impedance Algorithm: Singular transformation, direct inspection, Building Block algorithm for bus impedance matrix, Addition of links, addition of branches, (considering mutual coupling).

UNIT2

Balanced and unbalanced network elements: Representation of three phase network elements, representation under balanced and unbalanced excitation, transformation matrices, symmetrical components, sequence impedances, unbalanced elements and three phase power invariance.
Short circuit studies: Network representations for single line to ground fault, line to line fault, LL-G fault, and 3-phase faults, Short circuit calculations for various types of faults in matrix form.

UNIT3

Load flow studies: Load flow and its importance. Classification of buses, load flow techniques, Iterative solutions and computer flow charts using Gauss-Seidel and Newton-Raphson methods, Decoupled and fast decoupled methods, Representation of regulating and off nominal ratio transformers and modification of Y_{bus}.

UNIT4

Power system security: Introduction to Power system security, Addition and removal of multiple lines, network reduction for contingency analysis, current injection, shift destitution factor, single outage contingency analysis.
State estimation in power systems: data acquisition system, Method of least-squares, State estimation by weighted least square technique.

Suggested Books:

1. Stagg G W, El-Abaid A H, “Computer methods in Power system analysis”, McGraw Hill.
2. Singh L P, “Advanced Power System Analysis and Dynamics”, New Age, Int. Publication.
3. Ramana N V, “Power System Analysis”, Pearson Education.
4. Nagsarkar T K, Sukhija M S, “Power System Analysis”, Oxford University Press.
5. Uma Rao K, “Computer Techniques and Models in Power System”, IK Publications.
6. Grainger J J, Stevenson W D, “Power System Analysis”, McGraw Hill.
7. Allen Wood, Bruce Wollenberg, “Power Generation operation & control”, John Wiley & Sons.
8. Nagrath I J, Kothari D P, “Power System Engineering” McGraw Hill, New York.
9. Pai M A, “Computer Techniques in Power System Analysis”, 2nd Edition, TMH-New Delhi.

MTEL-103	Advanced Instrumentation & Control						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	This course will look at different types of Instruments with their controls.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand different types of **Instruments** with their applications.						
CO2	Understand basics of smart Sensor with their advantages ,disadvantages and applications						
CO3	To emphasize and analysis of Virtual Instruments.						
CO4	To study different types of VI structures						

Unit 1

Transducers: Introduction, Characteristics and Classifications of electrical transducers, measurement of displacement, Force, pressure, speed, temperature and intensity of light using different electrical transducers, advantages, disadvantages and applications of transducers

. Unit 2

Smart Sensors: Introduction, architecture of smart sensor, optical sensor, microelectronic sensor, chemical, Bio Sensor and Physical Sensor, piezo-resistive pressure sensor, fibre optic temperature sensor, light sensor, advantages, disadvantages and applications of smart sensors.

Unit 3

Virtual Instrumentation: Introduction, architecture of VI, Evaluation and architecture of VI, conventional Virtual Instrumentation, Advantage of Lab View, Software Environment, Creating and Saving VI, front Panel and block diagram Tool Bar, Palettes, front panel control and indicators, block diagram: Terminals, Nodes, Functions, Sub VI, Data Flow Program.

Unit 4

VI Structures: Control structures, selection structures, case structures, Sequence structures, formula node, array, single and multi-dimensional array, auto indexing, clusters, creating clusters control and indicators, data plotting.

Suggested Books:

1. Johnson G W, “Lab VIEW Graphical Programming”, Second edition, McGraw Hill.

2. Kring J & Travis J, “LabVIEW for everyone”, Prentice Hall, New Jersey.

3. James K, “PC Interfacing and Data Acquisition”, Elsevier.

4. Jerome J, “Virtual Instrumentation using Lab View”, Prentice Hall, India.

MTEL-105	Renewable Energy Resources						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of renewable energy resources and different factors related to them.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about renewable energy resources and solar power system.						
CO2	To acquaint students with the phenomenon of wind power system and its applications with grid.						
CO3	To impart knowledge to students about geothermal and ocean power system.						
CO4	To let student understand fuel cell, hydrogen and hybrid energy system.						

Unit 1

ENERGY RESOURCES: Renewable energy sources, distributed energy systems and dispersed generation, atmospheric aspects of electric energy generation, Impact of renewable energy generation on environment

SOLAR ENERGY: Solar Radiation and its Measurement, Solar Thermal Energy Collectors: different types of collectors and their performance analysis, Solar Thermal Energy Conversion System: solar water heater, solar distillation, slat thermal power plant and various applications of solar system, Solar Photovoltaic System: solar cell, VI characteristics, solar electricity and grid and off-grid solar system.

Unit 2

WIND ENERGY: Wind turbines and rotors, Wind Energy Extraction, Wind Characteristics, Power Density Duration Curve, Design of Wind Turbine Rotor, Design of Regulating System for Rotor, Wind Power Generation Curve, Sub-systems of a Horizontal Axis Wind Turbine Generator, Modes of Wind Power Generation, Estimation of Wind Energy Potential, Selection of Optimum Wind Energy Generator (WEG), Grid Interfacing of a Wind Farm, Methods of Grid Connection, Grid System and Properties, Capacity of Wind Farms for Penetration into Grid, Control System for Wind Farms, Economics of Wind Farms

Unit 3

GEOTHERMAL ENERGY: Structure of the Earth's Interior, Plate Tectonic Major Test, Geothermal Sites, Geothermal Field, Geothermal Gradients, Geothermal Resources, Geothermal Power Generation, Geothermal Electric Power Plant, Geothermal-Preheat Hybrid with Conventional Plant

OCEAN ENERGY: Development of a Tidal Power Scheme, Grid Interfacing of Tidal Power, Wave Energy, Mathematical Analysis of Wave Energy, Empirical Formulae on Wave Energy, Wave Energy Conversion, Principle of Wave Energy plant, Wave Energy Conversion Machines.

Unit 4

FUEL CELLS: Principle of Operation of Fuel Cell, Fuel Processor, Fuel Cell Types, Energy Output of a Fuel Cell, Efficiency, and EMF of a Fuel Cell, Operating Characteristics of Fuel Cells, Thermal Efficiency of Fuel Cell

HYDROGEN ENERGY SYSTEM: Hydrogen Production, Hydrogen Storage, Development of Hydrogen Cartridge, Gas Hydrate

HYBRID ENERGY SYSTEMS: Hybrid Systems AND ITS Types, Electric and Hybrid Electric Vehicles, Hydrogen-Powered-Electric Vehicles.

Suggested Books:

1. Kothari DP, Singal KC, Ranjan Rakesh, “Renewable energy sources and emerging technologies, 2nd ed, Prentice Hall (India)
2. Rai G D, “Non-Conventional Sources of Energy, Khanna Publishers.
3. Bansal N K, Kleemann M, Heliss M, “Renewable energy sources and conversion technology”, McGraw Hill Education.
4. Abbasi S A, Abbasi N, “Renewable energy sources and their environmental impact”, PHI.
5. Mittal KM, “Renewable energy Systems”, Wheelar Publishing.
6. Mukherjee D, “Renewable energy Systems”, New Age International.

MTEL-107	Power Electronics Applications in Renewable Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the application of power system in renewable energy resources.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about power electronics devices and DC-DC converters.						
CO2	To acquaint students with the modern power electronics converters.						
CO3	To impart knowledge to students about power electronics interface devices for solar energy.						
CO4	To let student understand wind energy interfacing devices.						

Unit1

Review of Power Devices: SCR, BJT, MOSFET, IGBT, GTO, Safe operating Limits, Selection of devices for various applications.

Phase controlled Converters: (1-φ&3-φ) thyristor fed half controlled, fully controlled and Dual converters with inductive and motor load.

DC to DC converters: Analysis of various conduction modes of Buck, Boost, Buck-Boost.

Unit2

Modern Power Electronic Converters: Basic concepts of VSI, single phase half bridge, full bridge and three phase bridge inverters, PWM modulation strategies, Sinusoidal PWM, Space vector modulation, Selective Harmonic Elimination method, other inverter switching schemes, blanking time, Current source inverters.

Unit3

Design of Power Electronics Interfaces for Solar PV: Solar PV technologies, MPPT, Design of DC-DC converters for MPPT, MPPT algorithms, Implementation of MPPT control through DSP controllers. Topologies for grid connected and standalone applications: single phase and three phase systems, Single stage and multistage, isolated and non-isolated.

Unit4

Power Electronics Interfaces for WES: Topologies of WES, design considerations for wind energy Switch rectifier/inverter system, Power Converters for Doubly Fed Induction Generators (DFIG) in Wind Turbines.

Power Electronics Interfaces for Fuel Cells: Types of fuel cells, Proton Exchange Membrane (PEM) fuel cell: features and operational characteristics, Design of DC-DC converters for PEM fuel cell, MPPT in Fuel Cell.

Suggested Books:

1. Mohan N, Undel and T M, Robbins W P, “Power Electronics, Converters, Applications & Design”, Wiley India Pvt. Ltd.
2. Bose B K, “Modern Power Electronics and AC Drives”, Pearson Education.
3. Joseph Vithayathil,“Power Electronics”, Tata McGraw Hil.
4. Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modelling, Control and Applications”, IEEE John Wiley Publications.
5. Solanki C S, “Solar Photo Voltaic”, PHI learning Pvt Ltd.

MTEL-109	Smart Grid						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of smart Grid and its advantages over conventional grid						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about Smart Grids and Appreciate the difference between smart grid & conventional grid						
CO2	To acquaint students with the phenomenon of smart metering concepts to industrial and commercial installations						
CO3	To impart knowledge to students about Formulate solutions in the areas of smart substations, distributed generation and wide area measurements						
CO4	To let student understand microgrid and related issues..						

UNIT-1

Introduction to Smart Grid, Evolution of Electric Grid Concept of Smart Grid, Definitions Need of Smart Grid, Concept of Robust & Self-Healing Grid, Present development & International policies in Smart Grid. Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources Power Quality Conditioners for Smart Grid

UNIT-2

Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS) Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation. Cyber Security for Smart Grid

UNIT-3

Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU)

UNIT-4

Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines Captive power plants, Integration of renewable energy sources

Suggested Books:

1. Keyhani A, “Design of smart power grid renewable energy systems”, Wiley IEEE.
2. Berger L T, Iniewski K, “Smart Grid: Applications, Communications and Security”, Wiley.
3. Gellings C W., “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press.
4. Ekanayake J B, Jenkins N, Liyanage K, Yokoyama A, “Smart Grid: Technology and Applications”, Wiley.
5. Borlase S, “Smart Grid: Infrastructure, Technology and solutions”, CRC Press.
6. Phadke A G, “Synchronized Phasor Measurement and their Applications”, Springer.

MTEL-111	Bio-Medical Signal & Image Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	This course will look at Biomedical signal and Image for understanding and their processing assessing						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand different types of biomedical signal and Identify and analyse different biomedical signals.						
CO2	Understand basics of Image processing and its methods						
CO3	To emphasize and analysis of Clustering and Classification						
CO4	To study different types of bio signals and their processing						

Unit-1

Signals and Biomedical Signal Processing: Introduction and overview, Analog, discrete and digital signals, Processing and transformation of signals, Signal processing for feature extraction, Characteristics of digital Images, Fourier transform: Properties of One-Dimensional Fourier Transform, Discrete Fourier Transform.

. Unit-2

Image Processing: Image filtering Enhancement and Restoration, Point processing, Mask processing: linear filtering in Space domain, Frequency-domain filtering, Smoothing and sharping filters in frequency domain, Wavelet transform, FFT to STFT, One-Dimensional Continuous and discrete Wavelet Transform, Image processing methods.

Unit-3

Clustering and Classification: Clustering versus Classification, Feature extraction, Biomedical and. Biological features, Signal and Image processing features, K-means: A Simple Clustering Method, study of different types of Classifiers for signal processing.

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Unit-4

Processing of Biomedical Signals: Electric activities of Cell, Electric data acquisition, Electrocardiogram: Signal of Cardiovascular system, Processing and feature extraction of ECG, Electroencephalogram, Signal of the brain, Processing and feature extraction of EEG, Electromyogram: Signal of muscles, Processing and feature extraction of EMG. Frequency and wavelet-domain analysis.

Suggested Books:

1.KayvanNajarian& Robert Splinter, “Introduction to Biomedical signal and Image Processing”, CRC Press
2.MetinAkay “Time Frequency & Wavelets in Biomedical Signal Processing”, Wiley-IEEE Press.
3. Amine Nait-Ali, “Advanced Biomedical Signal Processing”, Springer.

MTEL-113	Advanced Digital Signal Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of LTI system and designing of different types of Filters.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about LTI system and DFT.						
CO2	To acquaint students with the study and design of FIR filters.						
CO3	To impart knowledge to students about study and design of IIR filters.						
CO4	To let student understand the concept and design of adaptive digital filters and power spectrum estimation.						

UNIT-1

Introduction of DSP: Introduction to Signal Processing, Discrete Linear Systems, superposition Principle, UNIT-Sample response, stability & causality Criterion.

Fourier Transform & inverse Fourier transform: Frequency domain design of digital filters, Fourier transform, use of Fourier transform in Signal processing. The inverse fourier transform, sampling continuous function to generate a sequence, Reconstruction of continuous -time signals from Discrete-time sequences.

UNIT-2

Digital Filter Structure & Implementation: Linearity, time invariance & causality, the discrete convolution, the transfer function, stability tests, steady state response, Amplitude & Phase Characteristics, stabilization procedure, Ideal LP Filter, Physical reliability & specifications. FIR Filters, Truncation windowing & Delays, design example, IIR Filters: Review of design of analog filters & analog frequency transformation. Digital frequency transformation. Design of LP filters using impulse invariance method, bilinear transformation, Phase equalizer, digital all pass filters.

UNIT-3

Implementation of Filters: Realization block diagrams, Cascade & parallel realization, effect of infinite-word length, transfer function of degree 1&2, Sensitivity comparisons, effects of finite precision arithmetic on Digital filters.

UNIT-4

DFT & FFT & Z transform with Applications: Discrete Fourier transform, properties of DFT, Circular Convolution, Fast Fourier Transform, Realizations of DFT. The Z-transform, the system function of a digital filter, Digital Filter implementation from the system function, the inverse Z- transform, properties & applications, Special computation of finite sequences, sequence of infinite length & continuous time signals, computation of Fourier series & time sequences from spectra.

Suggested Books:

1. J G Proakis, “Digital Signal Processing using Matlab”, Pearson Education.
2. Alam V. Oppenheim and Ronald W. Schafer, “Digital Signal Processing” Pearson Education.
3. Rabiner & Gold, “Major Test& application of digital Signal Processing”, Pearson Education
4. Roman kuc, “Introduction to Digital Signal Processing,” Tata McGraw Hill Edition.
5. Richard G. Lyons, “Understanding Digital Signal Processing”, Pearson Education.
6. Paulo S. R. Diniz, Eduardo A. B. da Silva, Sergio L. Netto, “Digital Signal Processing: System Analysis and Design”, Springer.
7. Manolakis G Demitries, “Applied Digital Signal Processing”, Cambridge Univ. Press.

MTEL-115	Bio-Medical Instrumentation						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of different types of Biomedical Instruments with their controls.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the different types of biomedical transducer for signal measurement and recording.						
CO2	Understand basics of blood pressure, blood flow and respiratory system measurements.						
CO3	Understand the muscoskeletal and nervous system and their measurement.						
CO4	To emphasize and analysis of recent trends in biomedical Engg and safety measurement.						

Unit-1

Characteristics of Transducers and Electrodes for Biological Measurement: Introduction to human body, block diagram, classification, various physiological events and suitable transducer for their recording, bioelectric potentials.

Cardiac system: Cardiac musculature, Electro cardiography, ECG recording, phonocardiography, holter recording ECG lead system, Heart rate meter, vector cardiography, pacemakers,

Unit-2

Blood pressure and Blood flow measurement; Invasive and non-invasive methods of blood pressure, characteristics of blood flow and heart sound, Cardiac output measurement, Plethysmography.

Respiratory system: Mechanics or breathing, parameters of respiration, Respiratory system measurements, respiratory therapy instruments.

Unit-3

Muscoskeletal Systems; EMG, Clinical applications, Muscles stimulator, Instrumentation for measuring Nervous function; EEG signal, frequency band classification, Lead systems, EEG recording, Clinical applications of EEG signal, X-ray CT scan, MRI, PET.

Clinical Laboratory Instrumentation; Test on blood cell, Blood cell counter, Blood glucose monitors, auto analyzer, pulse-oximeter.

Unit-4

Recent Trends in Biomedical Engg: Patient care and monitoring, Non-invasive diagnostic instrumentation, biotelemetry, telemedicine, prosthetic devices, lie detector test, Application of lasers and ultrasonic in biomedical field.

Troubleshooting and Electrical safety of Biomedical instruments; Physiological effect of current and safety measurement.

Suggested Books:

1.W T Wester, J G Tompkins, “Design of Microprocessor based Medical Instrumentation”, Englewood cliffs

2.Tatsuo, Togato & Toshiya, “Biomedical transducers and instruments”, CRC Press

3. Joseph P Bronzino, “The Biomedical engineering handbook”, CRC Press

MTEL-117	Instrumentation & Control Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of how to create, simulate and measure the different applications in VI.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about mathematical, Boolean operations, half adder.						
CO2	Understand how to create the VI for decimal to binary conversion, array function, sequence structure. Also studying the properties and options of graphs/charts.						
CO3	To impart knowledge about measurement of temperature, strain and power using VI.						
CO4	Understand to create model for speed control of DC motor, analysis of PID controller.						

Following experiments (at least 10) are required to be performed in MATLAB/ETAP/LabView or equivalent:

1. Find addition, subtraction, multiplication and division of two numeric inputs
2. Perform various Boolean operations (AND, OR, NAND, NOR, XOR).
3. Add two binary bits and find the sum and carry (half adder).
4. Create a Vito find the decimal equivalent of a binary number using sub VI.
5. Create VI for studying array functions.
6. Create VI for studying sequence structure.
7. Create VI for studying properties and options of graphs/charts.
8. Measurement of Temperature using Virtual instrumentation.
9. Measurement of Strain using Virtual instrumentation.
10.ImplementationofVI to control the speed of a DC motor.
11.RealTime Power measurement and analysis using Virtual instrumentation.
12.Creating Models, Simulation and Analysis of PID Controller.
13. Study and Implementation of Displacement Transducers.

MTEL-119	Advanced Power System Lab-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of programing for various types of power system appliances.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about a program to develop Bus Admittance Matrix, power flow studies using Newton-Raphson and Gauss-Siedel method.						
CO2	Understand how to determine the generalized constants A, B, C, D of a long transmission line and voltage & current for three phase faults ona2-buspowersystem						
CO3	To impart knowledge about simulation and analysis of a single phase & three phase power system and generation, transmission & distribution in power system.						
CO4	To impart knowledge about simulation and analysis of different fault condition and contingency concept in a power system.						

Following experiments are required to be performed in MATLAB/ETAP/LabView or equivalent.

1. Write a program to develop Bus Admittance Matrix Y_{BUS}.
2. Write a program for the Power Flow Studies using N-R(Newton-Raphson) method.
3. Write a program for the power flow analysis of system using Gauss-Siedel Technique.
4. Determination of the generalized constants A, B, C, D of a long transmission line.
5. Determination of the voltage and current for three phase faults on a 2-bus power system.
6. Simulation and Analysis of a single phase & three phase power system.
7. Simulation & Analysis of generation, transmission & distribution in power system.
8. Simulation & Analysis of different fault condition in power system.
9. Simulation and Analysis of 9-bus power system.
10. Simulation and Analysis of contingency concept in a power system.

MTRM-111	Research Methodology and IPR						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTEL-102	Advanced Power System Protection						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of advanced protection system in modern power system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about need of protection system and various issues of CT and PT						
CO2	To acquaint students with the comparators and relays.						
CO3	To impart knowledge to students about distance protection and protection of feeders, generators and motors.						
CO4	To let student understand protection of transformers, buses and modern protection system.						

Unit1

Introduction: Need for protective systems, Zones of protection, classification of protective relays, electromechanical, solid state and digital relays, comparisons between different types of relays.
Current transformers and potential transformers: construction, operating principle and their performance

Unit2

Comparators: general equation of comparators, Analysis for amplitude comparator, analysis for phase comparator, duality between amplitude and phase comparators.
Over current relays, differential relays, operating and restraining characteristics, distance relays, impedance relays, reactance relays, and mho relay quadrilateral relays, elliptical relays, comparison with conventional relays.

Unit3

Distance protection: Principle of distance relaying, time grading of distance relays, schemes of distance protection, distance protection by impedance, reactance and mho relays, Effect of power swings on the performance of distance relays.
Pilot relaying schemes: Pilot wire protection, carrier current protection.
Protection of Generators and Motors: Types of faults, Stator and rotor protection against various types of faults.

Unit4

Protection of Transformers: Types of faults, differential protection schemes, harmonic restraint relay, over flux protection, Earthing transformer protection.
Bus Zone Protection: Types of Bus-bar faults, differential current protection frame leakage protection. Microprocessor based protective relays: Overcurrent relay, impedance relay, reactance relay, mho relay, microprocessor based distance relaying.
Application of artificial intelligence and wavelet transform in protective relays

Suggested Books:

1. TSM Rao, “Power System Protection–Static Relays”, Tata McGraw Hill Education Pvt. Ltd.
2. B. Bhalja, R P Maheshwari and N G Chothani, “Protection and Switchgear”, Oxford University Press.
3. Ravinder Nath & Chander, “Power System Protection and Switchgear”, New Age International Publishers.
4. Badri Ram & Vishwakarma, “Power system protection and switch gear” McGraw Hill Education(India)
5. C L Wadhwa, “Electrical Power Systems”, New Age International Publishers.
6. Protective Relays –Their Major Test and Practice Vol. I & II by W. Van Warrington.
7. Advanced power system analysis and dynamics by L P Singh: Wiley Eastern N. Delhi.
8. Digital Protection: Protective relay from Electro Mechanical to Microprocessor, L P Singh: Wiley Eastern.
9. Switchgear and protection by S S Rao: Khanna Pub

MTEL-104	Intelligent Control						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	This course will look at **different types of Intelligent controls.**						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand reasoning and apply the ANN models to different problems.						
CO2	Understand reasoning and apply the learning scheme to different problems.						
CO3	Understand reasoning and apply the Fuzzy system to different problems.						
CO4	Understand reasoning and apply the Genetic & PSO algorithm to different problems.						

Unit-1

ANN Models & Architecture:

Biological foundations, ANN models, Types of activation function, introduction to network architecture, multilayer feed forward network (MLFFN), Kohonen self-organizing map, radial basis Function network (RBFN), recurring neural network.

Unit-2

Learning Processes:

Supervised and unsupervised learning, error-correction learning, Hebbian learning, Boltzman learning, single layer and multilayer perception model, least mean square algorithm, back propagation algorithm, Application in forecasting and pattern recognition and other engineering problems.

Unit-3

Fuzzy Control System:

Fuzzy sets, fuzzy set operations, properties, membership functions, fuzzy to crisp conversion, measures of fuzziness, fuzzification and defuzzification methods, application in engineering problems. Simple fuzzy logic controllers with examples, special forms of fuzzy logic models, classical fuzzy control problems.

Unit-4

Genetic & PSO Algorithm:

Genetic Algorithm: Types of reproduction operators, crossover & mutation Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) - Graph Grammer Approach - Example Problems

Suggested Books:

1. M. T. Hagon, Howard B. Demuth and Mark Beale, “Neural Network Design”, PWS Publishing.

2. Jacek M Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House, Bombay.

3. Wasserman, “Neural Computing: Major Test and Practice”, Van Nastr and Reinhold.

4. Freeman “Neural Networks-Algorithms, application and programming techniques”, Pearson Education.

MTEL-106	HVDC Transmission & FACTS Devices						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of HVDC and FACTS devices.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about HVDC transmission system.						
CO2	To acquaint students with the interaction of AC and DC system and various links.						
CO3	To impart knowledge to students about facts devices.						
CO4	To let student understand compensation system and control techniques.						

Unit 1

HVDC Transmission: Development of HVDC Technology, Selection of converter configuration. Rectifier and Inverter operation. Control of HVDC converters and Systems.

Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

Unit 2

Interaction between HVAC and DC systems – Voltage interaction, over voltages on AC/DC side, Harmonic instability problems and DC power modulation.

Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

Unit 3

Introduction of Facts Concepts: Basic of flexible alternating current transmission system (FACTS) controllers, shunt, series, combined and other controllers, HVDC or FACTS, static VAR compensator (SVC) and static synchronous compensator (STATCOM), Static Synchronous Series Compensator (SSSC), Thyristor Controlled Series, Capacitor (TCSC). Solid State Contactors (SSC) and TSSC.

Unit 4

Combined Compensators: Introduction, Unified power flow controller (UPFC), conventional power control capabilities, real and reactive power flow control, comparison of UPFC to series compensators, control structure, dynamic performance. Interline power flow controller (IPFC) basic operating principles, control structure, application considerations.

Suggested Books:

1. Hingorani N.G, “Understanding FACTS (Concepts and Technology of Flexible AC Transmission System)”, Standard Publishers.
2. Song Y.H. and Johns A.T., “Flexible AC Transmission Systems”, IEEE Press.
3. Ghosh A. and Ledwich G., “Power Quality Enhancement using Custom Power Devices”, Kluwer Academic Publishers.
4. Mathur R.M. and Verma R.K., “Thyristor based FACTS controllers for Electrical Transmission Systems”, IEEE Press.
5. Bollen M.H.J., “Understanding Power Quality and Voltage Sag”, IEEE Press.
6. Padiyar K.R., “FACTS Controllers in Power Transmission and Distribution”, New Age International Publisher.
7. Miller T.J.E., “Reactive Power Control in Electric Systems”, John Wiley.
8. Kamakshaiah S, Kamaraju V, “HVDC Transmission”, McGraw Hill Education.

MTEL-108	Transients in Power System						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of transients in power system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about different types of factors effecting power quality.						
CO2	To acquaint students with the transients and lightning.						
CO3	To impart knowledge to harmonics.						
CO4	To let student understand about distributed generation and various issues related to power quality.						

UNIT-1

What is Power Quality, Power Quality is Equal to Voltage Quality, Why are we concerned about Power Quality, Voltage Imbalance, Waveform Distortion, Voltage Fluctuation, Power Frequency Variations, Power Quality Terms, Sources of Sags and Interruption, Estimating Voltage Sag Performance, Area of Vulnerability, Equipment Sensitivity of Voltage Sags, Transmission Systems Sag Performance Evaluation, Utility Distribution System Sag Performance Evaluation.

UNIT-2

Sources of Transient Overvoltage's: Capacitor Switching, Restrike during Capacitor Deenergizing, Lightning, Ferro - resonance, Other Switching Transients. Principles of Overvoltage Protection.

Devices for Overvoltage Protection: Surge Arresters and Transient Voltage Surge Suppressor, Isolation Transformers, Utility System Lightning Protection, Shielding, Line Arresters, Low Side Surges, Cable Protection, Scout Arrester Scheme, Computer Tools for Transient Analysis.

UNIT-3

Fundamentals of Harmonics: Harmonic Distortion, Voltage vs Current Distortion, Harmonics vs Transients, Power System Quantities Under Non Sinusoidal Conditions, Active, Reactive and Apparent Power, Power Factor: Displacement and True, Harmonic Phase Sequences, Triplen Harmonics.

Harmonic Sources from Commercial Loads: Single Phase Power Supplies, Fluorescent Lighting, Adjustable Speed Drives for HVAC and Elevators.

Effects of Harmonic Distortion: Impact on Capacitors, Impact on Transformers, Impact on Motors, Impact on Telecommunications, Impact on Energy and Demand Metering.

UNIT-4

Distributed Generation and Power Quality: Resurgence of DG, Perspectives on DG Benefits, Perspectives on Interconnection, DG Technologies, Fuel Cells, Wind Turbines, Photovoltaic Systems, Interface to the Utility System, Synchronous Machines, Asynchronous Machines, Electronic Power Inverters, Power Quality Issues, Voltage Regulation, Harmonics, Voltage Sags, Operating Conflicts, Voltage Regulation Issues, Islanding, Transformer Connections.

Suggested Books:

1. R C Dugan, M F McGranaghan, S Santoso, H. Wayne Beaty, "Electrical Power System Quality", McGraw Hill.
2. Akihiro Ametani, Naoto Nagaoka, Yoshihiro Baba, Teruo Ohno, "Power System Transients: Theory and Applications", CRC Press.
3. L.V. Bewley, "Traveling waves in Transmission Systems", Dover.
4. R. Rudenberg, "Electric Stroke waves in Power Systems", Harvard University Press, Cambridge, Massachusetts.
5. Allan Greenwood, "Electric Transients in Power Systems", Wiley Interscience.
6. CS Indulkar and DP Kothari, "Power System Transients, Statistical Approach", PHI Pvt Ltd., New Delhi.
7. VA Venikov, "Transient phenomena in Electrical Power Systems", Pergamon Press, London.
8. Klaus Ragaller, "Surges in High Voltage Networks", Plenum Press, New York.
9. Pritindra Chowdhari, "Electromagnetic transients in Po r System", John Wiley and Sons Inc.
10. Naidu M S and Kamaraju V, "High Voltage Engineering", TMH Publishing Company Ltd., New Delhi.

MTEL-110	Advanced Power Distribution & Automation						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of electricity distribution and automation.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about distribution automation.						
CO2	To acquaint students with the control and intelligent system in distribution automation.						
CO3	To impart knowledge to students about renewable energy resources and distribution management.						
CO4	To let student understand communication system implementation in distribution system.						

UNIT-1

Introduction: General Concept, Distribution of Power, Power Loads, Connected Loads.
Load Forecasting: Concept of Statistics, Regression Analysis, Correlation Theory, Factor in Power System Loading, Unloading the System, Forecast of System peak.

UNIT-2

System Planning: Planning Process, Basic Principle in system planning, System Development, Overview of Distributed generation, Different types of mapping: Global positioning System GPS, Automated mapping AM/Facility Management FM.
Introductory Methods in Power System Planning: Per Unit Calculation, Matrix Algebra, Symmetrical Components, Overview of Load Flow, Automated Planning: software needs, Data, solution techniques (Gauss Iterative method, Gauss seidel iterative method, Newton Raphson iterative method, Improved newton Raphson method) Effect of Abnormal Loads.

UNIT-3

Brief introduction of Distribution Automation, Role of PLC & SCADA in substation and distribution automation, Consumer information Service (CIS), Geographical information system GIS, Automatic meter Reading (AMR), Automation System.

UNIT-4

Metering System: Different types of Meter, Metering system component, Ferraris Meters, Solid state meters, Advance meter Infrastructure Systems (AMI).
Overview of Net metering, Meter current Rating, Prepaid Electricity meters, Meter selection and Location, testing methods.

Suggested Books:

1. A. S Pabla, "Electric Power Distribution", McGraw Hill Education.
2. James A. Momoh, "Electric Power Distribution Automation Protection and Control", CRC Press.
3. James N-Green and R Wilson, "Control and Automation of electric Power Distribution Systems", CRC Press.
4. Turan Gonen,"Electric Power Distribution System Engineering", CRC Press.
5. Abdelhay A. Sallam, "Electric Distribution Systems",Wiley-IEEEPress.

MTEL-112	Digital Control System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of digital control system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about signal processing in digital control system.						
CO2	To acquaint students with the control devices and systems.						
CO3	To impart knowledge to students about state variables, controllability and observability.						
CO4	To let student understand the various concepts of digital observers.						

Unit-1

Signal Processing in Digital Control: Basic digital control scheme, principle of signal conversion, basic discrete-time signal, time-domain model for discrete-time systems, z-transform, transfer function models, jury stability criterion, sample and hold systems, sample spectra and aliasing

Unit-2

Models of Digital Control Devices and Systems: Introduction, z-domain description of sampled continuous-time plants, z-domain description of systems with dead-time, implementation of digital controllers, digital PID controllers, digital temperature control system, stepping motors and their control, PLC

Unit-3.

Analysis using State Variable Methods: State variable representation-concepts, modeling, transformation, state diagrams, Jordan canonical form, Eigen values and Eigenvectors,

Solution of state equations, concepts of controllability and Observability,

Unit-4

Digital Observers: State regulator design-full order and reduced order state observer, design of state observers, compensator design by separation principle, state feedback with integral control , deadbeat control by state feedback and deadbeat observers

Suggested Books:

1. Ogata K," Discrete time Control Systems", Pearson Education.

2. Nagrath and Gopal, "Control System Engineering", New Age International.

3. Kuo B C, "Digital Control Systems", Oxford University Press.

4. Goapl, "Digital Control & State Variable Method", McGraw Hill Education.

MTEL-114	Advanced Microprocessors						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of advanced microprocessor.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about 8086 microprocessors.						
CO2	To acquaint students with the interfacing converters etc.						
CO3	To impart knowledge to students about microcontrollers.						
CO4	To let student about application of microprocessor and various controllers related to it.						

UNIT-1

Architecture of 8086 microprocessor, Memory Addressing, Bus Timings for MN/MX mode, interrupt structure. Memory Interfacing and Addressed encoding techniques for 8086 microprocessor

UNIT-2

Addressing modes, Instruction set and application programs, Assembler Directives, Programming Techniques using TASM, Interfacing D/A and A/D converters using programmable I/O devices, Interfacing Stepper motor. Architecture of INTEL X86 Family: CPU block diagrams, Pin diagrams and internal descriptions of 80286, 386, 486 and Pentium Processor, Instruction formats.

UNIT-3

Introduction to micro controllers, Architecture of 8051microcontroller, basic Instruction set, programming, serial data communication, inter facing with D/A and A/D converters.

UNIT-4

Application of Microprocessors, A Microcomputer-based Industrial Process-control System, Hardware for Control Systems and Temperature Controller, Overview of Smart-Scale Operation.

Suggested Books:

1. Hall D V, "Microprocessors & Interfacing", McGraw Hill Education.
2. Brey B, "The Intel Processors", Pearson Education.
3.Gibson, "Microprocessors",, Prentice Hall of India.
4. Jean Loup Baer, "Microprocessor Architecture", Cambridge University Press.
5. Ayala K J, "Micro Controller", Penram International

MTEL-116	Reliability Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of the course is to impart the students with the concept of Reliability Engineering and its application in Engineering**.**						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To emphasize and analysis of basic of reliability engineering.						
CO2	To understand the concept of Fault tree analysis in reliability.						
CO3	To understand the concept of Maintainability Analysis in reliability.						
CO4	To study the concept of Artificial Intelligence in reliability engineering.						

Unit-1

Review of basic concepts in Reliability Engg., Reliability function, different reliability models, etc. Reliability evaluation techniques for complex systems; Tie set and cut set approaches, different reliability measures, Reliability allocation/apportionment, reliability improvement, redundancy optimization techniques.

Unit-2

Fault tree analysis: fault tree construction, simplification and evaluation, importance measures, modularization, applications, advantages and disadvantages of fault tree techniques.

Unit-3

Maintainability Analysis: measures of system performance, types of maintenance, reliability centred maintenance, reliability and availability, evaluation of engine ring systems using Markov models.

Unit-4

Applications of fuzzy Major Test and neural networks to Reliability Engineering. Reliability testing, design for reliability and maintainability. Typical reliability case studies.

Suggested Books:

1. R. Rama Kumar, “Engineering Reliability”, Prentice Hall.
2. K B Mishra, “Reliability Analysis & Prediction”.
3. K B Mishra, “New trends in System Reliability Evaluation”.
4. M L Shooman, “Probabilistic reliability–an engineering approach”, R E Krieger Pub.
5. K K Aggarwal, “Reliability Engineering”.
6. Roy & Billington, “Reliability Engineering”.
7. Balagurswami, “Reliability Engineering”, McGraw Hill Education.

MTEL-118	Modeling & Simulation Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of modelling and simulation of different types of applications.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about to preform Thevenin's ,Norton's,& Superposition theorem and Avg. & R. M. S. value of R L C different R, L and C circuit.						
CO2	To impart knowledge about to preform half and full wave rectifier with different R, L and C load for both single and three phase.						
CO3	To impart knowledge about to preform different types of power electronics component mainly inverter and chopper.						
CO4	To impart knowledge about to preform speed and torque control of DC and AC motors.						

Following experiments (at least 10) are required to be performed in MATLAB/ETAP/LabView or equivalent.

1. To verify Thevenin's, Norton's & Superposition theorem.
2. To find Average & RMS value of (V-I) of RLC series & parallel; series parallel RC-RL circuit.
3. To perform1-ϕ (half & full) wave rectifier with (R, R-L & R-C) load.
4. To perform 3-ϕ (half & full) wave rectifier with (R, R-L & R-C) load.
5. To find Average RMS.&T.H.D. of 1-ϕ (half & full) wave inverter with (R & R-L) load.
6. To find Avg., R.M.S.&T.H.D. of 3-ϕ (half & full) wave inverter with (R & R-L) load.
7. To perform current source inverter (C.S.I.) & PWM inverter.
8. To perform step down (BUCK)& step up (BOOST) chopper.
9. To perform Type (A, B, C & D) chopper.
10. To perform Field & Armature control of separately excited DC motor.
11. To perform Field & Armature control of DC series & DC shunt motor.
12. To perform 3-ϕ Induction Motor with constant & variable torque.
13. To perform speed control of 3-ϕ Synchronous motor with constant & variable torque.

MTEL-120	Advanced Power System Lab-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of programing for various types of power system appliances.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge the simulation& analysis of the generator and transformer protection.						
CO2	To impart knowledge the simulation& analysis of power quality improvement, different types of load.						
CO3	To impart knowledge the simulation& analysis of PV cell.						
CO4	To impart knowledge the simulation& analysis of different non-conventional plant biomass gasifier and wind turbine.						

Following experiments are required to be performed in MATLAB/ETAP/LabView or equivalent.

1. Simulation & Analysis of the generator protection.
2. Simulation & Analysis of the transformer protection.
3. Simulation & Analysis of power quality improvement.
4. Simulation & Analysis of different types of relays in power system.
5. To perform the simulation of Photo-Electric Effect.
6. To perform the simulation to construct the PV cell to show the V-I & P-V characteristics curve of it.
7. ToperformthesimulationofPhotovoltaicpowerconversionforsingleand3-phase load on account with MPPT.
8. To perform the construction of a Simulink model of Biomass Gasifier.
9. To study mathematical modelling of DFIG based Wind Turbine and its impact on connection with grid.
10. To perform the simulation of Permanent Magnet Synchronous Generator (PMSG) based wind energy conversion system.
11. To perform the simulation of PV-Grid inter connection using MPPT technique with the partial shading effect.

MTEL-201	DISTRIBUTED GENERATION						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	To understand renewable energy sources. To gain understanding of the working of off-grid and grid-connected renewable energy generation schemes.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the planning and operational issues related to Distributed Generation.						
CO2	Acquire Knowledge about Distributed Generation Learn Micro-Grids						
CO3	understand renewable energy sources						
CO4	Understanding of the working of off-grid and grid-connected renewable energy generation schemes.						

UNIT-1

Need for Distributed generation. Renewable sources in distributed generation and current scenario in Distributed Generation. Introduction to micro-grids. Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids. Modelling & analysis of Micro-grids with multiple DGs. Micro-grids with power electronic interfacing units.

UNIT-2

Planning of DGs. Sitting and sizing of DGs optimal placement of DG sources in distribution systems. Grid integration of DGs Different types of interfaces, Inverter based DGs and rotating machine based interfaces. Aggregation of multiple DG units.

UNIT-3

Technical impacts of DGs. Transmission systems Distribution Systems De-Regulation Impact of DGs upon protective relaying. Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis...

UNIT-4

Economic and control aspects of DGs Market facts. Issues and challenges Limitations of DGs, Voltage control techniques. Reactive power control, Harmonics Power quality issues, Reliability of DG based systems.

Suggested reading:

1. H. Lee Willis, Walter G. Scott, “Distributed Power Generation – Planning and Evaluation”, Marcel Decker Press.
2. M Godoy Simoes, Felix A. Farret, “Renewable Energy Systems – Design and Analysis with Induction Generators”, CRC press.
3. Stuart Borlase. “Smart Grid: Infrastructure Technology Solutions” CRC Press

MTEL-203	ADVANCED ELECTRIC DRIVES & CONTROL						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of electric drives & control in electric system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study basic electric drives, types of loads, classes of motor duty.						
CO2	To study different types of DC drives, stability analysis, modern control techniques.						
CO3	To study mathematical modelling of induction motor drives, introduction to Cyclo-converter fed induction motor drive.						
CO4	To study different types of synchronous motor drives used in mills.						

UNIT 1

Introduction: Definition, Part of the electric drive, Types of loads, steady state & transient stability of Drive, state of art of power electronics and drives, thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating.

UNIT 2

D.C. Drives: Review of braking and speed control of D.C. motors, multi-quadrant operation, loss minimization in adjustable speed drives. Mathematical modelling of dc drives, stability analysis, modern control techniques: variable structure, adaptive control, Chopper-Controlled DC Drives.

UNIT 3

Induction motor drives: Review of braking and speed control of induction motors, constant V/F, constant air gap flux, controlled voltage, controlled current and controlled slip operation. Mathematical modelling of induction motor drives, transient response and stability analysis Introduction to Cyclo-converter fed induction motor drive. Pulse Width Modulation for Electric Power Converters

UNIT 4

Synchronous motor drives: Adjustable frequency operation, voltage fed drive, current fed self-controlled drive. Application of electric drives in steel mills, paper mills, textile mills and machine tools etc. A. C. motor drives in transportation system and traction.

References:

1. Dubey G K, “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi.

2. S K Pillai, “A First Course on Electrical Drives”, New Age International (P) Ltd., New Delhi.

3. Krishan R, “Electric Motor Drives: Modeling Analysis and Control”, PHI Pvt Ltd. New Delhi-2001.

4. Bose B K, “Power Electronics and Variable Frequency Drives: Technology and Applications”, IEEE Press, 1997.

5. Bose B K , “Modern Power Electronics and AC Drives”, Pearson Educational, Delhi,

MTEL-205	Power System Restructuring & Deregulation						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of restructuring and deregulation.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To impart knowledge about restructuring and its various issues related to it.						
CO2	To acquaint students with the deregulation and market models.						
CO3	To impart knowledge to students about transmission pricing.						
CO4	To let student understand in detail about congestion management and experiences of various nations.						

Unit-1

Introduction: Basic concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.

Power System Restructuring: An overview of the restructured power system, Difference between integrated power system and restructured power system, Explanation with suitable practical examples.

Unit-2

Deregulation of Power Sector: Separation of owner ship and operation, Deregulated models, pool model, pool and bilateral trades model, multilateral trade model.

Competitive electricity market: Independent System Operator activities in pool market, Wholesale electricity market characteristics, central auction, single auction power pool, double auction power pool, market clearing and pricing, Market Power and its Mitigation Techniques, Bilateral trading, Ancillary services.

Unit-3

Transmission Pricing: Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, Postage stamp method, Contract Path method, Boundary flow method, MW-mile method, MVA-mile method, Comparison of different methods.

Unit-4

Congestion Management: Congestion management in normal operation, explanation with suitable example, total transfer capability (TTC), Available transfer capability (ATC), Different Experiences in deregulation: England and Wales, Norway, China, California, New Zealand and Indian power system.

Suggested Books:

1.LoiLei Lai, "Power System Restructuring and Deregulation", John Wiley & Sons Ltd.

2.K Bhattacharya, M H T Bollen and J C Doolder, " Operation of Restructured Power Systems", Kluwer Academic Publishers.

3.Lorrin Philipson and H Lee Willis, "Understanding Electric Utilities and Deregulation", Marcel Dekker Inc, New York.

4.Yong-Hua Song, Xi-Fan Wang, "Operation of market-oriented power systems" ,Springer, Germany.

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.

Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.

Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.

Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.

Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development.*						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; Shrimad Bhagwad Geeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; Shrimad Bhagwad Geeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; Shrimad Bhagwad Geeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Dissertation Part – I and Dissertation Part - II

	Dissertation Part-I (MTEL-207) and Dissertation Part-II (MTEL-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain

The student should complete the following:

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part - II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
KURUKSHETRA UNIVERSITY, KURUKSHETRA
('A+' Grade, NAAC Accredited)

SCHEME OF EXAMINATIONS FOR
MASTER OF TECHNOLOGY IN COMPUTER ENGINEERING
(W. E. F. SESSION: 2018-19)

SEMESTER-I

S. No.	Course Code	Subject	Teaching Schedule			Hours/ Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	MTCE-101	Advanced Computer Architecture and Parallel Processing	3	0	0	3	60	40	100	3	**3**
2	MTCE-103	Software Quality Models & Testing	3	0	0	3	60	40	100	3	**3**
3	*	Program Elective -I	3	0	0	3	60	40	100	3	**3**
4	**	Program Elective -II	3	0	0	3	60	40	100	3	**3**
5	MTCE-117	Software Quality Models & Testing Lab	0	0	4	4	60	40	100	3	**2**
6	$	Program Elective Lab-I	0	0	4	4	60	40	100	3	**2**
7	MTRM-111	Research Methodology and IPR	2	0	0	2	60	40	100	3	**2**
8	***	Audit Course-I	2	0	0	2	--	100	100	3	**0**
Total						**24**	**420**	**280**	**700**	**-**	**18**

*Program Elective -I		**Program Elective -II	
Course No.	**Subject**	**Course No.**	**Subject**
MTCE-105	Advanced Computer Networks	MTCE-111	Algorithm Analysis and Design
MTCE-107	Distributed Operating Systems	MTCE-113	Soft Computing
MTCE-109	Number Theory and Cryptography	MTCE-115	Speech and Language Processing

$ Program Elective Lab-I			
MTCE-119	Advanced Computer Networks Lab	MTCE-125	Algorithm Analysis and Design Lab
MTCE-121	Distributed Operating Systems Lab	MTCE-127	Soft Computing Lab
MTCE-123	Number Theory and Cryptography Lab	MTCE-129	Speech and Language Processing Lab

*** Audit Course-I	
Course No.	**Subject**
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

Note: 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.
2. ***Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

SEMESTER-II

S. No.	Course Code	Subject	Teaching Schedule			Hours/ Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	MTCE-102	Social Networks	3	0	0	3	60	40	100	3	**3**
2	MTCE-104	Advanced Database System Design	3	0	0	3	60	40	100	3	**3**
3	*	Program Elective-III	3	0	0	3	60	40	100	3	**3**
4	**	Program Elective-IV	3	0	0	3	60	40	100	3	**3**
5	MTCE-118	Social Networks Lab	0	0	4	4	60	40	100	3	**2**
6	$	Program Elective Lab-II	0	0	4	4	60	40	100	3	**2**
7	#MTCE-120	Mini Project	0	0	4	4	-	100	100	3	**2**
8	***	Audit Course-II	2	0	0	2	--	100	100	3	**0**
Total						**26**	**360**	**340**	**700**	**-**	**18**

*Program Elective -III		**Program Elective -IV	
Course No.	**Subject**	**Course No.**	**Subject**
MTCE-106	Mobile Ad-hoc and Wireless Sensor Networks	MTCE-112	Security In Computing
MTCE-108	Information Theory and Coding	MTCE-114	Embedded System
MTCE-110	Agile Software Engineering	MTCE-116	Data Mining

$ Program Elective Lab-II			
MTCE-122	Mobile Ad-hoc and Wireless Sensor Networks Lab	MTCE-128	Security In Computing Lab
MTCE-124	Information Theory and Coding Lab	MTCE-130	Embedded System Lab
MTCE-126	Agile Software Engineering Lab	MTCE-132	Data Mining Lab

***Audit Course-II	
Course No.	**Subject**
MTAD-102	Constitution of India
MTAD-104	Pedagogy Studies
MTAD-106	Stress Management by Yoga
MTAD-110	Personality Development and Soft Skills

Note 1: After the second semester exams, the students are encouraged to go to Industrial Training/Internship for at least 6-8 weeks during the summer break with a specific objective for Dissertation Part–I (MTCE-207). The industrial Training/Internship would be evaluated as the part of the Dissertation–I (with the marks distribution as 40 marks for Industrial Training/Internship and 60 marks for Dissertation Part–I).

Note 2: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*****Note 3:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

#Note4: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

SEMESTER-III

S. No.	Course Code	Subject	Teaching Schedule			Hours/Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	*	Program Elective -V	3	0	0	03	60	40	100	3	**3**
2	**	Open Elective	3	0	0	03	60	40	100	3	**3**
3	MTCE-207	Dissertation Part-I	0	0	20	20	--	100	100	--	**10**
Total							**120**	**180**	**300**		**16**

*Program Elective-V	
Course No.	**Subject**
MTCE-201	Object Oriented Software System Design
MTCE-203	Big Data Analytics
MTCE-205	Digital Image Processing

**Open Elective		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER: IV

S. No.	Course Code	Subject	Teaching Schedule			Hours /Week	Examination Schedule & Percentage Distribution			Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Total		
1	MTCE-202	Dissertation Part-II	0	0	32	32	200	100	300	--	16
Total						**32**	**200**	**100**	**300**		16

Total Credits – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTCE-101	Advanced Computer Architecture and Parallel Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe and compare different parallel computers, processor architectures and various techniques to improve processor performance.						

Course Outcomes (CO)	
CO1	Classify parallel computers based on different criteria and compare various program flow mechanisms.
CO2	Contrast various processor architectures and solve problems of routing in various interconnection networks.
CO3	Explain various instruction pipeline design techniques, memory hierarchy concepts and identify ways to reduce miss penalty and miss rate.
CO4	Describe and distinguish various cache coherence protocols used in various shared memory architectures.

Unit 1

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers.

Program and network properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit 2

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit 3

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Unit 4

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design trade-offs, synchronization,

Enterprise Memory subsystem Architecture: Enterprise RAS Feature set: Machine check, hot add/remove, domain partitioning, memory mirroring/migration, patrol scrubbing, fault tolerant system.

Text Books:

1. Kai Hwang, “Advanced computer architecture”; TMH. 2000
2. Patterson and Hennessey, “Computer organization and design”, Morgan Kaufmann, 2nd Ed. 2002

Reference Books:

1. Harvey G.Cragon,”Memory System and Pipelined processors”; Narosa Publication. 1998.
2. V.Rajaranam&C.S.R.Murthy, “Parallel computer”; PHI. 2002.
3. R.K.Ghose, RajanMoona&Phalguni Gupta, “Foundation of Parallel Processing”, Narosa Publications, 2003
4. Stalling W, “Computer Organisation & Architecture”, PHI. 2000
5. D.Sima, T.Fountain, P.Kasuk, “Advanced Computer Architecture-A Design space Approach,”Addison Wesley,1997.
6. M.J Flynn, “Computer Architecture, Pipelined and Parallel Processor Design”; Narosa Publishing. 1998
7. Patterson, Hennessy, “Computer Architecture: A quantitative approach”; Morgan Kauffmann, February, 2002.
8. Hwan and Briggs, “Computer Architecture and Parallel Processing”; MGH. 1999.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-103	Software Quality Models & Testing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	The objective of this course is to provide the in-depth coverage of software quality models and software testing strategies. It focuses on test case generation techniques and testing levels. It also focuses on testing different kinds of software.						
Course Outcomes (CO)							
CO1	To develop test cases for any problem						
CO2	To pursue testing on any level of software design by using different testing strategies						
CO3	To learn the configuration management activities and testing object oriented software by using different testing methods.						
CO4	To apply testing principles for Testability, observability, controllability and software refactoring to achieve Agility.						

UNIT – I

Overview of SQM: Concepts of Software Quality, Quality Attributes, Software Quality Models: McCall, Boehm, ISO-9000, CMM.

Software testing principles: Need for testing, Psychology of testing, Testing economics, White box, Black box, Grey box testing, Software Development Life Cycle (SDLC) and Testing, Software Verification& Validation, Weyuker's adequacy axioms.

UNIT – II

Testing strategies: White box testing techniques: Control Flow based testing - Statement coverage, Branch Coverage, Path Coverage; Data flow based testing, Mutation testing, Automated code coverage analysis, Black box testing techniques: Boundary value analysis, Equivalence partitioning, Cause-effect graphing, Robustness testing, Levels of testing - Unit, Integration and System Testing; Acceptance testing: α, β, and γ testing.

UNIT – III

Configuration Management: Maintaining Product Integrity, Components, configuration items, change Management, Version Control, Configuration accounting, Reviews, Walkthrough, Inspection, and Configuration Audits.

Testing object oriented software: Challenges, Differences from testing non-Object Oriented Software, Class testing strategies, Class Modality, State-based Testing.

UNIT – IV

Testability and related issues: Design for Testability, Observability & Controllability, Design by Contract, Precondition, Post condition and Invariant, Regression Testing, Challenges, test optimization.

Miscellaneous topics: Stress Testing, Testing web-enabled applications, Ad hoc testing: Buddy testing, pair testing, Exploratory testing, Agile and extreme testing.

Text Books:

1. Jorgensen P. C., "Software Testing - A Craftman's Approach", 2nd Ed., CRC Press.
2. Glenford J. Myers, "The Art of Software Testing", 3rd Ed., Wiley India Pvt. Ltd.

Reference Books:

1. Mathur P. Aditya, "Foundations of Software Testing", 2nd Ed., Pearson Education.
2. Robert V. Binder, "Testing Object-Oriented Systems: Models Patterns and Tools", Pearson Education.
3. Limaye G. M., "Software Testing – Principles, Techniques, and Tools", Tata McGraw Hill.
4. Boris Beizer, "Black-Box Testing: Techniques for Functional Testing of Software and Systems",1st Ed., Wiley India Pvt Ltd.
5. William E. Perry, "Effective Methods for Software Testing", 3rd Ed., Wiley India Pvt Ltd.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-105	Advanced Computer Networks							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
3	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	To enable students to describe and deal with computer communication and networking, various reference models and architectures along with implemented wireless communication techniques and various security and privacy parameters are also studied.							
Course Outcomes (CO)								
CO1	To classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.							
CO2	To describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.							
CO3	To deploy high performance computing standards, VPN and routing protocols.							
CO4	To get familiar with various security and privacy standards/tools.							

Unit 1

MAC Protocols for high speed and wireless networks -IEEE 802.3 standards for fast Ethernet, gigabit Ethernet, 10G, and 100VG-AnyLAN, IEEE 802.11, 802.15, and 802.16 standards for Wireless PAN, LAN, and MAN

Unit 2

IPv6: IPv4 versus IPv6, basic protocol, Header-extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, DHCPv6, IPv6 Routers and Routing.

Mobility in networks – Mobility Management: Cellular architecture, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, Mobile IP and IPv6.

Unit 3

IP Multicasting. Multicast routing protocols, address assignments, session discovery, etc. IPsec protected channel service, virtual private network service, multiprotocol label switching, MPLS VPN

Traffic Types, TCP extensions for high-speed networks, transaction-oriented applications. Other improvements in TCP, Performance issues, TCP Congestion Control – fairness, scheduling and Delay modeling, QoS issues, differentiated services.

Unit 4

Network security at various layers. Security related issues in mobility. Secure-HTTP, SSL, Message digests, Key distribution protocols. Digital signatures and digital certificates.

Books and References:

1 W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
2 G. R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley, 1995.
3 W. R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the Unix Domain Protocols, Addison Wesley, 1996.
4 W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Edition, Prentice Hall, 1998.
5 C. E. Perkins, B. Woolf, and S. R. Alpert Mobile IP: Design Principles and Practices, Addison Wesley, 1997.
6 J.F. Kurose and K.W. Ross, Computer Networking – A Top-down Approach Featuring the Internet, Pearson Education, New Delhi, 2004.
7 N. Olifer & V. Olifer, Computer Networks: Principles, Technologies, and Protocols for network Design, Wiley-Dreamtech Low Price, New Delhi

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MTCE-107	Distributed Operating Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	This course is planned to understand the basics of distributed systems, and various issues in distributed operating systems. The focus is on distributed system models , distributed architecture, synchronization, process allocation methods and memory sharing techniques.						
Course Outcomes (CO)							
CO1	Understand basics of distributed system and architecture with related factors.						
CO2	Recognize the synchronization concepts, transactions processing and deadlock issues.						
CO3	Explanation of fault tolerance, real time system and distributed file system.						
CO4	To know the concepts of consistency, shared memory and description of distributed operating systems.						

Unit 1

Introduction: Distributed system, goals, Hardware and Software concepts, Fundamental Issues in Distributed Systems, Distributed System Models and Architectures.

Communication in distributed systems: Layered protocols, client-server model.RPC, Group communication.

Unit 2

Synchronization in distributed Systems: Clock synchronization, Clock synchronization Algorithms, Mutual Exclusion and its algorithms, Election algorithms: Bully algorithm, Ring algorithm, Atomic transactions, Transaction models, Deadlocks: Distributed deadlock detection and prevention.

Unit 3

Process management: Threads, System models, processor allocation, scheduling algorithms, fault tolerance, real-time distributed systems

Distributed File System: Design and implementation of distributed file system, scalability and mobility issues, fault tolerance.

Unit 4

Distributed Shared Memory: Shared memory, consistency models, Page-based distributed shared memory

Case Studies: AMOEBA, MACH

1 Distributed Operating Systems; Andrew S Tanenbaum, Pearson Ed.
2 Distributed Systems: Concepts and Design; G Colouris, J Dollimore, T Kindberg 3/e Pearson Ed. 2002.
3 Principles of Distributed Systems, VK Garg, Kluwer Academic Publishers, 1996.
4 Distributed Systems and Algorithmic Approach by Su Kumar Boss, Chamal& Hall.
5 Principles of Distributed Computing by V K Garg, IEEE Press.
6 Distributed Computing by A D KshemKalyani&MukeshSingha.
7 Distributed Algorithms by Nancy Lynch, Morgan Kaufmann Press.
8 Introduction to Distributed Algorithms by G Tel, Cambridge University.

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MTCE-109	Number Theory and Cryptography						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0	4	60	40	100	3Hrs.
Program Objective (PO)	To introduce the concepts and methodology used in the Number Theory and Cryptography.						
Course Outcomes (CO)							
CO1	To introduce the mathematical fundamentals involve in cryptography.						
CO2	To describe the process of primality testing and factorization						
CO2	To understand the strength and weakness of cryptosystems						
CO3	To introduce the elliptic curve cryptography.						

Unit I

Elementary Number Theory: Divisibility, Division Algorithm, Euclidean Algorithm; Congruences, Complete Residue systems, Reduced Residue systems; Fermat's little theorem, Euler's Generalization, Wilson's Theorem; Chinese Remainder Theorem, Generalized Chinese Remainder Theorem-Euler Phi-function, multiplicative property; Finite Fields, Primitive Roots; Quadratic Residues, Legendre Symbol, Jacobi Symbol; Gauss's lemma, Quadratic Reciprocity Law.

Unit II

Primality Testing and Factorization: Primality Tests; Pseudo primes, Carmichael Numbers; Fermat's pseudoprimes, Euler pseudo primes; Factorization by Pollard's Rho method; Simple Continued Fraction, simple infinite continued fractions; Approximation to irrational numbers using continued fractions; Continued Fraction method for factorization.

Unit III

Public Key Cryptosystems: Traditional Cryptosystem, limitations; Public Key Cryptography; Diffie Hellmann key exchange; Discrete Logarithm problem; One-way functions, Trapdoor functions; RSA cryptosystem; Digital signature schemes; Digital signature standards; RSA signature schemes; Knapsack problem; El Gamal Public Key Cryptosystem; Attacks on RSA cryptosystem: Common modulus attack; Homomorphism attack, timing attack; Forging of digital signatures; Strong primes, Safe primes, Gordon's algorithm for generating strong primes.

Unit IV

Elliptic Curve Cryptography: Cubic Curves, Singular points, Discriminant; Introduction to Elliptic Curves, Geometry of elliptic curves over reals; Weier strass normal form, point at infinity; Addition of two points; Bezout's theorem, associativity; Group structure, Points of finite order; Elliptic Curves over finite fields, Discrete Log problem for Elliptic curves; Elliptic Curve Cryptography; Factorization using Elliptic Curve; Lenstra's algorithm; ElGamal Public Key Cryptosystem for elliptic curves.

Reference Books:

1. A Course in Number Theory and Cryptography, Neal Koblitz, (Springer 2006).
2. An Introduction to Mathematical Cryptography, Jill Pipher, Jeffrey Hoffstein, Joseph H.Silverman (Springer, 2008).
3. An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, (Wiley 2006).
4. Elliptic curves: Number theory and cryptography, Lawrence C. Washington, (Chapman & Hall/CRC 2003).
5. An Introduction to Cryptography, R.A. Mollin (Chapman & Hall, 2001).
6. Rational Points on Elliptic Curves, Silverman and Tate (Springer 2005).
7. Guide to elliptic curve cryptography Hankerson, Menezes, Vanstone (Springer, 2004).
8. Elementary Number Theory, Jones and Jones (Springer, 1998).

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MTCE-111	Algorithm Analysis and Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To Apply important Algorithmic design paradigms & methods of analysis & to Synthesize efficient Algorithms in common engineering design situations.						
Course Outcomes (CO)							
CO1	To prove the correctness & analyse the asymptotic performance of Algorithms.						
CO2	To know various Number Theoretic Algorithms & Graph Algorithms.						
CO3	To Analyse various Geometric Algorithms.						
CO4	Understand NP-completeness & identify different NP-complete problems.						

Unit 1

Introduction:

Algorithm concepts, Analyzing and design, Pseudocode conventions, asymptotic efficiency of algorithms, asymptotic notations and their properties.

Analysis Techniques:

Growth Functions, Recurrences and Solution of Recurrence equation-, Amortized Analysis, Aggregate, Accounting and Potential Methods, Probabilistic analysis concepts, hiring problem and its probabilistic analysis, String Matching: naive string Matching, Rabin Karp, and String matching with finite Automata, KW and Boyer – Moore algorithm.

Unit 2

Number Theoretic Algorithms:

Elementary notions, GCD, Modular Arithmetic, Solving modular linear equations, The chines remainder theorem, Powers of an element, RSA cryptosystem, Primality testing, Integer factorization, Polynomials. Huffman Codes: Concepts, construction, correctness of Huffman's algorithms; Representation of polynomials, DFT, FFT, Efficient implementation of FFT, Graph Algorithm, Bellman Ford Algorithm, Single source shortest paths in a DAG Johnson's Algorithm for sparse graph, Flow networks & Ford fulkerson Algorithm, Maximum bipartite matching.

Unit 3

Computational Geometry:

Geometric structures using C++: Vectors, points, Polygons, Edges: Geometric Objects in space: Finding the intersection of a line & triangle, Finding star shaped polygons and convex hull using incremental insertion.

Unit 4

NP-completeness Concepts:

Polynomial time verification, NP-completeness and reducibility, showing problems to be NP-complete like Clique problem, vertex cover problem etc. Approximation algorithms of these problems.

Reference Books

1 T. H Cormen, C E Leiserson.R L Rivest& C Stein, "Introduction to algorithms", 2nd Edition, PHI.
2 Michael J Laszio, "Computational Geometry and Computer Graphics in C++", PHI. India 1996.
3 Brassard, Bratley, "Fundamentals of algorithms", Prentice Hall of India.
4 Knuth, "The Art of Computer Programming", Vol I-III, Pearson Education.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-113	Soft Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
4	**0**	**0**	**4**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To introduce the detailed study on Soft Computing with Neural Networks, Fuzzy Logic, Optimization & Regression and Genetic algorithms approaches.						
Course Outcomes (CO)							
CO1	Understand various types of Neural Networks.						
CO2	Understand the detailed explanation of Fuzzy Logic with fuzzy sets.						
CO3	Description of optimization, regression methods and Genetic Algorithms for solving engineering problems						
CO4	Understanding all concepts of Soft Computing for problem solving.						

Unit 1

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit 2

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations, Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Applications.

Unit 3

Regression and Optimization: Least-Squares Methods for System Identification -System Identification: An Introduction, Basics of Matrix Manipulation and Calculus, Least-Squares Estimator, Geometric Interpretation of LSE, Recursive Least-Squares Estimator, Recursive LSE for Time-Varying Systems, An introduction to LSE for Nonlinear Models, Derivative-based Optimization-Descent Methods, The Method of Steepest Descent, Newton's Methods, Step Size Determination, Conjugate Gradient Methods, Analysis of Quadratic Case, Nonlinear Least-squares Problems, Incorporation of Stochastic Mechanisms, Derivative-Free Optimization.

Unit 4

Genetic Algorithm: An Overview of GA, GA operators, GA in problem solving, Implementation of GA.

Text Books:

1. “Introduction to the Theory of Neural Computation”, Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
2. “Fuzzy Sets & Fuzzy Logic”, G.J. Klir& B. Yuan, PHI, 1995.
3. “Neuro-fuzzy and Soft Computing”, by J.-S.R. Jang, C.-T. Sun, and E. Mizutani, PHI.
4. “An Introduction to Genetic Algorithm”, Melanie Mitchell, PHI, 1998.
5. “Soft computing and Intelligent System Design”, F. O. Karray and C. de Silva, Pearson, 2009.

Reference Books:

1. “Neural Networks-A Comprehensive Foundations”, Prentice-Hall International, New Jersey, 1999.
2. “Neural Networks: Algorithms, Applications and Programming Techniques”, Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

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MTCE-115	Speech and Language Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3Hrs.**
Program Objective (PO)	This subject covers the overview and description of automatic speech recognition system.						
Course Outcomes (CO)							
CO1	To learn the concepts in mechanics of speech						
CO2	To understand the spectral analysis of the speech signal and noise reduction methodology.						
CO3	To implement and use of the statistical approaches for the design and development of Automatic Speech Recognition (ASR).						
CO4	Understand the formal language theory of language processing and complexity measures.						

Unit I

Mechanics of Speech: Speech Production Mechanism, Nature of Speech Signal, Discrete Time Modeling of Speech Production, Representation of Speech Signals, Classification of Speech Sounds, Phones, Phonemes, Phonetics, IPA and Phonetic Alphabets, Articulatory Features, Auditory Perceptions, Anatomical Pathways from Ear to the Perception of Sound Peripheral Auditory System.

Unit II

Spectral Analysis of Speech Signal: Time Domain Parameter of Speech Signal, Methods of Extracting The Parameters: Energy Filter bank Analysis, Short Time Fourier analysis, Formant Extraction, Pitch Extraction; Noise Reduction Techniques, Spectral Estimation, Feature Analysis: MFCC, PLP, RASTA, PLP-RASTA; TRAP.

Unit III

Statistical Framework of ASR: Probability, Bayes Theorem, Covariance and Correlation, Gaussian Mixture Model, ASR Framework: Feature Extraction, Acoustic Model, Pronunciation Model, Language Model, Decoder; Unit Selection, Limitation of Basic HMM and Applications, Advanced HMM, Refinement of HMM, Hybrid HMM/ANN.

Unit IV

Language Processing: Formal Language Theory: Chomsky Hierarchy, Chart Parsing for Context Free Grammars, Stochastic Language Models: Probabilistic Context-Free Grammar, N-gram Language Models, Complexity measure of Language Models: N-Gram Smoothing, Deleted Interpolation Smoothing, Backoff Smoothing, Class n-grams, Performance of N-gram Smoothing, Adaptive Language Models: Cache Language Models, Topic-Adaptive Models, Maximum Entropy Models.

References:

1. Speech and language processing, Daniel Jurafsky and James H. Martin, University of Colorado, Boulder.
2. Fundamentals of Speech Recognition, Lawrence Rabiner, Biing Hwang Juang and B.Yegnarayana, Pearson Edition
3. Speech Recognition – Theory and C++ Implementation, Claudio Becchetti, KlucioPrinaRicotti, Fondazione Ugo Bordoni, Rome, Italy.
4. Spoken Language Processing – A Guide to Theory, algorithm and system development, X.Huang, A. Acero, H. W. Hon.

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MTCE-117	Software Quality Models & Testing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Software Laboratory focuses on test case generation on testing different kinds of software and to provide the in-depth coverage of software quality models and software testing strategies.						
Course Outcomes (CO)							
CO1	To develop test cases for any problem						
CO2	To pursue testing on any level of software design by using different testing strategies						
CO3	Create a test plan document of real time applications.						
CO4	To apply testing tools for designing the test case to test the real time application.						

CASE STUDY 1

Write the test cases for the largest of three number based on:

- Boundary value analysis test
- Robustness based testing
- Equivalence class partitioning test
- Decision table based test

CASE STUDY 2

Cause Effect Graph Testing for a Triangle Program

Perform cause effect graph testing to find a set of test cases for the following program specification: Write a program that takes three positive integers as input and determine if they represent three sides of a triangle, and if they do, indicate what type of triangle it is. To be more specific, it should read three integers and set a flag as follows:

If they represent a scalene triangle, set it to 1.
If they represent an isosceles triangle, set it to 2.
If they represent an equilateral triangle, set it to 3.
If they do not represent a triangle, set it to 4.

CASE STUDY 3

Boundary Value Analysis for a Software Unit

The following is a specification for a software unit. The unit computes the average of 25 floating point numbers that lie on or between bounding values which are positive values from 1.0 (lowest allowed boundary value) to 5000.0 (highest allowed boundary value). The bounding values and the numbers to average are inputs to the unit. The upper bound must be greater than the lower bound. If an invalid set of values is input for the boundaries an error message appears and the user is reported. If the boundary values are valid the unit computes the sum and the average of the numbers on and within the bounds. The average and sum are output by the unit, as well as the total number of inputs that lie within the boundaries. Derive a set of equivalence classes for the averaging unit using the specification, and complement the classes using boundary value analysis. Be sure to identify valid and invalid classes.

Design a set of test cases for the unit using your equivalence classes and boundary values. For each test case, specify the equivalence classes covered, input values, expected outputs, and test case identifier. Show in tabular form that you have covered all the classes and boundaries. Implement this module in the programming language of your choice. Run the module with your test cases and record the actual outputs. Save an uncorrected version of the program for future use.

Case Study 4:

Write the test cases for any known application (e.g. banking application) using

I) Basis path testing
II) Component testing
III) Data flow analysis test

Case Study 5:

Create a test plan document for any application (e.g. Library Management System)

CASE STUDY 6

Model Based Testing

Design and develop a scientific calculator program using various GUI components and events. Build the test model for the same. Determine the inputs that can be given to the model.

Calculate expected output for the model. Run the test cases. Compare the actual output with the expected output. Any model-based technique can be used for building the test model.

MTCE-117(Contd…)

CASE STUDY 7
Study and implementation of

- Mutation test
- Slice based test

- **CASE STUDY 8**

Introduction to any two open source testing tool:

- Study of any testing tool (e.g. Win runner)
- Study of any web testing tool (e.g. Selenium)
- Study of any bug tracking tool (e.g. Bugzilla, bugbit)
- Study of any test management tool (e.g. Test Director)
- Study of any open source-testing tool (e.g. Test Link)

CASE STUDY 9
Web Application Testing for Student Grade System
With educational organizations under increasing pressure to improve their performance to secure funding for future provision of programmes, it is vital that they have accurate, up-to-date information. For this reason, they have MIS systems to record and track student enrolment and results on completion of a learning programme. In this way they can monitor achievement statistics. All student assignment work is marked and recorded by individual module tutors using a spreadsheet, or similar, of their own design. In the computing department these results are input into a master spreadsheet to track a student's overall progress throughout their programme of study. This is then made available to students through the web portal used in college. Perform web application testing for this scenario.

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MTCE-119	Advanced Computer Networks Lab							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
3	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	To enable students to describe and deal with computer communication and networking, various reference models and architectures along with implemented wireless communication techniques and various security and privacy parameters are also studied.							
Course Outcomes (CO)								
CO1	To classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.							
CO2	To describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.							
CO3	To deploy high performance computing standards, VPN and routing protocols.							
CO4	To get familiar with various security and privacy standards/tools.							

List of Practical

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics.
   a. ARP/RARP protocols
   b. RIP routing protocols
   c. BGP routing
   d. OSPF routing protocols
   e. Static routes (check using netstat)
5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.
6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
8. Implement AODV routing protocol in MANET.
9. Implement DSDV routing protocol in MANET.
10. Implement DSR routing protocol in MANET.
11. Study the effect of different Routing protocols (RIP and OSPF) on network's performance through simulation.
12. Create a scenario and study the performance of MANET mobility models.

MTCE-121	Distributed Operating System Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**To get awareness of Distributed Operating System and getting knowledge of various design aspects of operating system.**						
Course Outcomes (CO)							
CO1	Understand the design aspects of operating system						
CO2	Exposure on usage of various operating systems.						
CO3	Design modern distributed system components.						

List of Practical

1. Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
2. Simulate all file allocation strategies a) Sequential b) Indexed c) Linked
3. Implement process strategies: creation of Child, Zombie, and Orphan process
4. Implement file organization strategies a) Single level b) Two level c) Hierarchical
5. Simulate Bankers Algorithm for Dead Lock Avoidance
6. Simulate Bankers Algorithm for Dead Lock Prevention
7. Simulate all page replacement algorithms a) FIFO b) LRU c) LFU
8. Implement shared memory and semaphore concepts for Inter process communication

MTCE-123	Number Theory and Cryptography Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**To be able to implement and analyze algorithms for different encryption techniques. Applications to cryptography are explored including symmetric and public-key cryptosystems. To be able to implement different methods of attacks on data.**						
Course Outcomes (CO)							
CO1	To understand mathematics behind cryptography.						
CO2	Students will be able to implement algorithms of cryptography, including encryption/decryption and hash functions.						
CO3	Students will be able to implement various network security practice applications.						
CO4	Identify various attacks and formulate defense mechanism.						

List of Practical

1. Write a program to implement encryption using binary/byte addition.
2. Write a program to implement encryption using binary Exclusive-OR (XOR).
3. Write a program to implement Triple DES with CBC mode and Weak DES keys.
4. Write a program to implement RSA Encryption and Factorization Attacks.
5. Write a program to implement Attack on RSA encryption with short RSA modulus.
6. Write a program to implement hash generation and sensitivity of hash functions to plaintext modifications.
7. Write a program to implement Digital Signature Visualization.
8. Write a program to implement RSA Signature.
9. Write a program to implement Attack on Digital Signature/Hash Collision.
10. Write a program to implement Firewalls and IDS.

MTCE-125	Algorithm Analysis and Design Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	The student will learn how to design the algorithm techniques, become familiar with the different algorithm design techniques and improve the efficiency of existing algorithms.						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for real time problems						
CO2	The student should be able to Analyse the time and space complexity of algorithms.						
CO3	Students will be able to learn how to improve the efficiency of algorithms.						
CO4	To apply testing tools for designing the test case to test the real time application.						

List of Practical

1. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal’s algorithm.
2. Find Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.
3. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
4. Implement 0/1 Knapsack Problem using Dynamic Programming.
5. Print all the nodes reachable from a given starting node in a digraph using BFS method.
6. Implement Huffman code using Greedy approach.
7. Implement Naïve String matching technique to match the string.
8. Implement N Queen's problem using Back Tracking.
9. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra’s algorithm.
10. Implement longest common subsequence.

MTCE-127	Soft Computing Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To get awareness of Neural Network based learning and training; and getting knowledge of various Neural Network training based learning techniques. To explore the knowledge through implementation the Evolutionary approaches like Genetic and Differential Evolution.						
Course Outcomes (CO)							
CO1	To be able to get basic concepts of Neural Networks.						
CO2	To get understanding of designing and training various Neural Networks like AND, OR, X-OR Logic.						
CO3	Students are able to analyse and provide solutions for real world problems using Soft Computing techniques.						
CO4	Implementation of stochastic population-based Genetic and Differential Evolutionary approaches.						

List of Practical

1. Study of different types of Neural Networks.
2. To design and train AND gate using neural network training.
3. To design and train OR gate using neural network training.
4. To design and train X-OR gate using neural network training.
5. To design and train AND gate using Back propagation (BPN).
6. To design and train OR gate using Back propagation.
7. To design and train X-OR gate using Back propagation.
8. To implement Genetic Algorithm using soft computing approach.
9. To implement Differential Evolutionary approach for solving stochastic problems.
10. To solve real-world problems using population-based Genetic and Differential Evolutionary approaches.

MTCE-129	Speech and Language Processing Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**This Software Laboratory focuses on study of speech and the process of natural language in forms of token and tag some words to make meaningful. This also extracts information and measure the semantic similarity of sentences.**						
Course Outcomes (CO)							
CO1	To process the basic text in form of Tokenization and Stemming						
CO2	To study distributional properties in large samples of language data						
CO3	To implement and find semantics based on lexical semantics						
CO4	To extract information based on relation						

Case Study 1
Take a sample of sentences and process the text in form of tokenization and normalize this data using stemming

Case Study 2
Take a file of size less than 50MB and then select some word and convert these words to N-grams.

Case Study 3
A part-of-speech tagger, or POS-tagger, processes a sequence of words, and attaches a part of speech tag to each word. Take some adjective of English language and tag it.

Case Study 4
To Measure Semantic Similarity between sentences like sentence of "Harry is running fast" and "Harry is Sprinting"

Case Study 5
To associate each word with a word sense disambiguator to select the right meaning among all possible senses for each word.

Case Study 6
Build a system that will extract structured data, such as tables, from unstructured text and use them for training and evaluating models?

Case Study 7
Develop a Model Building in which a machine learning model is trained on a labeled dataset and Improve Performance of Text Classifier

MTRM-111	Research Methodology and IPR						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTCE-102	Social Networks						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	This emerging and innovative field will provide the insight into latest communication techniques used in the online social networks for identifying and representing the hidden relationships, tracking the flow of information and to recognize data patterns in social networks by using graph, matrix, relationships, clustering, and equivalence between users.						
Course Outcomes (CO)							
CO1	To understand the essentials of social networks by learning different types of entities and relationships as nodes, edges within the graph and represent these information as relational data to determine the relative importance of a vertex to find the design levels						
CO2	To explore the detailed explanation of data generalization and mining from Twitter, Facebook and LinkedIn in well informed and efficient manner.						
CO3	To describe the semantic web using mining associations, correlations, classification, betweenness, centrality, equivalence relation, centralization, clustering coefficient and structural cohesion to generate visualizations and perform empirical investigations of network data.						
CO4	To interpret and synthesize the results with respect to collated datasets by using structural equivalence, automorphic equivalence and regular equivalence for interpreting quality factors and mining of complex type of data to execute better recommendation.						

Unit: I: Social Networks and Related Concepts

Introduction to Social Networks: Introduction, uses, examples and types of social networks, Social and economic networks, Opportunities and challenges in social networks, Social structure in social networks, Properties of social networks, algorithmic and economic aspects of social networks

Social Network Data: Nodes, Edges, Relationship, Graphs, Samples and Boundaries, Formal methods, Adjacency Matrix for undirected and directed networked graphs and using matrices to represent social relations, Random graphs, Properties of random graphs, Percolations, Branching processes, Growing spanning tree in random graphs.

Level in Social Networks: Ego networks, partial networks, complete or global networks, social networks methods including binary or valued, directed or undirected.

Unit: II Mining the Social Web

Mining Twitter: Fundamental Twitter Terminology, creating a Twitter API Connection, Exploring Trending Topics, searching for Tweets, extracting Tweets entities, analyzing Tweets and Tweet entities with frequency analysis, computing the lexical diversity of Tweets, Examining patterns in Retweets, Visualizing frequency data with histograms.

Mining Facebook: Understanding the social graph API, Understanding the open graph protocol, Analyzing social graph connections

Mining LinkedIn: Making LinkedIn API requests, Downloading LinkedIn connections as a CSV file, Clustering, normalizing data for analysis, measuring similarity, and clustering algorithms.

Unit: III Mining Web pages and Semantic Web

Mining Web pages: Scraping, Parsing and Crawling the Web, Discovering semantics by decoding syntax, Entity-Centric analysis: A paradigm shift, Quality of analytics for processing human language data.

Mining the Semantically Marked-Up Web: Microformats: Easy-to-implement Metadata, Semantics markup to semantic Web: A brief interlude, The semantic Web: An evolutionary revolution.

Social Network Analysis: Introduction, History, Metrics in social network analysis (Betweenness, Centrality, Equivalence relation, Centralization, Clustering coefficient and Structural cohesion).

Unit IV: Equivalence in Social Networks

Structural equivalence, Automorphic equivalence and Regular equivalence

Text Books:

1. Matthew A. Russell, "Mining the Social Web", O'Reilly and SPD, Second edition New Delhi, 2013.
2. Hanneman, R. A., & Riddle, M., "Introduction to social network methods, Riverside, California: University of California, Riverside. Available at: http://faculty.ucr.edu/~hanneman/nettext/.
3. "Social network analysis: Theory and applications". A free, Wiki Book available at: http://train.ed.psu.edu/WFED-543/SocNet_TheoryApp.pdf.

Reference Books:

1. Lon Safko, "The Social Media Bible: Tactics, Tools, and Strategies for Business Success", Wiley 3rd Ed., 2012.
2. Peter K Ryan, "Social Networking", Rosen Publishing Group, 2011.
3. John Scott, Peter J. Carrington, "Social Network Analysis", SAGE Publishing Ltd., 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-104	Advanced Database System Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	This course is designed to recognize data storage in DBMS, data representation using ER and EER modelling, query processing techniques , recovery management, data base security using firewall and digital signature						
Course Outcomes (CO)							
CO1	Understand the basics of DBMS architecture and data storage mechanism						
CO2	Depiction of various levels in database designing and database representation mechanism.						
CO3	To know the concepts of query processing, transition management and recovery management						
CO4	Explanation of database security techniques such as Firewalls, proxy servers, SSL and digital signatures						

Unit 1

Introduction: Overview of DBMS and its internal Architectural, Data Storage and representation in DBMS: Memory Hierarchy, Secondary storage mechanism and reliability improvement through mirroring and RAID, Recovery from disk crashes, Representing Relational data elements with records (fixed and variable) use of page and block formats, Heap, sorted and clustered file organization.

Unit 2

Indexing in DBMS: Clustered, primary, secondary, dense and Sparse indexing, Hash and Tree based index structures, ISA and B+ tree data structures, bit map indexing, R-indexing.
Database Design: Three steps of Conceptual, logical and Physical design, and methodology for design, Overview of E-R and Extended E-R Modeling and conversion to logical tables and normalization, Physical database design and tuning **–** overview of tasks involved and methodology, Guidelines for index selection, Clustering, Demoralization and view definitions, Tuning of Queries with Explain PLAN.

Unit 3

Query Processing and Transaction management in DBMS: Query processing architecture in DBMS, relational operations and implementation techniques, Algorithms for Selection, Projection and Join, Query optimization, Query tree and optimization using Relational equivalences, Transaction Management DBMS: Transaction and ACID Properties, schedules and serializability, Concurrency control techniques – locking timestamps and Optimistic Concurrency control, Concept of Recovery management, Buffer and Recovery management structures in DBMS, Deferred update and ARIES algorithm for recovery with an example.

Unit 4

Database Security: Access Control mechanisms in DBMS, GRANT and REVOKE of VIEWS, Security for Internet applications through Encryption Firewalls, proxy servers, SSL and digital signatures.

Reference Books

1. Gracia-Mlina, Ullman and Widom, “Database System Implementation”,(2001)-Pearson Education.
2. Connolly &Begg, “Database Systems”, Third Edition (2002)-Pearson Publication.
3. Raghu Ramkrishnan&Gehrke**,** “Database Management Systems”, Third Edition McGraw Hill Publications (2003).

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-106	Mobile Ad-hoc and Wireless Sensor Networks							
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe and deal with computer communication and networking, various reference models and architectures along with implemented wireless communication techniques and various security and privacy parameters are also studied.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	Classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.							
CO2	Describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.							
CO3	Recently deployed high performance computing standards, VPN, routing protocols as to be gone through.							
CO4	Various security and privacy standards/tools to be described.							

Unit 1

Mobile Ad hoc Networks (MANET) – Mobility Management, modeling distributed applications for MANET, MAC mechanisms and protocols.

Unit 2

MANET Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, OLSR & TORA routing, location aided routing, zonal routing algorithm.

Unit 3

Ad hoc network security – Link layer, Network layer, Trust and key management.
Self policing MANET – Node Misbehaviour, secure routing, reputation systems.
Wireless Sensor Networks (WSN) – Design Issues, Clustering, Applications of WSN.

Unit 4

MAC layer and routing protocols in WSN
Data Retrieval Techniques in WSN – Sensor databases, distributed query processing, Data dissemination and aggregation schemes, Operating Systems for WSN, Security issues in WSN.

Books and References:

1 C. Siva Ram Murthy & B.S. Manoj, Mobile Ad hoc Networks – Architectures & Protocols, Pearson Education, New Delhi, 2004
2 C M Cordeiro& D.P. Agrawal, Adhoc & Sensor Networks – Theory and Applications, ISBN 981256-682-1, World Scientific Singapore, 2006
3 C. S. Raghvendra, Wireless Sensor Networks, Springer-Verlag, 2006.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-108	Information Theory and Coding						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3Hrs.**
Program Objective (PO)	The objective of this course is to introduce the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding in an exemplary way.						
Course Outcomes (CO)							
CO1	To understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.						
CO2	To describe the real life applications based on the fundamental theory and to apply convolution codes for performance analysis & cyclic codes for error detection and correction.						
CO3	To calculate entropy, channel capacity, bit error rate, code rate and steady-state probability.						
CO4	To implement the encoder and decoder of one block code or convolutional code using any program language.						

Unit 1

Overview; Basic Concepts - Entropy and Mutual information; Lossless Source Coding – Source entropy rate; Kraft inequality; Huffman code; Asymptotic equipartition property; Universal coding; Noisy Channel Coding - Channel capacity; Random channel codes; Noisy channel coding theorem for discrete memory-less channels; Typical sequences; Error exponents; Feedback; Continuous and Gaussian channels; Lossy Source Coding - Rate- Distortion functions; Random source codes; Joint source-channel coding and the separation theorem.

Unit 2

Source coding- Text, Audio and Speech: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio
layers I,II,III, Dolby AC3 - Speech: Channel V coder, Linear Predictive Coding Source coding- Image and Video: Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF –Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG

Unit 3

Standard Error control coding- Block codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes -Linear block codes,

Unit 4

Cyclic codes - Syndrome calculation, Encoder and decoder – CRC Error control coding- convolution codes: code tree, trellis, state diagram - Encoding – Decoding:
Sequential search and Viterbi algorithm – Principle of Turbo coding

Text Books:

1. Mark Kelbert(Author), Yuri Suhov, Information Theory and Coding by Example, Cambridge University Press, 2013.

Reference Books:

1. Simon Haykin and Michael Moher, Communication Systems, 5th Edition, Wiley, 2010
2. T.M. & Thomas, J.A. (2006). Elements of Information Theory. New York: Wiley.
3. Jiri Adamek, Foundations of coding, Wiley Interscience, 1991.
4. T. M. Cover and J. A. Thomas, Elements of information theory, Wiley, 1991.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-110	Agile Software Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
4	**0**	**0**	**4**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	Introduces the business value of adopting Agile approaches and provide complete understanding of the Agile development practices.						
Course Outcomes (CO)							
CO1	To understand the background and driving forces for taking an Agile approach to software development.						
CO2	To explore the business value of adopting Agile approaches.						
CO3	To drive development with unit tests using Test Driven Development.						
CO4	To apply design principles and refactoring to achieve Agility.						

Unit I: Fundamentals of Agile

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

Unit II: Agile Scrum Framework

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.

Unit III: Agile Testing

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

Unit IV: Agile Software Design and Development

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

Text Books:

1. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson publications.
2. Robert C. Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall.
3. Lisa Crispin, Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison Wesley.

Reference books:

1. Alistair Cockburn, Agile Software Development: The Cooperative Game, Addison Wesley.
2. Mike Cohn, User Stories Applied: For Agile Software, Addison Wesley.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-112	Security In Computing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**100**	**50**	**150**	**3 Hrs.**
Program Objective (PO)	To introduce the detailed study of Probability, Random Variables and Stochastic Processes.						
Course Outcomes (CO)							
CO1	To evaluate the risks and vulnerabilities in protocols/Standards.						
CO2	To apply number theory and algebra required for designing cryptographic algorithms.						
CO3	To Design symmetric key, asymmetric key encryption techniques, design authentication, message integrity and authenticated encryption protocols.						
CO4	To design and security analysis of systems including distributed storage and Electronic voting.						

UNIT – I

Computer Security Concept, Threats, Attacks and Assets, Security Functional Requirements, Security Architecture for Open System, Scope of Computer Security, Computer Security Trends and Strategy.
Cryptography: Terminology and Background, Substitution Ciphers, Transpositions, Cryptanalysis, Data Encryption Standard, DES & AES Algorithms and comparison, Public Key Encryption, Possible Attacks on RSA Malicious Software: Types of Malicious Software, Viruses, Virus countermeasures, Worms, Bots, Rootkits.

UNIT – II

Protection in General-Purpose Operating Systems: Security Methods of Operating Systems, Memory and Address Protection.
Designing Trusted Operating Systems: Security Policies, Models of Security, Designing of Trusted Operating System. Linux Security: Linux Security Model, Linux Vulnerabilities, Linux System Hardening, Application Security, Mandatory Access Control

UNIT – III

Database Security: Relational Database, Database Access Control, Inference, Statistical Databases, Database Encryption. Data Mining Security: Security Requirements, Reliability and Integrity, Sensitive data, Multilevel Databases, Proposal for Multilevel Security, Data Mining - Privacy and Sensitivity, Data Correctness and Integrity, Data Availability.
Trusted Computing: Concept of Trusted System, Trusted Computing and Trusted Platform Module, Common Criteria for Information Technology Security Evaluation.

UNIT – IV

Security in Networks: Threats in networks, Network security controls, Firewall and Intrusion Prevention Systems: Need, Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems. Intrusion Detection Systems.
Internet Security Protocols and Standards: Secure Socket Layer (SSL) and Transport Layer Security (TLS), IP4 and IP6 Security, Secure Email. Legal and Ethical Aspects: Cybercrime and Computer Crime, Intellectual Property, Copyrights, Patents, Trade Secrets, Privacy and Ethical Issues.

Text Books:

1. Pfleeger C. &Pfleeger S.L., "Security in Computing", 4th Ed., Pearson Education.
2. Stalling W., Brown L., "Computer Security Principles and Practice", 3rd Ed., Pearson Education.

Reference Books:

1. Schneier B., "Applied Cryptography: Protocols, Algorithms and Source Code in C", 2nd Ed., Wiley India Pvt. Ltd.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-114	Embedded Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0	4	60	40	100	3 Hrs.
Program Objective (PO)	To introduce the complete design of a modern embedded system with functional requirements for hardware and software components including processor, networking components, and sensors, along with applications, subsystem interfaces, networking, and middleware and to show how to understand and program such systems using a concrete platform built around.						
Course Outcomes (CO)							
CO1	Understand key concepts of embedded systems like History, definition and Classification, and characteristics of Embedded Systems						
CO2	Complete system design concepts of embedded systems for Processor and Memory Organization and peripheral devices.						
CO3	Understand the basics of Microcontrollers and assembly Language programming process.						
CO4	Become aware of interrupts and deployment of embedded processors and supporting devices in real-world applications						

Unit 1

Introduction to embedded systems: Background and History of Embedded Systems, definition and Classification, Programming languages for embedded systems: desirable characteristics of programming languages for embedded systems, low-level versus high-level languages, main language implementation issues: control, typing. Major programming languages for embedded systems. Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

Unit 2

Processor and Memory Organization: Structural units in processor, Processor selection for an embedded system, Memory devices, Memory selection, Allocation for memory to program segments and blocks and memory map of a system, DMA, Interfacing processor. I/O Devices -Device I/O Types and Examples? Synchronous -iso-synchronous and Asynchronous Communications from Serial Devices -Examples of Internal Serial-Communication Devices -UART and HDLC -Parallel Port Devices -Sophisticated interfacing features in Devices/Ports-Timer and Counting Device.

Unit 3

Microcontroller: Introduction to Microcontrollers, Evolution, Microprocessors vs. Microcontrollers, MCS-51 Family Overview, Important Features, Architecture.8051 Pin Functions, Architecture, Addressing Modes, Instruction Set, Instruction Types. **Programming:** Assembly Programming. Timer Registers, Timer Modes, Overflow Flags, Clocking Sources, Timer Counter Interrupts, Baud Rate Generation. Serial Port Register, Modes of Operation, Initialization, Accessing, Multiprocessor Communications, Serial Port Baud Rate.

Unit 4

Interrupts: Interrupt Organization, Processing Interrupts, Serial Port Interrupts, External Interrupts, Interrupt Service Routines. Microcontroller Specification, Microcontroller Design, Testing, Timing Subroutines, Look-up Tables, Serial Data Transmission. **Applications:** Interfacing Keyboards, Interfacing Displays, Interfacing A/D and D/A Converters, Pulse Measurement, Loudspeaker Interface, Memory Interface.

Books and References:

1. John Catsoulis, “Designing Embedded Hardware”, O’reilly
2. An Embedded Software Primer”, David E. Simon, Pearson Education
3. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley & Sons, Inc
4. Karim Yaghmour, “Building Embedded Linux Systems”, O’reilly
5. Michael Barr, “Programming Embedded Systems”, O’reilly
6. Alan C. Shaw, “Real-time systems & software”, John Wiley & sons, Inc.
7. Wayne Wolf, “Computers as Components”, Harcourt India Pvt. Ltd.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-116	Data Mining						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
4	0	0		60	40	100	3 Hrs.
Program Objective (PO)	To introduce the detailed study on data mining methodology.						
Course Outcomes (CO)							
CO1	Understand the basics of data mining and data warehousing						
CO2	Understand the detailed explanation of data generalization and statistical measures						
CO3	Description of mining associations, correlations, classification and prediction						
CO4	Description on cluster analysis and mining of complex type of data like world wide web and text data base						

Unit 1

Introduction

Data Mining, Functionalities, Data Mining Systems classification, Integration with Data Warehouse System, Data summarization, data cleaning, data integration and transformation, data reduction.

Data Warehouse

Need for Data Warehousing, Paradigm Shift, Business Problem Definition, Operational and Information Data Stores, Data Warehouse Definition and Characteristics, Data Warehouse Architecture and Implementation, OLAP.

Unit 2

Data Mining Primitives, Query Language and System Architecture, Concept Description, Data generalization, Analysis of attribute relevance, Mining descriptive statistical measures in large databases.

Unit 3

Mining association rules in large databases: Association rule mining, Mining single dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Relational databases and data warehouses, correlation analysis, classification and prediction.

Unit 4

Introduction to cluster analysis, Mining complex type of data: Multidimensional analysis and descriptive mining of complex data objects, Spatial databases, Multimedia databases, Mining time series and sequence data, Mining text databases, Mining the World Wide Web, Applications and trends in data mining.

Books and References:

1 Data Mining: Concepts and Techniques; Jiawei Han and Micheline Kamber; Elsevier.

2 "Mastering Data Mining: The Art and Science of Customer Relationship Management", by Berry and Lin off, John Wiley and Sons, 2001.

3 "Data Ware housing: Concepts, Techniques, Products and Applications", by C.S.R. Prabhu, Prentice Hall of India, 2001.

4 "Data Mining: Concepts and Techniques", J.Han, M.Kamber, Academic Press, Morgan Kanfman Publishers, 2001.

5 "Data Mining", by Pieter Adrians, DolfZantinge, Addison Wesley 2000.

6 "Data Mining with Microsoft SQL Server", by Seidman, Prentice Hall of India,2001.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-118	Social Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	This Software Laboratory focuses on accessing the dataset from social networks and then applying machine learning techniques, data cleaning and visualization of data in real time environments using Python programming and NLTK						
Course Outcomes (CO)							
CO1	To access the data from social networks						
CO2	To deign machine learning modules for efficient system						
CO3	Create the algorithms for accessing Social Media and data cleaning						
CO4	To apply testing tools for visualization of data in real time application.						

List of practical

1. Write a python program to remove an item from tuple and merge three dictionaries.
2. Write a python program to construct pyramids of stars (*) and numbers using nested for loop.
3. Write a python function to check whether a number is perfect or not and use filter function to print vowels from a given list.
4. Write a python program to estimate coefficients of an equation using linear regression model.
5. Write a python program to predict gender of a person if heigth, weight and shoe size are given using any four supervised learning algorithms.
6. Write a python program to find noun, verb and adjective in a given sentence.
7. Write a python program to calculate frequency of each word in a file after removing stopwords from it.
8. Write a program to for analyzing the behaviour (i.e. check whether a tweet is of positive, negative, or compound nature) of tweets and plot the results.
9. Write a program to sort the list of numbers using shell sort.
10. Write a python program to predict gender of a person from his/her name.
11. Write a python program to make a prediction about a movie from its review.
12. Write a program to plot the image in PNG format using matplotlib for average, max, and min of the data taken from a CSV file.
13. Write a program for classifying the text using NLTK.
14. Write a python program to guess behavior of a person.
15. Write a python program to print trending and common trends tweets in world,us and india.
16. Write a python program to use hashtag as basis of search query to fetch some tweets for further analysis.
17. Write a python program extract twitter entities such as hashtags, screen names.
18. Write a python program to clean any given dataset.
19 Write a python program to visualize a data using histogram, boxplot and scatter plot matrix.
20. Write a program for sentiment analysis of tweets (i.e. polarity and subjectivity).

MTCE-122	Mobile Ad-hoc and Wireless Sensor Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe and deal with computer communication and networking, various reference models and architectures along with implemented wireless communication techniques and various security and privacy parameters are also studied.						
Course Outcomes (CO)							
CO1	Classify traditional networks and discuss various wireless networking standards, compare and contrast various IEEE wireless LAN and Ethernet standards.						
CO2	Describe cellular architecture and IPv4 and IPv6 header formats has to be discussed along with mobile IP.						
CO3	Recently deployed high performance computing standards, MANET, routing protocols as to be gone through.						

List of practical

1. Create scenarios, simulate, and study the evolution of contention-oriented protocols (Aloha, Slotted Aloha, and Ethernet).
2. Implement ARP to find the medium access control address of the destination using the destination's internet protocol address.
3. Create scenarios, simulate, and study the variation of throughput and Mean Delay as the number of nodes increase.
4. Create scenarios and study the difference in performance (with respect to throughput and delay) between token ring and token bus protocols.
5. Write a program to correct error using hamming code in a data received from a network simulator, error is introduced during transmission through as simulator.
6. Simulate a network implementing X.25 protocol. Change the Automatic Repeat Request (ARQ) protocol and then compare the network's performance.
7. Create a scenario, simulate, and study the performance of the different congestion control algorithms .
8. Write a program for the flow control protocols i.e Stop and wait, Go back-N, selective repeat over UDP and verify through a simulator
9. Implement, and verify through a simulator, a program to create sub-network and assign addresses based on the number of hosts connected to the network.
10. Implement AODV routing protocol in MANET.
11. Implement DSDV routing protocol in MANET.
12. Implement DSR routing protocol in MANET.
13. Study the effect of different Routing protocols (RIP and OSPF) on network's performance through simulation.
14. Create a scenario and study the performance of MANET mobility models.

MTCE-124	Information Theory and Coding Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**This Information Theory and Coding Laboratory get exposure to emerging topics in information theory and coding.**						
Course Outcomes (CO)							
CO1	Determine various entropies and compare channel capacity of different channels.						
CO2	Understand techniques of design &performance evaluation of error correcting codes.						
CO3	**Design and develop solutions for technical issues related to information coding.**						
CO4	Learn about syndrome calculation and design of encoder and decoder.						

List of practical

1. Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as
a) Noise free channel
b) Error free channel
c) Binary symmetric channel
d) Noisy channel
Compare channel capacity of above channels.

2. Implement a program for generation and evaluation of variable length source coding using Huffman Coding and decoding (C/MATLAB).

3. Implement coding and decoding of Cyclic codes.

4. Implement coding and decoding of Linear block codes.

5. Implement coding and decoding of BCH and RS codes.

6. Implement coding and decoding of Convolutional codes.

7. Write a simulation program to implement source coding and channel coding for transmitting a text file.

8. Implement a program to study performance of a coded and uncoded communication system (calculate the error probability).

MTCE-126	Agile Software Engineering Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**This Software Laboratory focuses on to analyze, design and provide optimal solution for Computer Science & Engineering and multidisciplinary problems.**						
Course Outcomes (CO)							
CO1	To Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.						
CO2	To Design solutions for complex engineering problems						
CO3	To Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools						
CO4	To demonstrate the knowledge of and need for sustainable development. .						

List of practical

1. Understand the background and driving forces for taking an Agile Approach to Software Development. Study the Important Characteristics that make agile approach best suited for Software Development.

2. Understand the business value of adopting agile approach.

3. Study the Agile Process Examples
   a) SCRUM
   b) FDD
   c) Lean software development
   d) XP

3. Understand agile development practices using SCRUM

4. Drive Development with Unit Test using Test Driven Development.

5. Apply Design principle and Refactoring to achieve agility

6. To study automated build tool.

7. To study version control tool.

8. To study Continuous Integration tool.

9. Perform Testing activities within an agile project.

MTCE-128	Security in Computing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Security in computing laboratory provide an applied understanding of the principles of network and computer security.						
Course Outcomes (CO)							
CO1	Learn about the encryption and decryption using different algorithms.						
CO2	A hands-on experience in attack execution and the use of tools in such attacks.						
CO3	Create virtual private network to evaluate response time.						
CO4	The practical knowledge to secure computers and network including the setup of policies and security assessment.						

List of practical

1. Write a program for encryption and decryption using DES algorithm in Java.

2. Write a program for encryption and decryption using AES algorithm in Java.

3. Design and implementation of a simple client/server model and running application using sockets and TCP/IP.Eavespdropping attacks and it's prevention using SSH.

4. Create a virtual private network (VPN) WAN to evaluate application response time in the presence and absence of a firewall.

5. Isolate WLAN traffic using separate Firewall for VPN connection.

6. Implement a program to manage security in a small business network.

7. Implement security and networking policies settings across the company.

8. Demonstrate intrusion detection system (IDS) using any tool (snort or any other s/w).

9. Installation of rootkits and study about the variety of options.

10. Implement the simple substitution technique named Caesar cipher using C language.

MTCE-130	Embedded Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**This laboratory will develop the programming skills in the embedded systems field. Emphasis is given to interface handling; device driver and application development. Programming of mobile devices is included.**						
Course Outcomes (CO)							
CO1	To Familiarize with programming methods and tools for embedded systems.						
CO2	To Write efficient programs in C to develop embedded systems.						
CO3	To Program Device Drivers for embedded systems.						
CO4	To Program mobile devices.						

List of practical

1. Design an embedded system for traffic light controller using 8051 microcontroller.
2. Program for an embedded system in C using GNU development tools.
3. Program to demonstrate a simple interrupt handler and setting up a timer.
4. Program to create two tasks which trigger blinking of two LEDs at different timings.
5. Program to send messages to mailbox by one task and read from mailbox by another task.
6. Write an assembly program to configure and control General Purpose Input/Output (GPIO) port pins.
7. Program to imlement Buzzer interface on IDE environment.
8. To interface and convert Digital to Analog data using DAC in ARM processor.
9. To develop, code, configure and test a device driver.
10. To implement concurrency and resource management in mobile devices.

MTCE-132	Data Mining Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To get awareness of data mining tools and getting knowledge of various performance metrics for evaluation of data mining techniques. To explore the different validation techniques on training data set.						
Course Outcomes (CO)							
CO1	To be able to get basic concepts of data mining.						
CO2	To get understanding of data pre-processing, generalization and data characterization techniques to provide suitable input for a range of data mining algorithms.						
CO3	Students are able to analyze and provide solutions for real world problems using mining association techniques.						
CO4	Examine the different classification & clustering techniques in data mining.						

List of practical

1. Study of Data Mining tool.
2. Develop an application to extract association mining rule.
3. Develop an application for classification of data.
4. Develop an application for one clustering technique.
5. Develop an application for implementing Naive Bayes classifier.
6. Implementation of association mining rule –Apriori algorithm.
7. Develop an application for decision tree.
8. To create a Decision tree by training data set.
9. To create a Decision tree by cross validation training data set.
10. To create a Decision tree by using Prune mode and Reduced error Pruning and show accuracy for cross validation trained data set.

MTCE-201	Object Oriented Software System Design						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	To provide the thorough knowledge to use the concepts and their design attributes for object based system design and their related paradigms to foster better communication and product quality in order to solve the real time problems by applying the object oriented pattern and visual modeling throughout the software development life cycles.						
Course Outcomes (CO)							
CO1	To learn the basic concepts of object oriented design and methods and also to get exposure of UML for analyzing and designing quality software systems.						
CO2	To explore the details of object-oriented software development methods using use cases, relations, responsibilities, interface objects, services and system design and object-oriented methodologies for choosing and designing effective and time critical software systems.						
CO3	To realize the nature of design patterns by understanding and identifying design model, components, software behavior, Methodology for Object-Oriented Design (MOOD), and reusability and Life Cycle issues to create naturalized object oriented design.						
CO4	To evaluate object oriented design processes using software maintenance process, configuration management and maintenance models to articulate better software system for performing required tasks.						

Unit 1: Introduction, Methods and Concepts

Introduction: Object oriented concepts, Object-oriented domain analysis, software reuse, software life cycle models, unified modeling language (UML).

Object-oriented methods (OOM): Overview, Goals, Concepts: Object analysis model, Information model. Behavior model, Process model, Requirements definition model, benefits and weaknesses.

Unit 2: Object-Oriented Software Development Methods and Methodologies

Object-oriented software development methods: ObjectOry: System development and analysis, use cases, entities, interface objects, services and system design, advantages, Introduction to Object-oriented structured design and application examples.

Object-oriented Methodologies: Classification, Rumbaugh methodology, Jacobson methodology, Booch methodology, Responsibility-Driven design, Pun and Winder methodology, Shlaer/Mellor methodology.

Unit 3: Object-Oriented Design, Reusability and Life Cycle Issues

Object-Oriented Design: Representation of design model, Identification of components, classes, inheritance and objects, Identification of software behavior, Suitability of Methodology for Object-Oriented Design (MOOD), Context of MOOD, A CASE environment for MOOD, MOOD tools.

Reusability and Life Cycle Issues: Reusability during Object-Oriented design, Object-Oriented software life cycle model, Software life cycle issues.

Unit 4: Software Maintenance Concepts and Object-Oriented Programming Languages

Software Maintenance Concepts: Software maintenance process, Reverse engineering environment, Documentation for Software maintenance, Software configuration management and Software maintenance models.

Object-Oriented Programming Languages: Simula, SmallTalk, Ada95, Object COBOL.

Text Books:

1. Jag Sodhi, Prince Sodhi, Object-Oriented Methods for Software Development, McGraw-Hill.
2. Luiz Fernando Capretz, Miriam Captrez, Object-Oriented Software: Design and Maintenance, World Scientific.
3. Luiz Fernando Capretz, Object-Oriented Design Methodologies for Software Systems, Ph.D. Thesis, University of Newcastle upon Tyne, United Kingdom, November 1991. Available Online at: https://theses.ncl.ac.uk/dspace/bitstream/10443/1967/1/Capretz,%20L.F.%201991.pdf
4. Ali Bahrami, Object Oriented Systems Development: McGraw Hill, 1999.
5. Rumbaugh *et al*.,Object Oriented Modeling and Design, PHI, 1997 .
6. Wendy Boggs, Michael Boggs, Mastering UML with Rational Rose, Sybex BPB Publications, 2007.

Reference Books:

1 Object-Oriented Analysis and Design with Applications (3rd Edition) 3rd Edition, Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, Addison-Wesley, 2007
2. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, 1st Edition, Addison-Wesley, 2007
3. Refactoring: Improving the Design of Existing Code (Addison-Wesley Object Technology Series), Martin Fowler, Kent Beck, John Brant, William Opdyke, Don Roberts, Erich Gamma, Addison-Wesley, 2007
4. Object Oriented Analysis and Design: Understanding System Development with UML 2.0, Docherty, Wiley India,2010.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-203	**Big Data Analytics**							
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time**
4	**0**	**0**	**4**	**60**	**40**	**--**	**100**	**3 Hrs.**
Program Objective (PO)	Understand big data for business intelligence. Learn business case studies for big data analytics. Understand NoSQL big data management. Perform map-reduce analytics using Hadoop and related tools							
Course Outcomes (CO)								
CO1	Understand the basics of big data							
CO2	Understand the detailed explanation of NoSQL							
CO3	Analysing the data with Hadoop and learn the MapReduce							
CO4	Description on Hbase, Pig and Hive							

Unit 1

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Unit 2

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

Unit 3

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Unit 4

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.

Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
10. Alan Gates, "Programming Pig", O'Reilley, 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTCE-205	Digital Image Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
4	**0**	**0**	**4**	**60**	**40**	**100**	**3Hrs.**
Program Objective (PO)	**Introduces the working knowledge of how digital image processing is implemented by using various algorithms and also the various techniques of transformation, enhancement, restoration, compression, segmentation and image morphology.**						
Course Outcomes (CO)							
CO1	Knowledge in the science of images and image processing.						
CO2	To apply knowledge of mathematics, science and engineering in the area of computer vision.						
CO3	knowledge in the techniques of Digital Image Processing, including Image Enhancement in the Spatial and Frequency Domain, Compression, Morphology and Segmentation.						
CO4	Learn and apply knowledge in analyzing image segmentation, representation, description, and recognition techniques.						
CO5	Design and implement computer vision systems to detect, localize and recognize objects within images.						

Unit 1

Introduction And Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Unit 2

Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

Unit 3

Image Restoration:A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Pereodic Noise Reduction by Frequency Domain Filtering, Linear Position-InvarientDedradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards.

Unit 4

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recoginition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Text Books:

1 Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004.
2 A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003.

Reference Books:

1. Rosefield , "Digital Picture Processing", 1999.
2. W.K. Pratt, "Digital Image Processing", 2000.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit. A question paper template will also be provided.

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development.*						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-110	Personality Development and Soft Skills							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
2	0	0	0	--	100	-	100	3 Hrs.
Program Objective (PO)	To become a person with stable mind, pleasing personality and determination in order to achieve the highest goal.							
Course Outcomes (CO)								
CO1	Students become aware about leadership.							
CO2	Students will learn how to improve communication skills							
CO3	Understand the team building and conflict							
CO4	Student will learn how to manage the time.							

Unit 1

Leadership Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration. Interpersonal: Introduction to Interpersonal Relations, Analysis Relations of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

Unit II

Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication.

Stress Introduction to Stress, Causes of Stress, Impact Management Stress, Managing Stress

Unit III

Group Dynamics and team Building: Importance of groups in organization, Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Conflict: Introduction to Conflict, Causes of Conflict, Management Managing Conflict

Unit IV

Time Management: Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating the subordinates, Analysis of Motivation

Suggested reading

- E.Berne, Games People Play, Grove Press Inc., 1964; Penguin, 1968.
- Hargreaves, G. Stress Management, Marshall Publishing, London 1998
- Barker D, TA and Training, Gower Publishing Company Ltd., 1982.
- Jongewardm D & Seyer P C, Choosing Success, John Wiley & Sons Inc.1978
- Arnold, JHC Feldman, D.C. Organizational Behaviour IRWIN/McGRAW-HILL 1986
- Chandan, J.S., Organizational Behaviour. Vikas Publishing House PVT LTD 1994
- Statt, D.A. Using Psychology in Management Training, Taylor and Francis Inc.2000
- Luthans F., Organisational Behaviour, IRWIN/McGRAW-HILL 1998

	Dissertation Part-I (MTCE-207) and Dissertation Part-II (MTCE-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain.

The student should complete the following:

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part- II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

SCHEME & SYLLABUS FOR MASTER OF TECHNOLOGY (M.TECH.) IN SOFTWARE ENGINEERING (SE) PROGRAM AT U.I.E.T.

As per AICTE Model curriculum

(Applicable w.e.f. session 2018-2019 in Phased Manner)

Scheme for the course of Master of Technology (M.Tech.) in Software Engineering (Credit Based)
(Applicable from session 2018-2019)
Semester-I

S. No.	Course No.	Subject	Teaching Schedule			Hours/Week	Examination Schedule & Percentage Distribution				Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Practical	Total		
1	MTSE-101	Essentials of Software Engineering	3	0	0	3	60	40	--	100	3	3
2	MTSE-103	Modeling and Simulation	3	0	0	3	60	40	--	100	3	3
3	*	Program Elective-I	3	0	0	3	60	40	--	100	3	3
4	**	Program Elective-II	3	0	0	3	60	40	--	100	3	3
5	MTSE-117	Software Engineering Lab	0	0	4	4	--	40	60	100	2	2
6	MTSE-119	Agile Software Engineering Lab	0	0	4	4	--	40	60	100	2	2
7	MTRM-111	Research Methodology and IPR	2	0	0	2	60	40	--	100	--	2
8	***	Audit course-I	2	0	0	2	--	100	--	100	3	
Total						**24**	**300**	**280**	**120**	**700**	**-**	**18**

***Programme Elective-I**		****Programme Elective-II**	
Course No.	**Subject**	**Course No.**	**Subject**
MTSE-105	Software Project Management	MTSE-111	Software Reliability
MTSE-107	Agile Software Process	MTSE-113	Software Agents
MTSE-109	Software Process Maturity Model	MTSE-115	Human Interface System Design

*****Audit Course-I**	
Course No.	**Subject**
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

Note: 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.
2. ***Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

Scheme for the course of Master of Technology (M.Tech.) in Software Engineering
Semester-II

S. No.	Course No.	Subject	Teaching Schedule			Hours/Week	Examination Schedule & Percentage Distribution				Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Practical	Total		
1	MTSE-102	Software Risk Management	3	0	0	3	60	40	--	100	3	3
2	MTSE-104	Social Networks	3	0	0	3	60	40	--	100	3	3
3	*	Program Elective-III	3	0	0	3	60	40	--	100	3	3
4	**	Program Elective-IV	3	0	0	3	60	40	--	100	3	3
5	MTSE-118	Software Quality Models & Testing Lab	0		4	4	--	40	60	100	3	2
6	MTSE-120	Social Networks Lab	0		4	4	--	40	60	100	3	2
7	#MTSE-122	Mini Project	0	0	4	4	--	100	--	100	--	2
8	***	Audit course-II	2	0	0	2	--	100	--	100	3	
Total						**26**	**240**	**340**	**120**	**700**	**-**	**18**

***Programme Elective -III**		****Programme Elective-IV**	
Course No.	**Subject**	**Course No.**	**Subject**
MTSE-106	Cloud Computing	MTSE-112	Object Oriented Programming
MTSE-108	Software Testing & Quality Assurance	MTSE-114	Pattern Oriented Software Architecture
MTSE-110	Data Warehousing and Data mining	MTSE-116	Software Measurement and Metrics

List of Audit Course-II (AC-II) for Second Semester	
Course No.	**Subject**
MTAD-102	Constitution of India
MTAD-104	Pedagogy Studies
MTAD-106	Stress Management by Yoga
MTAD-108	Personality Development through Life Enlightenment Skills.

Note 1: After the second semester exams, the students are encouraged to go to Industrial Training/Internship for at least 6-8 weeks during the summer break with a specific objective for Dissertation Part–I (MTSE-207). The industrial Training/Internship would be evaluated as the part of the Dissertation–I (with the marks distribution as 40 marks for Industrial Training/Internship and 60 marks for Dissertation Part–I).

Note 2: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*****Note 3:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

#Note 4: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

Semester: III

S. No.	Course No.	Subject	Teaching Schedule			Hours /Week	Examination Schedule & Percentage Distribution				Duration of Exam (Hrs.)	Credit
			L	T	P		Major Test	Minor Test	Practical	Total		
	*	Program Elective -V	3	0	0	3	60	40		100	3	3
1	**	Open Elective	3	0	0	3	60	40		100	3	3
2	MTSE-207	Dissertation Part-I	0	0	20	20	--		100	100	3	10
Total							**120**	**80**	**100**	**300**		**16**

Programme Electives -V	
Course No.	**Subject**
MTSE-201	Software Quality Management
MTSE-203	Language Technologies
MTSE-205	Personal Software Process

****Open Elective**		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

Semester: IV

S. No.	Course No.	Subject	Teaching Schedule			Hours/Week	Examination Schedule & Percentage Distribution				Duration of Exam (Hrs.)	Credit
			L	T	P		Major test	Minor test	Practical	Total		
1	MTSE-202	Dissertation Part-II	0	0	32	16	0	100	200	300	3	16
Total						**16**		**100**	**200**	**300**		**16**

Total Credits – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTSE-101	**Essentials of Software Engineering**							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The main purpose of this course is to impart knowledge on the basic principles of software development life cycle.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To understand the software life cycle models							
CO2	To understand the importance of the software development process							
CO3	To understand the importance of modeling and modeling languages							
CO4	To design and develop correct and robust software products							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

Unit-1

Principles and motivation: History, Definitions, why engineered approach to software development, Software Development Process Models from the point of view of technical development and project management: Waterfall, Rapid Prototyping, Incremental Development, Spiral Model, Emphasis on computer assisted environment.

Software development methods: Formal, semi-formal and informal methods, Requirements elicitation, Requirement specification, Data, functions and event based modeling, Some of the popular methodologies such as Yourdon's SAD, SSADM etc., CASE tools classification, features, strengths and weaknesses, CASE: CASE standards.

Unit-2

Software Project Management: Principles of Software Project Management, Organizational and team structure, Project planning, Project Initiation and Project Termination, Technical, Quality and Management plans, Project Control, Project Estimation methods, Function points and COCOMO.

Unit-3

Software Quality Management: Quality Control, Quality Assurance and Quality Standards with emphasis on ISO 9000, Functions of Software QA organization dose in Project, Interaction with developers, Quality plans, Quality assurance towards quality improvement, Role of independent Verification and Validation, Total Quality Management, SEI maturity model, Software metrics.

Unit-4

Configuration Management: Need for Configuration Management, Configuration Management functions and activities, Configuration Management Techniques, Examples and Case studies.

Software Engineering Standards: Government Standards, IEEE (and other professional bodies) standards, Corporate Standards.

Reference books:

1. Eisner Howard, Computer Aided System Engineering, Prentice Hall, New Jersy.
2. Richard Fairly, Software Engineering Concept, Mc-Graw Hill, New York.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Pub. House, New Delhi.
4. Roger Pressmen, Software Engineering: A Practitioner's Approach McGraw Hill, New York.
5. Carlo Ghezzi, Mehdi Jazayeri, Dino Manlrioli, Fundamentals of Software Engineering Prentice Hall New Jersy.
6. Dong Bell, Ian Morrey, and Pugh, Software Engineering: A programming Approach Prentice Hall, New Jersy.
7. Kenneth Shere, Software Engineering and Management, Prentice-Hall, New Jersy.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-103	Modelling and Simulation							
Lecture	Tutorial	Practical	Credit	Theory	Sessional	Practical	Total	Time
3	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	This course will look at professional techniques for understanding, assessing and applying the software simulation models in software development systems.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To appreciate and understand scientific concepts of Software and Hardware design.							
CO2	To apply different simulation Models in Software Development							
CO3	To emphasize the Application of Simulation Models							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT-1

Systems: Models types, principles used in modelling, system studies, interacting subsystems andexample, simulation definition, examples, steps in computer simulation, advantages and disadvantagesof simulation, simulation study, classification of simulation languages.

System Simulation:

Techniques of simulation, monte carlo method, comparision of simulation and analytical methods, numerical computation techniques for continuous and discrete models, distributed leg models, cobweb models.

UNIT-II

Continuous system simulation:

Continuous system models, differential equation, analog computer analog methods, digital analog simulators, CSSLS, CSMPIII language.

System Dynamics: Historical background, exponential, Growth and decay models, modified exponential growth models, logistic curves and generalization of growth models, system dynamics diagrams, dynamo language.

UNIT-III

Probability concepts in simulation:

Stochastic variables, discrete and continuous probability function, continuous uniform distributed and computer generation of random numbers, uniform random number generator, non uniform continuously distributed random numbers, rejection method.

Discrete system simulation: Discrete events, representation of time, generation of arrival patterns, simulation of telephone system, delayed calls, simulation programming tasks, gathering statistics, discrete simulation languages.

UNIT-IV

Object Oriented approach in simulation, simulation in C++, Introduction to GPSS, general description, action times, choice of paths, simulation of a manufacturing shop, facilities andstorage, program control statements, priorities and parameters, numerical attributes, functions, simulation of a supermarket transfer models, GPSS model applied to any application, simulationprogramming techniques like entry types.

Reference books

1. G.Gordan "System Simulation" , 2ndEd, 2002 PHI.
2. T.A. Payer "Introduction to Simulation", McGraw Hill.
3. W.A. Spriet "Computer Oriented Modeling and Simulation".
4. Narsingh Deo "System Simulation with Digital Computers", PHI.
5. V. Rajaraman "Analog Simulation", PHI
6. Law & Kelton "Simulation Modelling and Analysis" 3 rd Ed., 2000, McGraw Hill.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-105	Software Project Management							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The course gives an insight of the most commonly used software architecture and design patterns and their applications							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To understand Software Project Models and Software Management Concepts.							
CO2	To understand the various methods of Cost Estimation.							
CO3	To Study about Software Quality Management.							
CO4	To understand Project Evaluation.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I - PROJECT CONCEPTS AND ITS MANAGEMENT

Project life cycle models-ISO 9001 model-Capability Maturity Model-Project Planning-Project tracking-Project closure. Evolution of Software Economics – Software Management Process Framework: Phases, Artifacts, Workflows, Checkpoints – Software Management Disciplines: Planning / Project Organization and Responsibilities / Automation / Project Control – Modern Project Profiles.

UNIT II - COST ESTIMATION

Problems in Software Estimation – Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card.

UNIT III - OFTWARE QUALITY MANAGEMENT

Software Quality Factors – Software Quality Components – Software Quality Plan – Software Quality Metrics – Software Quality Costs – Software Quality Assurance Standard – Certification – Assessment.

UNIT IV - PROJECT EVALUATION AND EMERGING TRENDS

Strategic Assessment–Technical Assessment–Cost Benefit Analysis–Cash Flow Forecasting–Cost Benefit Evaluation Technique–Risk Evaluation–Software Effort Estimation. Emerging Trends: Import of the internet on project Management – people Focused Process Models.

REFERENCES

1. Ramesh Gopalaswamy , *"Managing and global Software Projects"*, Tata McGraw Hill Tenth Reprint, 2011.
2. Roger S.Pressman, *"Software Engineering- A Practitioner's Approach", 7th* Edition ,McGraw Hill, 2010.
3. Daniel Galin, "*Software Quality Assurance: from Theory to Implementation*", Addison-Wesley, 2003.
4. Bob hughes and Mike Cotterell, *"Software Project Management"* second edition,1999.
5. Royce, W. *"Software Project Management: A Unified Framework",* Addison- Wesley, 1998.
6. Demarco, T. and Lister, T. *"Peopleware: Productive Projects and Teams,* 2nd Ed.", Dorset House,1999.
7. Fenton, N.E., and Pfleeger, S.L.. *"Software Metrics: A Rigorous and Practical Approach,* Revised" Brooks Cole, 1998.
8. Kaplan, R.S., Norton, D.P. *"The Balanced Scorecard: Translating Strategy into Action",* Harvard Business School Press, 1996.
9. Boehm, B. W. *"Software Risk Management: Principles and Practices"* in IEEE Software, January 1991, pp32-41.
10. Grant, J.L. *"Foundations of Economic Value Added"*, John Wiley & Sons, 1997.
11. Cooper, R., *"The Rise of Activity-Based Costing- PartOne: What is an Activity-Based Cost System"* Journal of Cost Management, Vol.2, No.2(Summer 1988), pp.45 – 54.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-107	Agile Software Process							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	This course imparts knowledge to students in the basic concepts of Agile Software Process, methodology and its development.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To understand the basic concepts of Agile Software Process.							
CO2	To gain knowledge in the area of various Agile Methodologies.							
CO3	To develop Agile Software Process.							
CO4	To know the principles of Agile Testing.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION

Software is new product development – Iterative development – Risk-Driven and Client-Driven iterative planning – Time boxed iterative development – During the iteration, No changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early "Top Ten" high-level requirements and skilful analysis – Evolutionary and adaptive planning – Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.

UNIT II-AGILE AND ITS SIGNIFICANCE

Agile development – Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback – Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence – Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT III-AGILE METHODOLOGY

Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history.

UNIT IV-AGILE PRACTICING AND TESTING

Project management – Environment – Requirements – Test – The agile alliances – The manifesto – Supporting the values – Agile testing – Nine principles and six concrete practices for testing on agile teams.

REFERENCES

1. Elisabeth Hendrickson, "*Agile Testing*" Quality Tree Software Inc 2008.
2. Craig Larman "*Agile and Iterative Development – A Manager's Guide*"
Pearson Education – 2004.
3. Alistair "*Agile Software Development series*" Cockburn - 2001.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-109	Software Process Maturity Model							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	To know about the software process and Software Process Maturity Models							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To study about various Software process maturity models							
CO2	To study about how to assess software process							
CO3	To know about the key process areas of the software process							
CO4	To study about software improvement sequences							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I - INTRODUCTION

Software Process - Software Maturity Framework – Software process Improvement – Process Maturity levels – Principles of Software process Change – Software Process Assessment

UNIT II - CMM

CMM Introduction – CMM Maturity Levels - Initial process- Repeatable Process – Defined Process – Managed Process – Optimizing Process.

UNIT III - TMM

Introduction to TMM – Structure of the TMM – Components of TMMi – Generic Goals and Generic Practices – Process areas for Generic practices – TMMi Maturity Levels – Initial – Managed – Defined – Management and Measurement – Optimization.

UNIT IV - AGILE MATURITY MODEL

Agile Software Development – Process Improvement framework for Agile Software Development – Intial Level – Explored Level – Defined level – Improved Level – Sustained Level - Software Process Improvement for Agile Software Development Practices.

REFERENCES

1. Watts S. Humphrey "*Managing the Software Process*", Pearson Education, 2008

2. Marry Beth Chrissis, Mike Konnard and Sandy Shrum, "*CMMI : guidelines for Process Integration and Product Improvement*", Addison Wesley, 3rd Edition,2011.

3. Mark. C. Paulk, "*CMM: Guidelines for Improving the Software Process*" Addison-Wesley, 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-111	**Software Reliability**							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	This course will look at professional techniques for understanding, assessing and applying the software reliability models in software development systems.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To appreciate and understand scientific concepts of Software and Hardware Reliability.							
CO2	To apply Software Reliability Growth Models in Software Development							
CO3	To emphasize the Application of Software Reliability Models							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-SOFTWARE RELIABILITY MODELS

Introduction - Historical Perspective and Implementation, classification, limitations and issues, Exponential Failure Models – Jelinski-moranda model, Poisson, Musa, Exponential models, Weibull Model, Musa-okumoto Model, Bayseian Model – Littlewood verral Model, Phase Based Model

UNIT II-PREDICTION ANALYSIS

Model Disagreement and Inaccuracy – Short & Long Term Prediction, Model Accuracy, Analyzing Predictive Accuracy – Outcomes, PLR, U & Y Plot, Errors and Inaccuracy, Recalibration – Detecting Bias, Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.

UNIT III-THE OPERATIONAL PROFILE

Concepts and Development Procedures – Customer Type, User Type, System Mode, Functional and Operational Profile, Test Selection - Selecting Operations, Regression Test, Special Issues – Indirect Input Variables, Updating, Distributed system.

UNIT IV-TESTING FOR RELIABILITY MEASUREMENT

Software Testing – Types, White and Black Box, Operational Profiles – Difficulties, Estimating Reliability, Time/Structure based software reliability – Assumptions, Testing methods, Limits, Starvation , Coverage, Filtering, Microscopic Model of Software Risk.

REFERENCES

1. Patric D. T.O connor, "*Practical Reliability Engineering*", 4th Edition, John Wesley & sons, 2003.
2. John D. Musa, "*Software Reliability Engineering",* Tata McGraw Hill, 1999.
3. Michael Lyu, "*Handbook of Software Reliability Engineering"*, IEEE Computer Society Press, ISBN: 0-07-039400- 8, 1996.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-113	Software Agents							
Lecture	Tutorial	Practical	Credit	Theory	Sessional	Practical	Total	Time
3	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	This course provides a thorough understanding of agent related system development							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To understand Agent development							
CO2	Gain Knowledge in Multi agent and Intelligent agents							
CO3	To Understand Agents and security							
CO4	Gain Knowledge in Agent Applications							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION

The agent landscape – The smart agent framework: Introduction – Initial concepts – Entities-Objects – Agents – Autonomy – Tropistic agent – Specification structure of SMART. – Agent relationships – An operational analysis of Agent relationships.

UNIT II-SOCIOLOGICAL AGENTS

Sociological Agents - Autonomous Interaction - Contract Net as a global directed system – Computational Architecture for BDI agents – Evaluating social dependence networks – Normative agents.

UNIT III-INTELLIGENT AUTONOMOUS AGENTS AND COMMUNICATION

Intelligent Agents –Deductive Reasoning Agents – Practical reasoning agents - Reactive agents – Hybrid Agents – Understanding Each other – Communicating – Methodologies

UNIT IV-APPLICATIONS OF AGENTS

Multi Agent system: Theory approaches and NASA applications – Agent based control for multi-UAV information collection-Agent based decision support system for Glider pilots – Multi agent system in E- Health Territorial Emergencies – Software Agents for computer network security- Multi-Agent Systems, Ontologies and Negotiation for Dynamic Service Composition in Multi- Organizational Environmental Management.

REFERENCES

1. Mohammad Essaaidi, Maria Ganzha, and Marcin Paprzycki, *"Software Agents, Agent Systems and Their Applications*", IOS Press, 2012.
2. Mark d Inverno and Michael Luck, *"Understanding Agent Systems"*, Springer,2010.
3. Michael Wooldridge, *"An Introduction to Multi Agent Systems*", John Wiley & Sons Ltd., 2009.
4. Lin Padgham, Michael Winikoff, *"Developing Intelligent Agent Systems: A Practical Guide"*, John Wiley & Sons Ltd., 2004.
5. Bradshaw , *"Software Agents*" , MIT Press, 1997.
6. Richard Murch, Tony Johnson, *"Intelligent Software Agents"*, Prentice Hall, 2000.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-115	Human Interface System Design							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	This course on user Interface Design provides a basic understanding of interface design and principles.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	Students learn about the design process management							
CO2	To understand about Interaction devices and windows strategies							
CO3	To understand about how to Manage Virtual Environments							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION

Goals of System Engineering – Goals of User Interface Design – Motivations of Human factors in Design – High Level Theories –Object-Action Interface Design - Three Principles – Guidelines for Data Display and Data Entry

UNIT II-MANAGING DESIGN PROCESS

Introduction- Organizational Design to Support Usability – The Three Pillars of Design- Development Methodologies- Ethnographic Observation – Participating Design- Scenario Development- Social Impact Statement for Early Design – Legal Issues- Reviews – Usability Testing and laboratories- Surveys- Acceptance tests – Evaluation during Active use- Specification Methods- Interface – Building Tools- Evaluation and Critiquing tools

UNIT III-MANIPULATION AND VIRTUAL ENVIRONMENTS

Introduction-Examples of Direct Manipulation Systems –Explanation of Direct Manipulation- Visual Thinking and Icons – Direct manipulation Programming – Home Automation- Remote Direct manipulation- Virtual Environments- Task

UNIT IV-WINDOWS STRATEGIES AND INFORMATION SEARCH

Introduction- Individual Widow Design- Multiple Window Design- Coordination by Tightly – Coupled Widow- Image Browsing- Personal Role Management and Elastic Windows – Goals of Cooperation – Asynchronous Interaction – Synchronous Distributed – Face to Face- Applying Computer Supported Cooperative Work to Education – Database query and phrase search in Textual documents – Multimedia Documents Searches – Information Visualization – Advance Filtering Hypertext and Hypermedia – World Wide Web- Genres and Goals and Designers – Users and their tasks – Object Action Interface Model for Web site Design

REFERENCE

1. Alan Dix et al, " *Human - Computer Interaction ",* Pearson , 2010.
2. Ben Shneiderman , "*Designing the User Interface*", 4th Edition, Pearson, 2010.
3. Dr. Jonathan Lazar, Dr. Jinjuan Heidi Feng, Dr. Harry Hochheiser, "*Research Methods in Human Computer Interaction*" –John Wiley 2010.
4. Wilbert O. Galiz , "*The Essential guide to User Interface Design*", Wiley Dreamtech, 2009.
5. Jef Raskin , "*The Human Interface* ", Addison – Wesley – 2008.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTRM-111	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Practical**	**Total**
2	**0**	**0**	**2**	**60**	**40**	**-**	**100**
Program Objective (PO)	To enable students to Research Methodology and IPR for further research work and investment in R & D which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2:

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-117	Software Engineering Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**This Software Laboratory focuses on the software engineering methodologies for project development and to gain knowledge about open source tools for Computer Aided Software Engineering.**						
Course Outcomes (CO)							
CO1	To develop test cases for any problem						
CO2	Use open source case tools to develop software.						
CO3	Analyze and design software requirements in efficient manner.						

List of Practical

SOFTWARE REQUIRED:
Open source Tools: StarUML / UMLGraph / Topcased/ Argo UML

Prepare the following documents for each experiment and develop the software using software engineering methodology.

1. **Problem Analysis and Project Planning -**Thorough study of the problem –Identify Project scope, Objectives and Infrastructure.
2. **Software Requirement Analysis -** Describe the individual Phases/modules of the project and Identify deliverables.
3. **Data Modeling -** Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
4. **Software Development and Debugging** – implement the design by coding
5. **Software Testing** - Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

Case Studies:
Academic domain
1. Course Registration System
2. Student marks analysing system

Railway domain
3. Online ticket reservation system
4. Platform assignment system for the trains in a railway station

Medicine domain
5. Expert system to prescribe the medicines for the given symptoms
6. Remote computer monitoring

Finance domain
7. ATM system
8. Stock maintenance

Human Resource management
9. Quiz System
10. E-mail Client system.

MTSE-119	Agile Software Engineering Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**This Software Laboratory focuses on to analyze, design and provide optimal solution for Computer Science & Engineering and multidisciplinary problems.**						
Course Outcomes (CO)							
CO1	To Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.						
CO2	To Design solutions for complex engineering problems						
CO3	To Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools						
CO4	To demonstrate the knowledge of and need for sustainable development. .						

List of practical

1. Understand the background and driving forces for taking an Agile Approach to Software Development. Study the Important Characteristics that make agile approach best suited for Software Development.

2. Understand the business value of adopting agile approach.

3. Study the Agile Process Examples
   a) SCRUM
   b) FDD
   c) Lean software development
   d) XP

3. Understand agile development practices using SCRUM

4. Drive Development with Unit Test using Test Driven Development.

5. Apply Design principle and Refactoring to achieve agility

6. To study automated build tool.

7. To study version control tool.

8. To study Continuous Integration tool.

9. Perform Testing activities within an agile project.

MTSE-102	Software Risk Management							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The goal of this course is to engage students in active discovery of risk management principles and the process of designing and implementing a risk management program.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To understands fundamentals of Risk Management Process.							
CO2	To learn Risk Management Infrastructure process.							
CO3	To learn applications of Risk Management.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT-1

Introduction to Software Risk Management: P212 Success Formula: Major Factors in Risk Management Capability, People, Process, Infrastructure, Implementation, Risk Management Roadmap.

UNIT-2

Risk Management Process: Identity Risk, Analyze Risk, Plan Risk, Resolve Risk.

UNIT-3

Risk Management Infrastructure: Develop policy, Define standard process, Train Risk Technology, Verify Compliance, Improve Practice.

UNIT-4

Risk Management Implementation: Establish Initiative, Develop Plan, Tailor Standard Process, Assess Risk, Control Risk. People in Crisis and Control Problem, Mitigation, Prevention, Anticipation, Opportuninty.

Reference Books:

1. Elaine M. Hall, Managing Risk: Methods for Software Systems Development, The SEI Series in Software Engineering, Addison –Welsey, Masschachusetts.
2. Down. Alex, Michael Coleman. And Peter Absolon. Risk Management For Software Projects, McGraw-Hill, New York.
3. Charette. Robert N, Application Strategies for Risk Analysis, McGraw Hill, New York.
4. Grey. Stephen, Practical Risk Assessment for Project Management. Chichester, John Wiley & Sons. New York.
5. Glendon. A and Alan Waring, Managing Risk. International Thomson Business & COMPUTER Press, New York.
6. Jones.Capres. Assessment and Control of Software, Prentice Hll Press, New Jersey.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-104	Social Networks					
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**
3	0	0	3	60	40	100
Program Objective (PO)	This emerging and innovative field will provide the insight into latest communication techniques used in the online social networks for identifying and representing the hidden relationships, tracking the flow of information and to recognize data patterns in social networks by using graph, matrix, relationships, clustering, and equivalence between users.					
Course Outcomes (CO)						
CO1	To understand the essentials of social networks by learning different types of entities and relationships as nodes, edges within the graph and represent these information as relational data to determine the relative importance of a vertex to find the design levels					
CO2	To explore the detailed explanation of data generalization and mining from Twitter, Facebook and LinkedIn in well informed and efficient manner.					
CO3	To describe the semantic web using mining associations, correlations, classification, betweenness, centrality, equivalence relation, centralization, clustering coefficient and structural cohesion to generate visualizations and perform empirical investigations of network data.					
CO4	To interpret and synthesize the results with respect to collated datasets by using structural equivalence, automorphic equivalence and regular equivalence for interpreting quality factors and mining of complex type of data to execute better recommendation.					

Unit: I: Social Networks and Related Concepts

Introduction to Social Networks: Introduction, uses, examples and types of social networks, Social and economic networks, Opportunities and challenges in social networks, Social structure in social networks, Properties of social networks, algorithmic and economic aspects of social networks

Social Network Data: Nodes, Edges, Relationship, Graphs, Samples and Boundaries, Formal methods, Adjacency Matrix for undirected and directed networked graphs and using matrices to represent social relations, Random graphs, Properties of random graphs, Percolations, Branching processes, Growing spanning tree in random graphs.

Level in Social Networks: Ego networks, partial networks, complete or global networks, social networks methods including binary or valued, directed or undirected.

Unit: II Mining the Social Web

Mining Twitter: Fundamental Twitter Terminology, creating a Twitter API Connection, Exploring Trending Topics, searching for Tweets, extracting Tweets entities, analyzing Tweets and Tweet entities with frequency analysis, computing the lexical diversity of Tweets, Examining patterns in Retweets, Visualizing frequency data with histograms.

Mining Facebook: Understanding the social graph API, Understanding the open graph protocol, Analyzing social graph connections

Mining LinkedIn: Making LinkedIn API requests, Downloading LinkedIn connections as a CSV file, Clustering, normalizing data for analysis, measuring similarity, and clustering algorithms.

Unit: III Mining Web pages and Semantic Web

Mining Web pages: Scraping, Parsing and Crawling the Web, Discovering semantics by decoding syntax, Entity-Centric analysis: A paradigm shift, Quality of analytics for processing human language data.

Mining the Semantically Marked-Up Web: Microformats: Easy-to-implement Metadata, Semantics markup to semantic Web: A brief interlude, The semantic Web: An evolutionary revolution.

Social Network Analysis: Introduction, History, Metrics in social network analysis (Betweenness, Centrality, Equivalence relation, Centralization, Clustering coefficient and Structural cohesion).

Unit IV: Equivalence in Social Networks

Structural equivalence, Automorphic equivalence and Regular equivalence

Text Books:

1. Matthew A. Russell, "Mining the Social Web", O'Reilly and SPD, Second edition New Delhi, 2013.
2. Hanneman, R. A., & Riddle, M., "Introduction to social network methods, Riverside, California: University of California, Riverside. Available at: http://faculty.ucr.edu/~hanneman/nettext/.
3. "Social network analysis: Theory and applications". A free, Wiki Book available at: http://train.ed.psu.edu/WFED-543/SocNet_TheoryApp.pdf.

Reference Books:

1. Lon Safko, "The Social Media Bible: Tactics, Tools, and Strategies for Business Success", Wiley 3rd Ed., 2012.
2. Peter K Ryan, "Social Networking", Rosen Publishing Group, 2011.
3. John Scott, Peter J. Carrington, "Social Network Analysis", SAGE Publishing Ltd., 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-106	Cloud Computing							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	To provide a comprehensive introduction to cloud computing and about cloud Services							
			Course Outcomes (CO)					
After completion of course students will be able to								
CO1	To understand Cloud Computing basics and its models.							
CO2	To learn the fundamentals of Data Centers.							
CO3	To understand the Architecture of Data Centers and Design Principles							
CO4	To understand the Security aspects and security framework.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION

Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.

UNIT II-CLOUD COMPUTING FOR EVERYONE

Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping schedules managing projects, presenting on road.

UNIT III-USING CLOUD SERVICES

Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.

UNIT IV-OUTSIDE THE CLOUD

Evaluating web mail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating on line groupware, collaborating via blogs and wikis

Storing and Sharing: Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.

REFERENCES

1. Michael Miller, "*Cloud Computing*", Pearson Education, New Delhi, 2009.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "*Cloud Computing: A Practical Approach*", McGraw Hill, 2009.
3. Mauricio Arregoces,Maurizio Portolani, "*Data Center Fundamentals*", Cisco Press,2004.
4. Scott Lowe, Jason W, Mc. Carty and Mathew K. Johnson, "*VMware, Vsphere 4 Administration, Instant Reference*", Published by Sybex, 2009.
5. George Reese, "*Cloud Application Architectures Building Applications and Infrastructure in the Cloud*", O'Reilly Media, 2009.
6. Grantt Sauls "*Introduction to Data Centers*", Certified Data Centers Specialist, Tutorial.
7. Brendan O'Brien, Alberto Rodriguez, Stephen Sutherland and Mark Wheatley, "*Server Virtualization Software*", Tutorial, 2009.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-108	Software Testing & Quality Assurance							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The purpose of this course is to presents the knowledge about Testing background such introduction of Bug , cause of Bug, how it effect on cost of project, role of STLC cycle realities of software testing. This subject also gives the knowledge software testing fundamentals, under the study of types of testing this subject enlighten the Configuration testing, Compatibility testing, Foreign language testing, Usability testing, Testing the documentation, Testing for software security, Web site testing and more. At the end this subject focuses on the test planning and quality assurance.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To discuss software testing background.							
CO2	To introduce software testing techniques.							
CO3	To explain different types of testing to understand realistic problem.							
CO4	To create awareness about the process part as per as software testing is concern.							

UNIT I-INTRODUCTION TO SOFTWARE TESTING

Introduction – s/w testing background - What is a bug? Why do bugs occur? The cost of bugs. Goals of a software tester. Characteristics of s/w tester. Software development process- product component, software project staff, software development lifecycle model. The realities of s/w testing – testing axioms, s/w testing terms and definitions, Software Testing Life Cycle(STLC).

UNIT II- S/W TESTING FUNDAMENTALS

S/w testing fundamentals- Examining the specifications - Black box and white box testing, Static and dynamic testing, Static black box testing, Performing a high level review of the specification, low level specification test techniques. Testing the s/w with blinders on – Dynamic black box testing, Test to pass and test to fail, Equivalence partitioning, data testing, State testing, Other black box test techniques. Examining the code – Static white box testing, Formal review, Coding standards and guidelines, Generic code review checklist. Testing the software with X-ray glasses – Dynamic white box testing, Dynamic white box testing, verses debugging testing the pieces

UNIT III TYPES OF TESTING

Configuration testing, Compatibility testing, Foreign language testing, Usability testing, Testing the documentation, Testing for software security.Web site testing, Automated testing and test tools- Benefits of automation and tools, various test tools, Software test automation, Random testing. Bug bashes and beta testing – Having other people test your s/w, Test sharing, Beta testing, Outsourcing your testing.

Performance Testing – Introduction, Benefits of performance testing. Types of performance testing Tools for performance Testing, Process for performance testing, challenges.

UNIT IV-TEST PLANNING AND QUALITY ASSURANCE

Planning the test – Goal of test planning, Various test planning topics, Writing and tracking test cases- Goal of test case planning, Test case planning overview, Test case organization and tracking, Reporting what you find - Getting the bug fixed, Isolating and replacing bugs, Bug's lifecycle, Bug tracking system, Measuring the success, Software quality assurance- Quality is free, Testing and quality assurance in the work place, Test management and organizational structures, capability maturity model (CMM), ISO 9000 Test Metrics and Measurement – Test Defect Metrics.

TEXT BOOKS:

1. Ron Patton, "Software Testing" SAMS Publishing
2. Marnei L. Hutcheson – "Software Testing Fundamentals: Methods and Metrics" WILEY Pub.

REFERENCE BOOKS:

1. Pressman "Software Engineering" McGraw-Hill publications.
2. Strinivasan Desikan and Gopal swami Ramesh,Software Testing – Principles and Practices, Pearsons.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-110	Data Warehousing and Data Mining							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	This course enables to understand the concepts of Data Warehousing and Data Mining.							
Course Outcomes (CO)								
After completion of course students will be able to								

CO1	To learn the fundamentals of designing a large-scale data warehouse using relational technologies
CO2	To understand the Data Warehouse and OLAP Technology in Data Mining
CO3	To study the Mining Association Rules in Large Databases, Classification
CO4	To know Cluster Analysis and its Application Trends in Data Mining.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-DATA WAREHOUSING AND BUSINESS ANALYSIS

Data Warehousing and Business Analysis: - Data warehousing Components – Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT II-DATA MINING

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT III-CLASSIFICATION AND PREDICTION

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT IV-APPLICATIONS OF DATA MINING

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

REFERENCES

1. Jiawei Han and Micheline Kamber "*Data Mining Concepts and Techniques*" Second Edition, Elsevier, Reprinted 2008.
2. Sam Anahory & Dennis Murray, "*Data Warehousing in the real world*", Pearson Education Ltd, 2011.
3. Alex Berson and Stephen J. Smith "*Data Warehousing, Data Mining & OLAP*", Tata McGraw – Hill Edition, Tenth Reprint 2007.
4. K.P. Soman, Shyam Diwakar and V. Ajay "*Insight into Data mining Theory and Practice*", Easter Economy Edition, Prentice Hall of India, 2006.
5. Gupta G. K. "*Introduction to Data Mining with Case Studies*", Easter Economy Edition, Prentice Hall of India, 2006.
6. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "*Introduction to Data Mining*", Pearson Education, 2007.
7. Jiawei Han & Micheline Kamber "*Data Mining Concepts and Techniques*" , Morgan Kaufmann Publishers, Elsevier,2nd Edition, 2006.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-112	Object Oriented Programming							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The course provide insight knowledge about programming language (C++ and JAVA)							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To learn the fundamentals of Object Oriented Programming							
CO2	To understand the concepts of Classes & Objects in C++ and Java							
CO3	To understand the concept of static and dynamic polymorphism in C++and Java.							
CO4	To understand the concept of streams in C++ and Java.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION TO OOP

Overview of C++ - classes - structures - union - friend function - friend class -inline function - constructors – static members - scope resolution operator - passing objects to functions - function returning objects -Arrays - pointers - this pointer - references - dynamic memory allocation

UNIT II-OVERLOADING & INHERITANCE

Function overloading - default arguments - overloading constructors - pointers to functions Operator overloading - member operator function - friend operator function - type conversion - inheritance - types of inheritance - virtual base class - polymorphism - virtual function.

UNIT III-TEMPLATES & EXCEPTION

Class templates and generic classes - function templates and generic functions -- exception handling - derived class exception - exception handling functions - Streams - formatted I/O with its class functions and manipulators - creating own manipulators - file I/O - conversion functions- standard template library.

UNIT IV-INTRODUCTION FOR JAVA

JAVA Basics: Importance and features of java- Modifiers- Access Controls-Data types- Expressions-Declarations-Statements- classes and objects and Control Structures-Program Structures-String handling-Packages-Interfaces-Working with java.util Package- Garbage Collection-Object Class - Exception Handling, I/O and JDBC: Exception Handling: Fundamentals exception types- uncaught exceptions throw- throw final- built in exception- creating your own exceptions.

REFERENCES

1. Balagurusamy E, "*Object Oriented Programming with C++",* 4/E, TMG, 2011.
2. Hubbard, *"Programming with C++",* 3/e, Schaum Outline Series, TMH, 2010.
3. Thomas Wu- "*An Introduction to Object Oriented Programming with Java – Special"* Indian Edition 5th 2010.
4. Balagurusamy E, "*Programming with Java: A Primer"*, 4th Edition, Tata Mcgraw Hill, 2009.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-114	Pattern Oriented Software Architecture							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The course gives an insight of the most commonly used software architecture and design patterns and their applications							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	The students get basic knowledge of patterns and description of patterns							
CO2	To understand basic architectural patterns.							
CO3	To get an insight on the design patterns and mining.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION TO SOFTWARE ARCHITECTURE

Introduction – Software architecture – An engineering discipline for software - Architectural Styles – Pipes and filters – Layered Systems - Black board – Repositories - Process control - Distributed system – Interactive system – Adaptive system

UNIT II-DESIGN PATTERNS & PATTERN SYSTEM

Introduction to patterns – Pattern category – Relationship between patterns –Pattern Description – Patterns software architecture -Structural decomposition Organization of work – Access control – Management and Communication –Idioms, Pattern system – Pattern Classification – Pattern Selection –implementation – Evolution – Patterns in Software architecture – Non –functionalproperties – Techniques of Software architecture.

UNIT III-COMMUNITY, MINING, CONCURRENT & NETWORKED

Roots – Community – Pattern Mining - Organizing and Indexing – Methods andtools – Algorithm – Data Structures and Patterns – Formalizing Patterns,Concurrent and Networked Objects, Service Access and Configuration Patterns

UNIT IV-EVENT HANDLING & SYNCHRONIZATION PATTERNS

Event Handling Patterns – Reactor, Proactor, Asyn Completion Tokens, Acceptor- Connector, Synchronization Patterns – Locking – Scoped, Strategized, Thread - safe Interface, Double-Checked Locking Optimization.

REFERENCES

1. Frank Buschmann, Kelvin Henney & Douglas Schimdt, "*Pattern-Oriented Software Architecture - A System of Patterns",* Volume 1, Wiley,2007.
2. Frank Buschmann, Kelvin Henney & Douglas Schimdt, "*Pattern-Oriented Software Architecture – Pattern for Concurrent and Networked Objects"*,Volume 2 ,Wiley,2000.
3. Mary Shaw , David Garlan , "*Software architecture perspectives on a Emerging Dicipline*",EEE,PH1,1996.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-116	Software Measurement and Metrics							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	The purpose of this course is to provide the knowledge about Software Metrics, Essentials of software metrics and practical knowledge to assess software.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To provide a solid background knowledge about software Metrics.							
CO2	To educate various metrics and models to assess software.							
CO3	To provide hands on experience to use and implement metrics.							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-THE HISTORY AND EVOLUTION OF SOFTWARE METRICS

Evolution of the software industry and evolution of software measurements – The cost of counting function point metrics – The paradox of reversed productivity for high-Level languages- The Varieties of functional metrics – Variations in application size and productivity rates – Future Technical Developments in Functional Metrics- Software measures and metrics not based on function points.

UNIT II-MEASURING SOFTWARE QUALITY

Quality control and international competition – Defining quality for measurement and estimation – Five steps to software quality control- Measuring software defect removal- Measuring Defect removal efficiency – Measuring the costs of defect removal – Evaluating defect prevention methods – Measuring customer reported defects- Measuring invalid defects, Duplicate defects and special cases-Reliability Models - The Rayleigh Model- Reliability Growth Models.

UNIT III-PROCESS METRICS

In-Process Metrics for Software Testing - Test Progress S Curve - Testing Defect Arrivals Over Time - Product Size Over Time - CPU Utilization - Effort/Outcome Model. Complexity Metrics and Models - Lines of Code - Halstead's Software Science - Cyclomatic Complexity. - Syntactic Constructs - Structure Metrics.

Metrics for Object-Oriented Projects - Concepts and Constructs - Design and Complexity Metrics - Lorenz Metrics and Rules of Thumb - CK OO Metrics Suite - Productivity Metrics.

UNIT IV-MECHANICS OF MEASUREMENT

Software Assessments – Software Baselines – Software Benchmarks- What a Baseline analysis covers – Developing or Acquiring a baseline data collection Instrument – Administering the data collection questionnaire – Analysis and aggregation of the Baseline data. Measuring and Analyzing Customer Satisfaction - Surveys - Data Collection - Sampling Methods - Analyzing Satisfaction Data. Conducting In-Process Quality Assessments - Preparation - Evaluation - Quantitative Data - Qualitative Data - Evaluation Criteria - Overall Assessment.

REFERENCES

1. Caper Jones, *"Applied Software Measurement: Global Analysis of Productivity and Quality"* , Third Edition, McGraw Hill Companies, 2008.
2. Stephen H. Kan, *"Metrics and Models in Software Quality Engineerin*g", Addison Wesley, 2011.
3. Mark Lorenz, Jeff Kidd, *"Object-Oriented Software Metric*s", Prentice Hall, 2000.
4. Naresh Chauhan, *"Software Testing Principles and Practices*", Oxford University Press, 2010.
5. Ravindranath Pandian C., *"Software Metrics A Guide to planning, Analysis, and Application*", Auerbach, First Indian Reprint, 2011.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-118	Software Quality Models & Testing Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
0	0	4	2	60	40	100	3 Hrs.
Program Objective (PO)	This Software Laboratory focuses on test case generation on testing different kinds of software and to provide the in-depth coverage of software quality models and software testing strategies.						
Course Outcomes (CO)							
CO1	To develop test cases for any problem						
CO2	To pursue testing on any level of software design by using different testing strategies						
CO3	Create a test plan document of real time applications.						
CO4	To apply testing tools for designing the test case to test the real time application.						

Case Study 1: Write the test cases for the largest of three number based on:

- Boundary value analysis test
- Robustness based testing
- Equivalence class partitioning test
- Decision table based test

Case Study 2: Cause Effect Graph Testing for a Triangle Program-Perform cause effect graph testing to find a set of test cases for the following program specification: Write a program that takes three positive integers as input and determine if they represent three sides of a triangle, and if they do, indicate what type of triangle it is. To be more specific, it should read three integers and set a flag as follows:
If they represent a scalene triangle, set it to 1.
If they represent an isosceles triangle, set it to 2.
If they represent an equilateral triangle, set it to 3.
If they do not represent a triangle, set it to 4.

Case Study 3: Boundary Value Analysis for a Software Unit-The following is a specification for a software unit. The unit computes the average of 25 floating point numbers that lie on or between bounding values which are positive values from 1.0 (lowest allowed boundary value) to 5000.0 (highest allowed boundary value). The bounding values and the numbers to average are inputs to the unit. The upper bound must be greater than the lower bound. If an invalid set of values is input for the boundaries an error message appears and the user is reported. If the boundary values are valid the unit computes the sum and the average of the numbers on and within the bounds. The average and sum are output by the unit, as well as the total number of inputs that lie within the boundaries. Derive a set of equivalence classes for the averaging unit using the specification, and complement the classes using boundary value analysis. Be sure to identify valid and invalid classes. Design a set of test cases for the unit using your equivalence classes and boundary values. For each test case, specify the equivalence classes covered, input values, expected outputs, and test case identifier. Show in tabular form that you have covered all the classes and boundaries. Implement this module in the programming language of your choice. Run the module with your test cases and record the actual outputs. Save an uncorrected version of the program for future use.

Case Study 4: Write the test cases for any known application (e.g. banking application) using
I) Basis path testing
II) Component testing
III) Data flow analysis test

Case Study 5: Create a test plan document for any application (e.g. Library Management System)

Case Study 6: Model Based Testing-Design and develop a scientific calculator program using various GUI components and events. Build the test model for the same. Determine the inputs that can be given to the model.
Calculate expected output for the model. Run the test cases. Compare the actual output with the expected output. Any model-based technique can be used for building the test model.

Case Study 7: Study and implementation of

- Mutation test
- Slice based test

Case Study 8: Introduction to any two open source testing tool:

- Study of any testing tool (e.g. Win runner)
- Study of any web testing tool (e.g. Selenium)
- Study of any bug tracking tool (e.g. Bugzilla, bugbit)
- Study of any test management tool (e.g. Test Director)
- Study of any open source-testing tool (e.g. Test Link)

Case Study 9: Web Application Testing for Student Grade System-With educational organizations under increasing pressure to improve their performance to secure funding for future provision of programmes, it is vital that they have accurate, up-to-date information. For this reason, they have MIS systems to record and track student enrolment and results on completion of a learning programme. In this way they can monitor achievement statistics. All student assignment work is marked and recorded by individual module tutors using a spreadsheet, or similar, of their own design. In the computing department these results are input into a master spreadsheet to track a student's overall progress throughout their programme of study. This is then made available to students through the web portal used in college. Perform web application testing for this scenario.

MTSE-120	**Social Networks Lab**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	This Software Laboratory focuses on accessing the dataset from social networks and then applying machine learning techniques, data cleaning and visualization of data in real time environments using Python programming and NLTK						
Course Outcomes (CO)							
CO1	To access the data from social networks						
CO2	To deign machine learning modules for efficient system						
CO3	Create the algorithms for accessing Social Media and data cleaning						
CO4	To apply testing tools for visualization of data in real time application.						

List of practical

1. Write a python program to remove an item from tuple and merge three dictionaries.
2. Write a python program to construct pyramids of stars (*) and numbers using nested for loop.
3. Write a python function to check whether a number is perfect or not and use filter function to print vowels from a given list.
4. Write a python program to estimate coefficients of an equation using linear regression model.
5. Write a python program to predict gender of a person if heigth, weight and shoe size are given using any four supervised learning algorithms.
6. Write a python program to find noun, verb and adjective in a given sentence.
7. Write a python program to calculate frequency of each word in a file after removing stopwords from it.
8. Write a program to for analyzing the behaviour (i.e. check whether a tweet is of positive, negative, or compound nature) of tweets and plot the results.
9. Write a program to sort the list of numbers using shell sort.
10. Write a python program to predict gender of a person from his/her name.
11. Write a python program to make a prediction about a movie from its review.
12. Write a program to plot the image in PNG format using matplotlib for average, max, and min of the data taken from a CSV file.
13. Write a program for classifying the text using NLTK.
14. Write a python program to guess behavior of a person.
15. Write a python program to print trending and common trends tweets in world,us and india.
16. Write a python program to use hashtag as basis of search query to fetch some tweets for further analysis.
17. Write a python program extract twitter entities such as hashtags, screen names.
18. Write a python program to clean any given dataset.
19 Write a python program to visualize a data using histogram, boxplot and scatter plot matrix.
20. Write a program for sentiment analysis of tweets (i.e. polarity and subjectivity).

MTSE-201	Software Quality Management							
Lecture	Tutorial	Practical	Credit	Theory	Sessional	Practical	Total	Time
3	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	This course covers the principles of software development emphasizing processes and activities of quality assurance.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	The student must relate to quality assurance plan							
CO2	The students must apply quality assurance tools & techniques in their project							
CO3	To learn about standards and certifications							
CO4	To describe procedures and work instructions in software organizations							

UNIT I-INTRODUCTION

The Software Quality Challenge - Software Quality Factors - Components of the Software Quality Assurance System. Pre-Project Software Quality Components - Contract Review - Development and Quality Plans

UNIT II-SOFTWARE QUALITY ASSURANCE COMPONENTS IN THE PROJECT LIFE CYCLE

Integrating Quality Activities in the Project Life Cycle – Reviews - Software Testing – Strategies - Software Testing – Implementation - Assuring the Quality of Software Maintenance - Assuring The Quality of External Participants' Parts – Case Tools and their Affect on Software Quality.

UNIT III-SOFTWARE QUALITY INFRASTRUCTURE COMPONENTS

Procedures and Work Instructions - Supporting Quality Devices - Staff Training, Instructing and Certification - Preventive and Corrective Actions – Configuration Management - Documentation and Quality Records Controls

UNIT IV-SOFTWARE QUALITY MANAGEMENT COMPONENTS

Project Progress Control- Components, Internal & External Participants, Progress control regimes, Computerized tools, Software Quality Metrics – Objective, Classification, Process & Product Metrics, Implementation & Limitation of Software Metrics - Software Quality Costs – Objective, Classification Model of cost, Extended Model and Applications.

REFERENCES

1. Daniel Galin, “Software Quality Assurance: From Theory to Implementation”, Pearson Addison-Wesley, 2012.
2. Roger S. Pressman, “Software Engineering-A Practitioner’s Approach”, McGraw Hill pub.2010.
3. Allen Gilles “Software quality: Theory and management”, International Thomson, Computer press 1997.
4. Stephen H.Kan, “Metrics and models in software quality Engineering”, Addison –Wesley 2003.
5. Humphrey Watts, “Managing the Software Process” Addison Wesley, 1986.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTSE-203	Language Technologies							
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Practical**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**-**	**100**	**3 Hrs.**
Program Objective (PO)	This course enables to understand the importance and the benefits of software configuration and change management.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To learn the basic concepts of natural language processing							
CO2	To study the different techniques involved with information retrieval							
CO3	To learn about text mining							
CO4	To study the different scenarios and future directions							

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

UNIT I-INTRODUCTION

Natural Language Processing – Linguistic Background- Spoken language input and output Technologies – Written language Input - Mathematical Methods - Statistical Modeling and Classification Finite State methods

UNIT II-INFORMATION RETRIEVAL

Information Retrieval architecture - Indexing- Storage – Compression Techniques – Retrieval Approaches – Evaluation - Search engines- commercial search engine features- comparison- performance measures – Document Processing – NLP based Information Retrieval – Information Extraction.

UNIT III-TEXT MINING

Categorization – Extraction based Categorization- Clustering- Hierarchical Clustering- Document Classification and routing- finding and organizing answers from Text search – use of categories and clusters for organizing retrieval results – Text Categorization and efficient Summarization using Lexical Chains – Pattern Extraction.

UNIT IV-APPLICATIONS

Machine Translation – Transfer Metaphor - Interlingua and Statistical Approaches - Discourse Processing – Dialog and Conversational Agents – Natural Language Generation – Surface Realization and Discourse Planning.

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

REFERENCES

1. Daniel Jurafsky and James H. martin, “Speech and Language Processing”, Pearson Prentice Hall; 2 edition, 2008.
2. Ron Cole, J.Mariani, et.al “Survey of the State of the Art in Human Language Technology”, Cambridge University Press, 2007.
3. Michael W. Berry “Survey of Text Mining: Culstering, Classification and Retrieval”, Springer Verlag, 2003.
4. Christopher D.Manning and Hinrich Schutze, “Foundations of Statistical Natural Language Processing “, MIT Press, 2000.

MTSE-205	Personal Software Process							
Lecture	Tutorial	Practical	Credit	Theory	Sessional	Practical	Total	Time
3	0	0	3	60	40	-	100	3 Hrs.
Program Objective (PO)	To learn about how a software professional personally manages the software processes in all aspects.							
Course Outcomes (CO)								
After completion of course students will be able to								
CO1	To study how to manage and track the time for software processes.							
CO2	To learn how to schedule the process and manage the commitment.							
CO3	To learn about software Development process							
CO4	To learn how to estimate the product and process quality.							

UNIT I-INTRODUCTION AND TIME MANAGEMENT

Software Engineering – Personal Software Process – Improvement Process – Time Management – Logic of Time Management - Elements of Time Management – Categorizing your Activities – Gather Data on time spent by Activity – Evaluating your Time Distribution – Setting Ground rules – Prioritizing your time – Track Time – Recording your Time Data – Tracking your time – Handling Interruptions – Tracking Completed tasks.

UNIT II-MANAGING COMMITMENTS AND SCHEDULES

Defining Commitment – Responsibly made Commitment – Handling Missed Commitments – Importance of Managing Commitments – Consequences of not Managing Commitments – Way to Manage Commitments – Need for Schedules – Gantt Chart – Making a Project Schedule – Checkpoints – Tracking Project Plans – Tracking Earned Value

UNIT III-SOFTWARE PROCESSES AND QUALITY

Need for Processes – Process Script – Checkpoints and phases – Updated Project Plan Summary Form - Defects – Software Quality – Defects and Quality – Defects Versus Bugs – Defect Types – Understanding Defects – Defect Recording Log – Steps in Finding Defects – Ways to Find and Fix Defects.

UNIT IV-PRODUCT AND PROCESS QUALITY

Product Quality – Testing – The Filter view of Testing - Calculating yield values – Estimating the Ultimate Yield – Prototyping – Process Quality – Process Measures – Defect Removal Paradox – Defect Removal strategy – Appraisal/Failure ratio.

REFERENCES

1. Watts.S.Humphery, "*PSP: A Self-Improvement Process for Software Engineers*", Addison Wesley, 2005.
2. Watts.S.Humphery, "*Introduction to the Personal Software Process*", Addison Wesley, 1997.
3. http://www.sei.cmu.edu/library/abstracts/reports/00tr022.cfm
4. http://repository.cmu.edu/cgi/viewcontent.cgi
5. http://dl.acm.org/citation.cfm?id=650271

Note for paper setter: Nine questions will be set in all. Question No. 1, which will be objective/ short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise, with two questions from each unit. The candidate will be required to attempt FIVE questions in all with Q.1 (compulsory) and four other questions, selecting one question from each unit.

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost.Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment.Strategies for Survival.Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation.Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep&Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes.Work ethics, Indian vision of humanism.Moral and non- moral valuation.Standards and principles.Value judgements.

Unit 2

Importance of cultivation of values.Sense of duty.Devotion, Self-reliance.Confidence, Concentration.Truthfulness, Cleanliness.Honesty, Humanity.Power of faith, National Unity.Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude.Positive Thinking.Integrity and discipline.Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith.Self-management and Good health.Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development*.						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.Strength and nature of the body of evidence for effective pedagogical practices.Pedagogic theory and pedagogical approaches.Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yogasan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; ShrimadBhagwadGeeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; ShrimadBhagwadGeeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; ShrimadBhagwadGeeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

	Dissertation Part-I (MTSE-207) and Dissertation Part-II (MTSE-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain

The student should complete the following:

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part - II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

M.Tech. (Material Science and Technology) – Scheme

(w.e.f. session: 2018-2019 onwards)

Semester - I

Paper code	Subject	Teaching Schedule			Marks Allocation			Credit
		L	P	Total	Minor Test	Major Test	Total	
MMST-101	Introduction to Materials	3	-	3	40	60	100	3
MMST-103	Characterization Techniques	3	-	3	40	60	100	3
*	Program Elective –I	3	-	3	40	60	100	3
MMST-113	Thermodynamics of Materials	3	-	3	40	60	100	3
MMST-115	Material Science and Technology Lab - I	-	8	8	40	60	100	4
MTRM-111	Research Methodology and IPR	2	-	2	40	60	100	2
**	Audit Course-I	2	-	2	100	-	100	0
	Total	*16*	*8*	*24*	*240*	*360*	*600*	*18*

****Audit Course-I**	
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

***Program Elective –I**	
MMST-105	Ceramic and Composite Material Technology
MMST - 107	Ion Beams in Materials Processing
MMST - 109	Thin Film Technology and its Applications
MMST - 111	Flame Retardant Polymers

***Note1:** The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

** **Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

Semester - II

Paper code	Subject	Teaching Schedule			Marks Allocation			Credit
		L	P	Total	Minor Test	Major Test	Total	
MMST-102	Ion Beam Based Characterization Techniques	3	-	3	40	60	100	3
MMST-104	Statistical Methods for Data Analysis	3	-	3	40	60	100	3
MMST-106	Nanomaterials	3	-	3	40	60	100	3
MMST-108	Environmental Law & Materials	3	-	3	40	60	100	3
MMST-110	Material Science and Technology Lab – II	-	8	8	40	60	100	4
#MMST-112	Mini Project	-	4	4	40	60	100	2
*	Audit Course-II	2	-	2	100	-	100	0
	Total	*14*	*12*	*26*	*240*	*460*	*700*	*18*

*** Audit Course - II**	
MTAD-102	Constitution of India
MTAD-104	Pedagogy Studies
MTAD-106	Stress Management by Yoga
MTAD-108	Personality Development through Life Enlightenment Skills.

Note: 1.#**. Mini project:** During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

2. * Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

3. Students be encouraged to go to Industrial Training/Internship for at least 6-8 weeks during the summer break with a specific objective for Dissertation Part–I (MMST-207). The industrial Training/Internship would be evaluated as the part of the Dissertation Part–I (with the marks distribution as 40 marks for Industrial Training/Internship and 60 marks for Dissertation work).

Semester - III

Paper code	Subject	Teaching Schedule			Marks Allocation			Credit
		L	D	Total	Minor Test	Major Test	Total	
*	Program Elective –II	3	-	3	40	60	100	3
**	Open Elective	3	-	3	40	60	100	3
MMST-207	Dissertation Part-I	-	20	20	40	60	100	10
	Total	*6*	*20*	*26*	*120*	*180*	*300*	*16*

*Program Elective –II**:** 1.Polymer Science and Technology (MMST - 201)
2. Intelligent Macromolecules (MMST - 203)
3. Green Chemistry (MMST -205)

****Open Elective**	
MTOE-201	Business Analytics
MTOE-203	Industrial Safety
MTOE-205	Operations Research
MTOE-207	Cost Management of Engineering Projects
MTOE-209	Composite Materials
MTOE-211	Waste to Energy

Semester - IV

Paper code	Subject	Teaching Schedule			Marks Allocation			Credit
		L	D	Total	Minor Test	Major Test	Total	
MMST-202	Dissertation Part-II	-	32	32	100	200	300	16
	Total	-	*32*	*32*	*100*	*200*	*300*	*16*

Total credits of all four semesters – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

Introduction to Materials

MMST - 101

L	P	
3	0	

Major Test: 60 marks
Minor Test: 40 marks
Total: 100 marks
Time: 3hrs

Unit - I

Introduction: Historical perspective of materials, Material science and technology, Classification of materials, Advanced materials, Materials of the future, Modern materials' needs.

Metallic Materials: Ferrous alloys: Steels, Cast irons; Non-ferrous alloys: Copper, Aluminum, Magnesium, Titanium and its alloys, refractory metals, super alloys, noble metals; Fabrication of metals: forming operations, casting, miscellaneous techniques; Thermal processing of metals: annealing processes, heat treatment of steels, precipitation hardening.

Unit - II

Crystalline Materials: Crystalline and non-crystalline materials; Fundamental concepts: lattice translational vector, symmetry operation, space lattice, basis, crystal structure, unit and primitive cell, two and three-dimensional lattice types; Metallic crystal structures: FCC, BCC, HCP and their unit cell characteristics; Some simple crystal structures: Sodium chloride, Cesium Chloride, Diamond and cubic Zinc sulfide; Crystallographic points, directions and planes.

Unit - III

Dielectric Materials: Introduction, Types of dielectric materials, Different types of polarizations, Local or internal field, Clausius - Mosotti equation, Dielectric loss, Dielectric breakdown, Ferroelectric materials, Dielectric properties, Frequency and temperature dependence of dielectric properties, Applications of dielectrics.

Superconducting Materials: Introduction, Types of superconductors, Properties and applications of superconducting materials.

Unit - IV

Magnetic Materials: Basic terminology, Classification of magnetic materials, Langevin theory of diamagnetism and paramagnetism, Weiss theory of paramagnetism and Ferromagnetism, Ferrimagnetic materials: structure and applications; Hard and Soft magnetic materials; Energy product of magnetic material, Magnetic recording materials, Magnetic principle of analog recording and reading, Magnetic bubble memory, Magnetic principle in computer data storage, Magnetic tape, Floppy disk, Magnetic hard disk, Computer aided tomography.

Biomaterials: Introduction, Classification of biomaterials, Applications.

References Books:

1. Material Science and Engineering: An Introduction, W.D. Callister, *Wiley- India Pvt. Ltd., New Delhi.*
2. Introduction to Solid State Physics, C. Kittel, *John Wiley & Sons (ASIA) Pte. Ltd. Singapore.*
3. Material Science and Engineering, V. Raghavan, *PHI Learning Private Limited, New Delhi*.
4. Material Science, V. Rajendran, A. Marikani, *Tata McGraw-Hill Publishing Company Limited, New Delhi*.
5. Engineering Materials: Properties and Applications of Metals and Alloys, C.P. Sharma, *Prentice-Hall of India Private Limited, New Delhi*.
6. Biomaterials: The intersection of Biology and Materials Science, J.S. Temenoff, A.G. Mikos, *Pearson, New Delhi*.

Characterization Techniques
MMST-103

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Hardness Testing Techniques: Introduction, Brinell hardness test: technique, precautions, advantages and applications, disadvantages; Vickers hardness test: process, derivation of Vickers formula, sources of errors, advantages and applications, disadvantages; Rockwell hardness test: introduction, dial reading, principle of operation, advantages, precautions; Superficial Rockwell hardness test: method, precautions; Microhardness test: method, precautions, applications; Comparison of Macrohardness and Microhardness tests.

Unit - II

Thermal Analysis Techniques: Introduction, Factors affecting thermal analysis results, Thermo-gravimetric Analysis (TGA) technique: components, kinetics of reactions, applications; Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC) Techniques: components, applications; Simultaneous TG-DTA and TG-DSC: techniques and applications.

Unit - III

Microscopic Analysis Techniques: Light Microscopy: elementary geometrical optics, limits of resolution, different types of microscopy; Electron Microscopy: introduction, electron optics; Principle, instrumentation, methodology and applications of Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Force Microscope (AFM).

Unit - IV

Spectroscopy Techniques: Infrared Spectroscopy: introduction, molecular vibrations, instrumentation, modes of operations, sampling techniques and applications; Ultraviolet and Visible Spectroscopy: introduction, colour and light absorption- the chromophore concept, theory of electronic spectroscopy, instrumentation and sampling, solvent effects and applications.

References Books

1. Mechanical Behaviour and Testing of Materials, A.K. Bhargava, C.P. Sharma, *PHI Learning Private Limited, New Delhi*.
2. Instrumental Methods of Analysis, H.W. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, *CBS Publishers & Distributers*, *New Delhi*.
3. Thermal Methods of Analysis: Principles, Applications and Problems, P.J. Haines, Blackie Academic & Professional, London.
4. Biophysics, V. Pattabhi, N. Gautham, *Narosa Publishing House, Kolkata.*
5. Organic Spectroscopy, *W. Kamp, Replika Press Pvt. Ltd. India*.

Ceramic and Composite Materials Technology

MMST - 105

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Ceramic Materials: Introduction, Ceramic structure: basic crystal structures; Silicate ceramics: silica, silica glasses, silicates (simple, layered); Carbon: diamond, graphite, fullerenes, material of importance (carbon nanotubes); Imperfections in ceramics: brief introduction to atomic point defects, impurities in ceramics, diffusion in ionic materials; Mechanical properties of ceramics: brittle fracture (fractography of ceramics); Stress-strain behavior: flexural strength, elastic behavior; Mechanism of plastic deformation: crystalline and non-crystalline ceramics.

Unit - II

Applications and Processing of Ceramics: Type and applications of ceramics: glasses, glass-ceramics, clay products, refractories (fireclay refractory, silica refractory, basic refractory, special refractory), abrasives, cements, advanced ceramics (MEMS, optical fibres, ceramic ball bearings, piezoelectric ceramics); Fabrication and processing: glasses, glass-ceramics (glass properties, glass forming, annealing, glass tempering etc.), clay products (characteristics of clay, composition of clay products); Fabrication techniques: hydroplastic forming and slip casting, drying, firing, power pressing, tape casting.

Unit - III

Composites Structure and Processing: Introduction, Types of composites: particle reinforced (large particle composites, dispersion strengthened), fiber reinforced composites (fibre phase, matrix phase), polymer-matrix composites (GFRP, CFRP, aramid fibre-reinforced polymeric composite), metal-matrix composites, carbon-carbon composites, ceramic-matrix composites, cement-matrix composites (properties of each type of composite); Processing of fiber reinforced composites, Structural composite: laminar and sandwich panel composite.

Unit - IV

Application of composites: Composite material for various types of applications: thermal, electrical, electromagnetic, thermoelectric, dielectric, electromagnetic windows, optical (optical wave guides, LASER), magnetic, electrochemical, multiple functions, biomedical.

References Books:

1. Material Science and Engineering: An Introduction, W.D. William Callister, *John Wiley and Sons*, *New York*.
2. Chemical Synthesis of Advanced Ceramic Materials, D. Segal, *Cambridge University Press*, *New York*.
3. Composite Materials: Engineering and Science, F.L. Mathews, R. D. Rawlings, *Woodhad Publishing limited and CRC Press, USA*.

Ion Beams in Materials Processing

MMST - 107

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Ion-Solid Interactions: Fundamental principles, Binary elastic collisions, Ion stopping, Ion channeling, Ion induced target modification: ion implantation, ion mixing, ion sputtering.

Unit - II

Materials Processing-I: Introduction, Ion irradiation effects in crystalline materials: depth profiles and ion channeling, implantation-induced crystal damage, sputtering effects and implanted profile change, radiation damage annealing; Ion implantation into semiconductors: ion implantation into Silicon, ion implantation into Germanium, ion implantation into compound semiconductors.

Unit - III

Materials Processing-II: Ion beam synthesis of new phases in solids: introduction, buried insulating layers in silicon, ion beam-synthesized silicide layers, ion beam synthesis of nano-crystals in insulators; Ion beam mixing of interfaces, Ion beam slicing of thin layers, Ion beam shaping of Nanomaterials, Ion beam processing of other materials: ion implantation into metals, polymers and insulating optical materials.

Unit – IV

Ion Beam Preparation of Materials: Removal of target atoms by sputtering, Effect on sputtering yield: ion energy and ion atomic number, ion incident direction, selective sputtering due to ion channeling, target material, preferential sputtering; Preparation steps by ion beam irradiation: ion beam-induced cleaning and etching, ion beam-induced material deposition, ion beam-induced depth profiling, ion beam cutting, ion beam thinning.

References Books:

1. Ion Beams in Materials Processing and Analysis, B. Schmidt, K. Wetzig, *Springer Wien Heidelberg, New York*.
2. Ion Implantation and Synthesis of Materials, M. Nastasi, J.W. Mayer, *Springer Berlin Heidelberg, New York*.
3. Materials Science with Ion Beams, H. Bernas, *Springer-Verlag Berlin, Heidelberg, New York*.
4. Ion-Solid Interactions: Fundamentals and Applications, M. Nastasi, J.W. Mayer, J.K. Hirvonen, *Cambridge University Press*.

Thin Film Technology and its Applications

MMST - 109

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Thin Film Technology: Introduction, Thin film growth process: structural consequences of the growth process; Physical Vapor Deposition (PVD): introduction, vacuum evaporation, sputtering, PVD setup; Chemical Vapor Deposition (CVD), Chemical Solution Deposition (CSD), Electrochemical Deposition (ECD), Monitoring and analytical techniques: deposition rate and thickness measurement, structure analysis, composition analysis, Micro-fabrication techniques.

Unit - II

Thin Film in Optics: Optics of thin films, Antireflection (AR) coating, Multilayer and inhomogeneous AR coatings, Reflection coatings, Interference filters, Thin film polarizers, Beam Splitters, Integrated optics: waveguides, thin film optical components, passive devices; Active devices.

Unit - III

Quantum Engineering Applications: Introduction, Basic concepts, Superconductivity in thin films, S-N transition devices: switching devices, cryotron amplifiers, computer memory devices; Superconductive tunneling devices: quasiparticle tunneling, pair tunneling, SQUIDs, Applications of SQUIDs, Superconducting electronics.

Unit - IV

Surface Engineering Applications: Introduction, Surface passivation applications: coating of reaction product, metallic coatings, inorganic coatings, organic coatings; Tribological applications: wear-resistant coatings, lubricating coatings; Decorative applications, Miscellaneous applications: adhesion-promoting coatings, preparation of heterogeneous catalysts, preparation of nuclear fuels, fabrication of structure forms, biomedical applications.

References Books:

1. Thin Film Devices Applications, K.L. Chopra, I. Kaur, *Plenum Press, New York*.
2. Handbook of Thin Film Technology, Edited by L.I. Maissel, R. Glang, *McGraw-Hills Book Company, New York*.

Flame Retardant Polymers

MMST - 111

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Flame Retardant Polymers: Polymers: introduction, classification of polymers, polymer flames, flame retardation; Condensed-phase processes: bond dissociation, chemistry of polymer degradation, char forming polymers; Smoke: introduction, smoke measurement, effect of polymer structure on smoke formation, smoke suppressants for polymers.

Unit - II

Mechanisms and Modes of Action in Flame Retardancy of Polymers: Introduction, General considerations, Gas-phase mechanisms, Condensed-phase mechanism, Modes of action of halogen, phosphorus, borates, metal hydroxides and other hydrated inorganic additives-based flame retardants.

Unit - III

Flame Retardant Polymer Composites: Introduction, Properties of the constituents of composites, Flammability of composite structures, Methods of imparting flame retardancy to composites.

Flame Retardant Polymer Nanocomposites: Introduction, Structure and properties of layered silicates, Structure of Nanocomposites, Synthesis methods, Flame-retardant properties of Nanocomposites, Mechanism of flame retardancy in Nanocomposites.

Unit - IV

Recent Developments in Flame-retarding Thermoplastics and Thermosets: Introduction, Factors affecting flammability and its reduction, Testing procedures and hazard assessments: general aspects, Flame-retardant thermoplastics: Polyolefins, Polystyrenes, Acrylics, PVC, Saturated polyesters, Polyamides, Polycarbonate and Poly(phenylene oxide); Flame-retardant elastomers, Flame-retardant Thermosets, Inherently flame-retardant polymers.

References Books:

1. Fire Retardant Materials, Edited by A.R. Horrocks, D. Price, CRC Press, *Woodhead Publishing Limited, Cambridge, England*.
2. Handbook of Building Materials for Fire Protection, Edited by C.A. Harper, *McGraw-Hill, New York*.
3. Fire Retardancy of Polymers: New Applications of Mineral Fillers, Edited by M.L. Bras, C.A. Wilkie, S. Bourbigot, *Published by the Royal Society of Chemistry, Cambridge, UK*.
4. Flame - Retardant Polymeric Materials, Edited by M. Lewin, S.M. Atlas, E.M. Pearce, *Plenum Press, New York*.
5. Polymer Science and Technology, R.O. Ebewele, *CRC Press, New York*.
6. Plastics Technology Handbook, M. Chanda, S.K. Roy, *CRC Press, Taylor & Francis Group, New York.*
7. Fire Retardancy of Polymeric Materials, Edited by C.A. Wilkie, A.B. Morgan, *CRC Press, Taylor & Francis Group, New York*.
8. Flame Retardant Polymer Nanocomposites, Edited by A.B. Morgan, C.A. Wilkie, *Wiley-Interscience, A John Wiley & Sons, New Jersey*.

Thermodynamics of Materials

MMST-113

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Basic Concepts of Classical Thermodynamics: Methodology and scope of thermodynamics, Thermodynamics system, State and phase, Equilibrium and non-equilibrium systems, Reversible, Irreversible and Quasistatic processes, State parameters and functions, The zeroth and first laws of thermodynamics and their consequences.

Thermodynamics Potentials: Definitions, Physical meaning and transformations of thermodynamics potentials, Maxwell relations and transformations of thermodynamic parameters, Chemical potential as natural variable.

Laws and Equations of Thermodynamics: The second law of thermodynamics, The third law of thermodynamics, Extremum principles in equilibrium thermodynamics, Equations of state.

Unit - II

Entropy: Entropy as state functions, Entropy differentials, Entropy as a measure of energy quality, Balance of entropy in isolated, closed and open systems, Micro- and macro-states molecular interpretation of entropy and increase of disorder.

Chosen Elements of Statistical Thermodynamics: Distribution function, Boltzmann probability distribution, Canonical Ensemble, Entropy of mixing.

Chosen Applications of Classical Thermodynamics: Ideal and real gases, Thermo- dynamical quantities for pure liquids and solids, Many component solutions: ideal, non-ideal, dilute, regular; Thermodynamics functions of mixing.

Unit - III

Thermodynamics of Chemical Transformations: Energy conservation in chemical reactions, Thermal effects of chemical reactions, Hess law, Kirchoff law, Chemical reaction rate, Chemical equilibrium and the law of mass action, Entropy production in chemical reaction, Coupled reactions, Le Chatelier-Braun principle.

Stationary States: Entropy production in the stationary state, Stability of stationary state, Stationary state with chemical reactions, Coupling of stationary states.

Unit - IV

Thermodynamics of Phase Changes: Phase equilibrium and the Gibbs phase rules, Phase diagram, Phase transitions: thermodynamics, classification and free energy at the phase transition, Gibb theory of crystallisation, Crystallisation rate, Avrami equation.

Fundamentals of Non-equilibrium Thermodynamics: Characteristic of the non-equilibrium systems, Entropy production in irreversible processes.

Local Equilibrium and Local Formulation of the Second Law: Maximum and minimum of entropy production, Minimisation of energy dissipation, Negentropy.

References Books

1. Introduction to Modern Thermodynamics, D. Kondepudi, *John Wiley & Sons, New York*.
2. Modern Thermodynamics: From Heat Engine to Dissipative Structures, D. Kondepudi, Ilya Prigogine, *John Wiley & Sons, New York*.
3. Thermodynamics of Materials: Tom 1, D.V. Ragone, *John Wiley & Sons, New York*.
4. Thermodynamics of Materials: Tom 2, D.V. Ragone, *John Wiley & Sons, New York*.
5. Introduction to the Thermodynamics of Materials, D.R. Gaskell, *Taylor & Francis, New York.*
6. Physical Ceramics: Principles for Ceramic Science and Engineering, Y. Ming, D.P. Birnie, W.D. Kingery, *John Wiley & Sons, New York*.

Material Science and Technology Lab- I

MMST-115

L	*P*	*Major Test: 60 marks*
0	*8*	*Minor Test: 40 marks*
		Total : 100 marks
		Time : 3hrs

1. To characterize the thermo-gram and differential thermo-grams of some compounds.
2. To determine the molecular weight of polystyrene sample using viscometric method.
3. To prepare phenol-formaldehyde resin (Resole) and then convert it into phenolic laminate.
4. To prepare Hexamethylene –diamine and Adipic acid (Nylon 66) polymer.
5. To determine the amount of sodium and potassium in different water samples by flame photometer.
6. To find the band gap of semiconductor using four probe method.
7. To study the hysteresis loss by tracing a BH curve.
8. To study the hardness of materials by Brinell hardness testing machine.
9. To study the hardness of materials by Rockwell hardness testing machine.
10. To study the hardness of materials by Vicker hardness testing machine.

Note: At least eight experiments should be performed by the students. The experiments may be included or excluded depending upon lab facility.

MTRM-111	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2^{nd} edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

Ion Beam Based Characterization Techniques

MMST-102

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total:100 marks
		Time: 3hrs

Unit - I

Rutherford Backscattering Spectroscopy: Introduction, Scattering fundamentals: kinematic factor, stopping cross-section, Rutherford scattering cross-section; Principle of Rutherford Backscattering Spectroscopy, Fundamental of RBS techniques and its characteristics, Deviations from Rutherford formula, Instrumentation/Experimental, RBS spectra from thin and thick layer, Spectrum Analysis/Simulation, Applications and limitations of RBS.

Unit - II

Elastic Recoil Detection Technique: Introduction, Fundamentals of the ERDA technique, Principle and characteristics of ERDA, ERDA using E-detection, ERDA with particle identification and depth resolution: ERD using transmission telescope, position-sensitive detector, Time-of-flight spectrometry; Heavy ion ERDA, Data analysis, Advantages and limitations of ERDA.

Unit - III

Accelerator Mass Spectrometry (AMS): Introduction, Principle, Experimental, AMS using low-energy accelerators, Sample preparation for AMS, Time-of-Flight Spectrometry (TOF-MS), Detection limits of particle analyzed by AMS, Applications of AMS, Advantages and limitations of AMS.

Unit - IV

XRF and PIXE Techniques: Introduction, Principle of XRF and PIXE techniques, Theory and concept, Instrumentation/Experimentation: modes of excitation for XRF analysis, x-ray detection and analysis in XRF, Source of excitation and x-ray detection in PIXE analysis: ion sources, choice of beam/PIXE using heavy ion beams, Qualitative and Quantitative analysis, Sources of background, Applications of XRF and PIXE techniques.

References Books

1. Atomic and Nuclear Analytical Methods, H.R. Verma, *Springer Berlin Heidelberg, New York*.
2. Fundamentals of Surface and Thin Film Analysis, L.C. Feldman, J.W. Mayer, *North Holland, New York*.

Statistical Methods for Data Analysis

MMST-104

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Statistical Methods: Introduction, Functions and Importance.

Measures of Central Tendency: Measure of average value: introduction, objectives, requisites of good average and types; Simple Arithmetic Mean: method- individual observations, discrete series, continuous series, open-end classes, properties, merits and demerits; Weighted Arithmetic Mean, Median: method-individual observations, discrete series, continuous series, property, merits and demerits, usefulness; Mode: method-individual observations, discrete series, continuous series, merits, demerits and usefulness; Relation between Mean, Median and Mode, Geometric Mean: properties, methods-individual observations, discrete series, continuous series, uses, merits and demerits; Harmonic mean: methods, usefulness, merits and demerits; Relationship between AM, GM and HM.

Unit - II

Measures of Dispersion: Introduction, Significance, Properties and methods, Range: method, merits, demerits and uses; The Interquartile Range or the Quartile deviation: method, merits, demerits; Mean Deviation: method in discrete and continuous series, merits, demerits and usefulness; The Standard Deviation: method in discrete and continuous series, properties, coefficient of variation, variance, merits and demerits.

Skewness and Kurtosis: Skewness: introduction, tests, methods, moments, moments about arbitrary origin, Sheppard's correction for grouping errors, measure of Skewness based on moments; Measures of Kurtosis.

Unit - III

Theoretical Distribution: Introduction, Binomial Distribution: introduction, properties, constants, standard deviation, importance, fitting; Poisson Distribution: introduction, constants, role, fitting; Normal Distribution: introduction, graph, importance, properties, condition for normality, area under the curve, significance, methods of fitting- ordinates and areas.

Unit - IV

Propagation of Errors: Standard error of a sum, difference, product and compound quantity.

Empirical Laws and Curve fitting: Introduction, Graphical method, Law Reducible to Linear Law, Principle of least squares, Working procedure to fit the straight line, parabola and other curves; χ^2 test and goodness of fit.

References Books

1. Statistical Methods, S.P. Gupta, *Sultan Chand & Sons Educational Publishers, New Delhi*.
2. Theory of Error, J. Topping, *Unwin Brothers Limited, London*.
3. Higher Engineering Mathematics, B.S. Garewal, *Khanna Publications, New Delhi*.
4. An Introduction to Probability: Theory and its Applications, Vol.-I, W. Feller, *Wiley India*.

Nanomaterials

MMST-106

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Material Science at Nanoscale: Introduction, Lesson from nature, Nanoworld is uniquely different, Classification of nanomaterials, Applications in various fields.

Nanoparticle Synthesis: Introduction, Classification of nanoparticles synthesis techniques, Solid-state synthesis of nanoparticles, Vapor phase synthesis of nanoparticles: inert gas condensation, plasma based, flame based, spray pyrolysis; Solution processing of nanoparticles: sol-gel, solution precipitation, water-oil microemulsion.

Unit - II

Carbon Nanotubes: Introduction, Structure of carbon nanotubes : single-wall, multiwall; Synthesis of carbon nanotubes, Solid carbon source-based production techniques: laser ablation, electric arc, three phase ac arc plasma; Gaseous carbon source-based production techniques: heterogeneous process, homogeneous process; Synthesis of carbon nanotubes with controlled orientation, Growth mechanism of carbon nanotubes: catalyst-free growth, catalytically activated growth, low and high temperature conditions; Properties of carbon nanotubes, Applications of carbon nanotubes.

Unit - III

Metal Oxide Nanoparticles: Introduction, Synthesis Methods: Hot-injection, Heating-up, Solvothermal, Seed-Mediated growth, Self-Assembled nanoparticles; Organic-Inorganic Hybrid Materials: introduction, rare earth oxide based hybrid nanoparticles, tungsten oxide based hybrid materials, hybrid materials synthesized in other solvents; Properties and Applications.

Unit - IV

Polymer Nanocomposites: Introduction, Polymer matrices, Synthesis methods, Solution intercalation, Melt intercalation, Roll milling, In-situ polymerization, Emulsion polymerization, High shear mixing, Properties of polymer nanocomposites, Applications of polymer nanocomposites,

References Books

1. Nanomaterials Handbook, edited by Y. Gogotsi, *Taylor & Francis Group, New York*.
2. Springer Handbook of Nano-technology, edited by B. Bhushan, *Springer*.
3. Carbon Nanotubes: Properties and Applications, edited by M.J. O'Connell, *Taylor & Francis Group, New York*
4. Metal Oxide Nanoparticles in Organic Solvents: Synthesis, Formation, Assembly and Applications, M. Niederberger, N.Pinna, *Springer*, *New York*.
5. Polymer Nanocomposites: Processing, Characterization and Applications, J.H. Koo, *McGraw Hill, New York*.
6. Principles of Polymer Science, P. Bahadur, N.V. Sastry, *Narosa Publishing House, New Delhi.*
7. Nanotechnology: Basic Science and Emerging Technologies, M. Wilson, M. Simmons, B. Raguse, *Overseas Press, New Delhi*.
8. Nano Science and Technology, Edited by R.W. Kelsall, I.W. Hamley, M. Geoghegan, *John Wiley & Sons Ltd, India*.

Environmental Law & Materials

MMST-108

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total:100 marks
		Time: 3hrs

Unit-I

Environmental Law: Environmental protection under constitution, Fundamental duty of citizens to protect environment; Environmental protection as principle of State Policy; Environment and fundamental rights, The U.N. conference on Human Environmental, Stockholm, 1972.

Unit - II

Environmental Materials: Introduction, Approaches/Methods of considering environmental impact of a material or product: life cycle analysis.

Raw Material Extraction: Introduction, Extraction of Aluminum and Iron, Environmental impact of extraction metallurgy, Energy consumption in extraction of material and in recycling of a product: in case of Aluminum and Steel.

Unit - III

Design of Materials: Proper material selection, Process selection and product design for successful recycling, Waste minimization, Energy efficiency and increased lifetime.

Impact of Processing of Materials: Environmental problems associated with processing of metals, polymers, ceramics, composites, food and methods to overcome these problems.

Unit - IV

Sustainable Materials: Introduction, Uses of sustainable materials generally plant- based materials: wood, natural fiber composites, natural polymers; Recycled materials like polymers, composites, aluminium and steel.

Materials for Green Energy: Need of renewable energy, Brief description of bio-fuel, biomass, hydroelectricity, geothermal, solar energy, tidal power, wind power, wave power as resources for renewable energy, Production of green energy: solar cell materials, fuel cell technology and catalytic pollution control.

References Books

1. Materials and Environment -Eco Informed Material Choice, M.F. Ashby, *Elsevier*.
2. Sustainable Energy without Hot Air, J.C. Mackay, *UIT Cambridge, England*.
3. Environmental Laws, Cases and Materials, P. Weinberg, *University Press of America*.
4. Fundamentals of Materials for Energy and Environmental Sustainability, D.S. Ginley, D. Cahen (Edited book), *Cambridge University Press*.
5. Environmental Ethics and Policy Book: Philosophy, Ecology, Economics, D.V. De Veer, *Wadsworth publisher.*

Material Science and Technology Lab - II
MMST-110

L	*P*	*Major Test: 60 marks*
0	*8*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

1. To determine the melting point of metals through Differential Thermal Analysis (DTA).
2. To study the thermal decomposition of calcium oxalate ($CaC_2O_4.H_2O$) with the help of Thermogravimetry analysis (TGA) technique.
3. Estimate the purity of potassium chloride (KCl) and potassium sulphate (K_2SO_4) through Differential Thermal Analysis (DTA).
4. Determine the glass transition, crystallization and melting temperatures of Soda-lime glass.
5. To study the complete thermal profile of polymeric materials.
6. To study the optical properties of Potassium Permanganate ($KMnO_4$) Solutions through UV-visible spectroscopy.
7. Estimate the band gap of semi-conductors with the help of UV-visible spectroscopy.
8. Investigate thermal kinetics involved during the pyrolysis of biomass by using single heating rate kinetic model.
9. To separate the organic compounds from a given mixture by Colum Chromatography.
10. To determine the relative viscosity and specific viscosity of a given polymeric solution by using Ubbelohde viscometer.

Note: At least eight experiments will be performed by the students.

Polymer Science and Technology

MMST-201

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total: 100 marks
		Time: 3hrs

Unit - I

Basic Concepts: Specific features of polymer structure: regular, irregular polymers, chemical heterogenity, polydisperity, polar and non polar polymers; Classification of polymers, Polymerization mechanisms, Molecular weight of polymers: number-average, weight-average, Z-average and viscosity average; Chemical transformation of polymers: degradation, effect of high temperature, mechanical transformations, light and ionizing radiations, chemical degradation.

Unit - II

Glass Transition Temperature: Definition, Glassy solids and glass transition, Transition and associated properties, Factors affecting glass transition temperature, Glass transition temperature and molecular weight, Glass transition temperature and plasticizers, Glass transition temperature of co-polymers, Glass transition temperature and melting point, Importance of glass transition temperature, Heat distortion temperature, Determination of glass transition temperature.

Unit - III

Crystallinty in Polymers: Crystalline solids and their behaviour towards x-rays polymers and x-ray diffraction, Degree of crystallinity, Crystallisability, Crystallites, Helix structures, Spherulites, Polymer single crystals, Effect of crystallinity on preparation of polymers.

Unit - IV

Ceramics: Clays, Silica, Feldspars, Methods for fabrication of ceramic ware, Ceramic products, Glazes procelain and Vitreous enamels.

Composite Materials: Introduction, Constitution, Classification: particle-reinforced composites, fibre-reinforced composites, structural composites, hybrid composites; Processing of Fibre: reinforced composites, Applications of composite materials.

References Books

1. Physical Chemistry of Polymers, A. Tager, Mir Publishers.
2. A Text book of engineering Chemistry, S.S. Dara, S. Chand & Company Ltd.
3. Industrial Chemistry, O.P. Vermani, A.K. Narula, Galgotia Publications Pvt. Ltd.

Intelligent Macromolecules

MMST - 203

L	*P*	*Major Test: 60 marks*
3	*0*	*Minor Test: 40 marks*
		Total:100 marks
		Time: 3hrs

Unit - I

Concepts of Intelligent Macromolecules: Introduction, Synthetic macromolecules: chain structure, classification, synthesis, chain confirmation, macromolecular structure in solution, primary, secondary, tertiary and quaternary structures; Biological macromolecules: brief description of structure of DNA, proteins, polysaccharides; Carbon nanomaterials, Intelligent macromolecules.

Unit - II

Conducting Polymers: Introduction, Conjugated conducting polymers: structure, synthesis (soluble conjugated polymers, conjugated polymer films) and properties; Charge transfer polymers: organic charge transfer complexes, polymer charge transfer complexes, charge transfer between fullerene and polymers.

Dendrimers and Fullerene: Introduction, Dendrimers, Synthesis: divergent approach, convergent growth approach; Structure: dendrimer with a metal core, hollow core, hydrophobic interior and hydrophilic exterior layer, guest molecules trapped in their cavities; Fullerene: chemistry of C_{60} (addition reaction, dimerisation and polymerization), polymeric derivatives of C_{60} (fullerene charm bracelets, fullerene pearl necklace).

Unit - III

Carbon Nanotubes: Introduction, Structure, Properties, Synthesis: multi-wall, single wall; Purification, Microfabrication, Chemical modification: end-functionalisation (oxidation of carbon nanotubes, covalent coupling via oxidized nanotubes end), modification of nanotube outerwall, fuctionalisation of nanotube innerwall; Non-covalent chemistry of carbon nanotubes.

Unit - IV

Intelligent Macromolecules Applications: C_{60} superconductivity, Carbon nanotube Super-capacitors, Conducting polymer batteries, Carbon nanotube nano electronics: nano wires, super conductors, rings, nano circuits; Conjugated polymer sensors with electrical transducers: conductometric, potentiometric, ampermetric, volumetric.

References Books:

1. Intelligent Macromolecules for Smart Devices from Material Synthesis to Device Applications, L. Dia, *Springer, USA*.
2. Dendrimer Chemistry, F. Vögtle, G. Richardt, N. Werner, *John Wiley and Sons, Germany*.
3. Fullerenes: Principles and Applications, Edited by F. Langa, J.F. Nierengarten, *RSC publication*, *England*.

Green Chemistry

MMST - 205

L	*P*		*Major Test: 60 marks*
3	*0*		*Minor Test: 40 marks*
			Total: 100 marks
			Time: 3hrs

Unit - I

Green Chemistry: Introduction, Need for green chemistry: pesticides, chlorofluorocarbons, acid rain, global warming; Goals of green chemistry, Limitations in the pursuit of goals of green chemistry, Progress of green chemistry, Importance of green chemistry in daily life.

Unit -II

Principles of Green Chemistry and Designing of Chemical Synthesis: Twelve principles of green chemistry, Designing of green synthesis using these principles, Prevention of waste/byproducts, Atom economy: rearrangement reactions, addition reactions, substitution reactions, elimination reactions; Prevention/minimization of toxic products, Designing safer chemicals: selection of appropriate auxiliary substances (solvents, separation agents), green solvents, immobilized solvents, ionic liquids.

Unit - III

Green Synthesis Methods and Conversions: Microwave synthesis, Electro-organic synthesis, Thermo-chemical conversion: direct combustion, gasification; Biochemical conversion: anaerobic digestion, alcohol production from biomass.

Unit - IV

Green Synthesis/Reactions: Green synthesis of compounds: adipic acid, catechol, methyl acrylate, urethane, acetaldehyde, benzyl bromide, paracetamol.

References Books:

1. Green Reaction Media in Organic Synthesis, M. Koichi, *Wiley-Blackwell, USA.*
2. Introduction to Green Chemistry, V. Kumar, *Vishal Publishing Co., Jalandhar.*
3. Green Chemistry, R. Sanghi and M.M. Srivastava, *Narosa Publishing House, New Delhi.*

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.

3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development*.						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; Shrimad Bhagwad Geeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; Shrimad Bhagwad Geeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; Shrimad Bhagwad Geeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Dissertation Part – I and Dissertation Part - II

	Dissertation Part-I (MMST-207) and Dissertation Part-II (MMST-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain

The student should complete the following:

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part - II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHEME OF EXAMINATIONS FOR
MASTER OF TECHNOLOGY IN
BIOTECHNOLOGY
(W. E. F. SESSION: 2018-19)

SEMESTER-I

S. No.	Course Code	SUBJECT	L	T	P	Total	Minor Test	Major Test	Practical	Cr.	Duration of Exam (Hrs.)
1	MTBT-101	Genomics and Proteomics	3	-	-	3	40	60		3	3
2	MTBT-103	Advances in Bioprocess Engineering	3	-	-	3	40	60		3	3
3	*	Program Elective –I	3	-	-	3	40	60		3	3
4	**	Program Elective-II	3	-	-	3	40	60		3	3
5	MTBT-117	Bio-analytical Techniques Lab	-	-	4	4	40		60	2	3
6	MTBT-119	Fermentation Technology Lab	-	-	4	4	40		60	2	3
7	MTRM-111	Research Methodology and IPR	2	-	-	2	40	60		2	3
8	***	Audit Course-I	2			2	100			0	3
		Total	16		8	24	280	300	120	18	
								700			

*Program Elective-I		**Program Elective -II	
Course No.	Subject	Course No.	Subject
MTBT-105	Phytomedicine	MTBT-111	Biomaterial Technology
MTBT-107	Microbial Diversity	MTBT-113	Biosensor Technology
MTBT-109	Fungal Biotechnology	MTBT-115	Protein Engineering

***Audit Course-I	
Course No.	Subject
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

Note: 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

2. *** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

SEMESTER- II

S. No.	Course Code	Subject	L	T	P	Total	Minor* Test	Major Test	Practical	Cr.	Duration of Exam (Hrs.)
1	MTBT-102	Drug Discovery and Development	3	-	-	3	40	60		3	3
2	MTBT-104	Medical Biotechnology	3	-	-	3	40	60		3	3
3	*	Program Elective-III	3	-	-	3	40	60		3	3
4	**	Program Elective-IV	3	-	-	3	40	60		3	3
5	MTBT-118	Molecular Techniques Lab		-	4	4	40		60	2	3
6	MTBT-120	Advanced Molecular Techniques. Lab	-	-	4	4	40		60	2	3
7	# MTBT-122	Mini Project	-	-	4	2	40	60		2	3
8	***	Audit Course-II	2			2	100			0	3
	Total		**14**		**12**	**24**	**280**	**300**	**120**	**18**	**3**
							700				

*Program Elective -III		**Program Elective -IV	
Course No.	**Subject**	**Course No.**	**Subject**
MTBT-106	Metabolic Engineering	MTBT-112	Biomedical Equipments
MTBT-108	Biofuel Technology	MTBT-114	Gene Therapy and Gene Editing
MTBT-110	Advanced Industrial Biotechnology	MTBT-116	Metagenomics

*** Audit Course - II	
MTAD-102	Constitution of India
MTAD-104	Pedagogy Studies
MTAD-106	Stress Management by Yoga
MTAD-108	Personality Development through Life Enlightenment Skills.

Note: 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

2. *** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

3. Students be encouraged to go to Industrial Training/Internship for at least 6-8 weeks during the summer break with a specific objective for Dissertation Part–I (MTBT-203). The industrial Training/Internship would be evaluated as the part of the Dissertation Part–I (with the marks distribution as 40 marks for Industrial Training/Internship and 60 marks for Dissertation work).

#4**. Mini project:** During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

SEMESTER -III

S. No.	Course Code	Subject	L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	MTBT-201	Advanced Food Biotechnology	3	-	-	3	40	60	3	3
2	*	Open Elective	3	-	-	3	40	60	3	3
3	MTBT-203	Dissertation Part-I	-	-	20	-	100	-	10	-
		Total	**6**		**20**	**6**	**180**	**120**	**16**	-
	Total					**300**				

*Open Elective		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER-IV

Sr. No.	Course Code		L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	MTBT-202	Dissertation Part- II	-	-	32	-	100	200	16	3
	Total				**32**		**100**	**200**	**16**	-
							300		**16**	

Total credits of all four semesters – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM or equivalent etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTBT-101	GENOMICS AND PROTEOMICS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enlighten the knowledge of the Students on different areas of genomics and proteomics						

Course Outcomes (CO)	
CO1	Students will be able to know structural organization and different tools used for analysis.
CO2	Students will be able to gain knowledge about Genome sequencing
CO3	Students will be able to know about techniques used in protein analysis.
CO4	Students will be able to study analysis of Genomic and Proteomics

Unit I

Introduction: Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing principles and translation to large scale projects; Next-Gen sequence technology and applications. Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis- RFLP, DNA fingerprinting, RAPD, PCR,. DNA chips and their use in transcriptome analysis; Mutants and RNAi in functional genomics.

Unit II

Genome sequencing projects: Human, microbes, plants and animals; Accessing and retrieving genome project information from web; Identification and classification using molecular markers-16SrRNAtyping/sequencing, EST and SNP's contigs; allele/gene mining; synteny and comparative genomics. Dart

Unit III

Proteomics: Protein analysis (includes measurement of concentration, amino acid composition, N-terminal sequencing);2 Delectrophoresis of proteins; Microscale solution isoelectric focusing; Peptide fingerprinting; Protein-protein interactions, Yeast two hybrid system. SAGE.

Unit IV

Genomic and Proteomic analysis: Metabolomics for elucidating metabolic pathways, Analysis of microarray data; Protein and peptide microarray-based technology; PCR-directed protein *insitu* arrays; Structural proteomics. Real Time PCR, Platform technologies for screening.

References:

1. Voet D, Voet JG & PrattCW, Fundamentals of Biochemistry, 2ndEdition.Wiley2006
2. Brown TA, Genomes, 3rd Edition. Garland Science2006
3. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition..
4. PrimroseS & TwymanR, Principles of Gene Manipulation and Genomics, 7thEdition, Blackwell,2006.
5. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rdEdition, ASM Press, 1998.
6. Specific journals and published references.

MTBT-103	**Advances in Bioprocess Engineering**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major**	**Minor**	**Total**	**Time**
3	**0**	**-**	**3**	**60**	**40**	**100**	3
PURPOSE	To sensitize the students about Advances in Bioprocess Engineering						
COUSE OUTCOMES							
CO 1	To sensitize students about basic concept of Bioprocess and its historical development.						
CO2	The students will be able to understand about ideal reactors for kinetic data measurement and industrial bioreactor.						
CO3	The students will be able to learn about techniques used for recovery of fermentation product.						
CO4	The students will be able to understand the basic concepts in process optimization.						

Unit I

Introduction to Bioprocess Engineering: **Historical development of bioprocessing technology**, processing and production of recombinant products. Batch and chemostat cultures; Computer simulations; Fed-batch and mixed cultures; Scale-up principles. Transport phenomenon in bioprocess systems.

Unit II

Kinetics of substrate utilization and product formation. Ideal reactors for kinetics measurements. **High performing reactors and industrial reactors**. Kinetics of balanced growth.. Structured kinetic models. Product formation kinetics. Segregated kinetic models of growth and product formation.

Unit III

Recovery and purification of fermentation products: Liquid-liquid extraction, cell disruption and isolation of non- secreted products, Lyophilization and Spray drying. Membrane based affinity separations; two-phase affinity partitioning; use of reverse micelles in protein separation; chiral separations; molecular imprinting.

Unit IV

Fermentation Technology: Case studies on production of lactic acid, glutamic acid, penicillin, microbial lipase and protease, recombinant insulin. Case studies should deal with strain improvement, medium designs, and process optimization.

References-

1. Biochemical Engineering fundamentals" by J E Bailey and D F Ollis, 2nd ed, McGraw-Hill .
2. "Principles of fermentation technology" by P F Stanbury and A Whitaker, Pergamon press.
3. "Principles of Cell Energetics" : BIOTOL series, Butterworth - Heinemann.
4. "Bioprocess Technology - Kinetics & Reactors" by A Moser, Springer-Verlag.
5. "Biotechnology" Vol.4 Meanning Modeling and Control Ed. K.Schugerl, VCH (1991).
6 "Biotechnology" Vol.3 Bioprocessing Ed.G. Stephanopoulos, VCH (1991).
7. "Biochemical Engineering and Biotechnology Handbook" by B.Atkinson&F.Mavituna, 2nd Ed. Stockton Press (1991).
7. Specific journals and published references.

MTBT-105	Phytomedicine						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	Students will have knowledge about various strategies for the development of phytomedicine and mode of action of bioactive compound for the treatment of diseases						

Course Outcomes (CO)	
CO1	Students will learn about basics of Phytomedicine and quality issue associated with current medicine
CO2	Students will learn about selection of plant for medicine development and current status of phytomedicine in India
CO3	Students will have knowledge about various steps and strategies involved in phytomedicine development
CO4	Students will have knowledge about application of phytomedicine in treatment of severe diseases, mode of action of various biomolecules

Unit I

What is phytomedicine? History of phytomedicine. Taxonomy, Morphology and Ecology of Medicinal plants: a botanical perspective. Economic value of phytomedicne. Bioactive compounds in phytomedicine. Role of plant-derived compounds in drug development. Different classes of plant Secondary metabolites as a source of phytomedicine. Medicinal plant: molecular biology and Biotechnology approaches. Breeding and cultivation of medicinal plants, quality issues of current herbal medicines

Unit II

Selecting medicinal plants for development of phytomedicine and use in primary health care**;** bioactive phytocompounds and products traditionally used in India and Asia. Recent developments in drug discovery from plants. Examples of plant-derived compounds currently involved in clinical trials Phytomedicine: India's contribution.

Unit III

Development of phytomedicine; extraction, sample preparation, application of all available modern, high-tech methods to standardize phytomedicines before going for systematic pharmacological investigations and clinical studies. Quality control, screening, toxicity, and regulation of herbal drugs.

Unit IV

Application of phytomedicine in modern drug development. Molecular modes of action of some successful molecules used in phytomedicine, phyto-complexes versus single-entity drug, bioavailability issue. Drug delivery system for herbal-based therapeutics Methods for testing the anti-microbial, anti-cancer, anti-HIV, anti-diabetic, and neuroprotective activities of plant extracts. Reverse pharmacology approach for Phytomedicine development.

References:

1. Iqbal Ahmad, Farrukh Aqil, Mohammad Owais: Modern Phytomedicine: Turning Medicinal Plants into Drugs. (Wiley) 2006.
2. Leland J. Cseke; Ara Kirakosyan, Peter B. Kaufman, Sara Warber;James A. Duke; Harry L. Brielmann: Natural Products from Plants, 2ndedition; (CRC Press)2006.
3. Naturally Occurring Bioactive Compounds, 1st Edition (Advances in Phytomedicine vol 3). Edited by Rai & Carpinella. Publisher: ElsevierScience; 1 edition (December 2, 2006).
4. Stephen Neidle, Antony D Buss, Mark S Butler: Natural Product Chemistry for Drug Discovery; 1st Edition; (Royal Society ofChemistry).2009
5 Chemistry and Pharmacology of Naturally Occurring BioactiveCompounds. Editor, Goutam Brahmachari . Publisher: CRC Press; 1edition (February 20, 2013) 2013.

MTBT-107	MICROBIAL DIVERSITY						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	60	40	100	3 Hrs.
Program Objective (PO)	To familiarize the students with the diversity of microorganisms on the Earth and concept of metagenomics						
Course Outcomes							
CO1	Learner will know about microbial evolution and systematics and overview of bacterial diversity						
CO2	Students will be able to learn about diversity of Gram-positive bacteria						
CO3	This unit will enable the students to understand the archaeal diversity						
CO4	Students will be able to learn eukaryotic and viral diversity and will also learn the concept of metagenomics						

UNIT I

Microbial Evolution and Systematics. Early Earth and the origin and diversification of life. Microbial evolution andsystematic. Bergey's Manual of Systematic Bacteriology. Archaea and Bacterial Domains.

Overview. Bacterial Diversity: The phylogeny of bacteria. Phototrophic, Chemolithotrophic and MethanotrophicProteobacteria. Aerobic and Facultatively Aerobic Chemoorganotrophic Proteobacteria. Morphologically unusual Proteobacteria. Delta and Epsilonproteobacteria.

UNIT II

Overview of Gram positive and other bacteria. Actinobacteria.Cyanobacteria and Prochlorophytes. Chlamydia. Planctomyces/ Pirellula. Verrucomicrobia. Flavobacteria. Cytophaga Group. Green Sulphur and Non-Sulphur Bacteria. Spirochetes. Dienococci. Hyperthermophilic Bacteria- Nitrospira and Deferribacter.

UNIT III

Archaeal Diversity. Phylogeny and general metabolism. Euryarchaeota. Crenarchaeota. Evolution and life at hightemperature.

UNIT-IV

Eukaryotic and Viral Diversity. Phylogeny of Eukarya. Protists, Fungi, Unicellular Red and Green Algae. ViralDiversity. Viruses of Bacteria and Archaea. RNA and DNA viruses of Eukaryotes. Retroviruses and Hepadnaviruses.

Culture independent studies of microorganisms – metagenomics: principles and applications – steps in construction of a metagenomes – examples of metagenomic studies – metagenomics as a tool to reveal the vast microbial diversity.

References:

1. Madigan. M. T. 2008. Brock: Biology of Microorganisms. 12th Edition. Benjamin Cummings. California, USA.
2. Prescott, L. M., Harley, J. P. and Klein, D. A. 2007. Microbiology. 7th Edition. McGraw Hill, USA.
3. Atlas, R. M. and Bartha, R. 1997. Microbial Ecology: Fundamentals and Applications. Benjamin Cummings, California, USA.
4. Specific Journals and Published References

MTBT-109	FUNGAL BIOTECHNOLOGY						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3.0**	**60**	**40**	**100**	**3 Hrs.**
Purpose	**To familiarize the students with the concepts of Fungal Biotechnology**						
Course Outcomes							
CO1	**Learner will know about basics of fungal biotechnology and fungal diversity**						
CO2	**Students will be able to understand the diversity of protozoal fungi**						
CO3	**This unit will enable the students to understand applications of fungi in various sectors**						
CO4	**Students will be able to learn about keratonophilic and endophytic fungi**						

UNIT-I

Fungal biotechnology : Fungi and Fungus-like Organisms—Introduction and Classification. Historical Development of Mycology.

Fungal Diversity—Kingdom Fungi. Phylum *Chytridiomycota* Phylum *Zygomycota* Phylum *Zygomycota* Class *Trichomycetes.* Phylum *Ascomycota* Introduction. Phylum *Basidiomycota* Introduction. Anamorphic Fungi (Deuteromycetes). Fungi as symbionts-Lichens.

UNIT-II

Fungal Diversity- Kingdom *Straminipila* (Heterokont Zoosporic Organisms). Phylum *Oomycota, Hyphochytriomycota, Labyrinthulomycota* (Net Slime Molds). *Plasmodiophoromycota* (Endoparasitic Slime Molds), *Dictyosteliomycota.* (Dictyostelid Cellular Slime Molds, *Acrasiomycota* (Acrasid Cellular Slime Molds). *Myxomycota* (Plasmodial or True Slime Molds).

UNIT-III

Fungi as Saprotrophs and their Role in Nutrient Cycling and Bioremediation**.** Fungal Biotechnology–Introduction and Applications in agriculture, food, medicine and industry.

Opportunities of fungal applications in pulp and paper manufacturing. Role of fungi in bioremediation. Fungi in bioremediation of toxic metals from waste water. Recycling of agro-wastes for protein production through mushroom cultivation. *Curvularia lunata* : A versatile organism for biotransformation of organic compounds

UNIT-IV

Fungi in enzyme industries. Starch hydrolysing enzymes of thermophilic moulds. Production and application of fungal Xylanases.

Keratinophilic fungi : Diversity and sensitivity to some medicinal plants Current trends in aeromycological research

Endophytic Fungal Biology- Present Status and Future prospective in Biotechnology.

References:

1. Rai, M. K. and Deshmukh S. K. Fungi: Diversity and Biotechnology. Scientific Publishers.
2. Aneja, K. R. and Mehrotra, R.S. Fungal Diversity and Biotechnology

MTBT-111	BIOMATERIAL TECHNOLOGY						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to understand the role of gene therapy in treatment of severe diseases.						
Course Outcomes (CO)							
CO1	Students will learn about basics of Biomaterials, need of biomaterials, types of biomaterials, techniques for characterization of biomaterialas and their potential applications						
CO2	Students will learn about biomaterial degradation, cell interaction with biomaterial and process to improve biocompatibility						
CO3	Students will have knowledge about Biomaterial implantation, imuune and infalammatory response to biomaterial, tests for hemocompatibility						
CO4	Students will have learn about the risk of Infection, tumorigenesis and calcification Associated with biomaterials						

UNIT I

Introduction to biomaterials: Definition of biomaterials, History and current status of the field, Types of biomaterials, Important properties of biomaterials. Characterization techniques (X-ray diffraction, UV-VIS, IR and NMR Spectroscopy, Mass spectrometry, HPLC- Size exclusion chromatography).

UNIT II

Biomaterial degradation in Biological environment; Biodegadable materials: Ceramics and polymers; Processing to improve biocompatibility: sterilization and fixation. Cell interactions with biomaterials: Introduction: Cell-surface interactions and cellular functions. Techniques: Assays to determine effects of cell-material interactions: Cytotoxicity assays, DNA and RNA assays and Protein production assays- Immunostaining.

UNIT III

Biomaterial implantation and Immune response to biomaterials. Undesired immune responses to biomaterials: innate vs. acquired responses to biomaterials and hypersensitivity reactions. Clinical signs of acute inflammation against biomaterials. In vitro assays for inflammatory response. Biomaterials and thrombosis: Tests for hemocompatability.

UNIT IV

Infection, tumorigenesis and calcification of biomaterials. Overview of potential problems with biomaterial implantation, steps to infection, techniques for infection experiments. Biomaterial related tumorigenesis, In vitro and in vivo models for tumorigenesis experiments, pathologic calcification of biomaterials and techniques for pathologic calcification experiments.

Text/References:

1. Temenoff, I.S. and Mikos, A.G. Biomaterials: The Intersection of Biology and Material Science. Pearson Education, India. 2009 Indian ed.
2. Ratledge C and Kristiansen B, Basic Biotechnology, Cambridge University Press, 2nd Edition, 2001.
3. J B Park, Biomaterials - Science and Engineering, Plenum Press, 1984.
4. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.
5. C.P.Sharma & M.Szycher, Blood compatible materials and devices, Technomic Publishing Co. Ltd., 1991.
6. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers. (Dordrecht. 1986)
7. Eugene D. Goldbera, Biomedical Ploymers. 8. Specific journals and published references.

MTBT-113	BIOSENSOR						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	60	40	100	3 Hrs.

Program Objective	To enable students to formulate project, set up a business in field of biotechnology and will be able to understand ethical issue associated it.

Course Outcomes (CO)	
CO1	To familiarize with basic concepts of general properties of transducers and other analytical instruments
CO2	Students will come to know about bioassay design and implementation and basic concepts of automation and robotics
CO3	This unit will enable the students to learn about data retrieval, handling and integration of databases and basics of human cardiac and vascular system
CO4	Students will be able to know the basic concepts and applications of various types of biosensors

UNIT-I

Introduction: Electrical quantities and units, functional elements of an instrumentation system, static and dynamic characteristics, principle of analog and digital meters, CRO, energy meters, time and frequency meters, multimeters.

Transducers: Classification, resistive strain gauges, RTD, LVDT, Piezoelectric transducers, Electromagnetic transducers, Optical transducers, Transducers for biomedical science and their applications.

Analytical Instruments: pH meters, radiometric devices, fluorescence spectrophotometers, chromatology (chromatographic techniques- GC and HPLC), electrophoresis, lab on a chip – related instrumentation, Validation, commissioning and maintenance of the above equipments.

UNIT II

Assay Technologies and Detection methods: Introduction, bioassay design and implementation, radiometric assay, scintillation proximity assay, fluorescence methodology to cover all types of fluorescence measurements and instrumentation, Reporter gene assay applications. Bio-analytical applications.

Automation and Robotics: Introduction: management and services issues of a centralized robotics HTS (high throughput screening) core, flexible use of people and machines, Bar-code technology and a centralized database, factors for the successful integration of assays, equipment, robotics and software. Perspectives on scheduling.

UNIT III

Data retrival, handling and integration: Database systems, systems integration, data management and tracking

Cardiac and Vascular system: Overview of cardiovascular system, types of blood pressure sensors, Lumped parameters modeling of a catheter- sensor/system, heart sounds, cardiac catheterization, indirect measurement of blood pressure, measuring blood flow rate, measuring blood volume, pacemakers, defibrillators, cardiac-assist devices and heart valves- related instrumentation of equipments and involved sensors.

Respiratory system: Modeling the respiratory system, measuring gas flow rate and lung volume, tests of respiratory mechanics, measuring gas concentration, tests of gas transport, ventilators, anesthesia machines- related instrumentation of equipments and involved sensors.

UNIT IV

Biosensors: Introduction to biosensors: concepts and applications, biosensors for personal diabetes management, micro fabricated sensors and the commercial development of biosensors, electrochemical sensors, chemical fibrosensors, Ion-selective FETs, noninvasive blood-gas monitoring, blood-glucose sensors. Noninvasive biosensors in clinical analysis, Applications of biosensors based instruments to the bioprocess industry. Applications of biosensors to the environmental samples, Introduction to biochips and their application to genomics, BIA core- an optical biosensors

Text Books:

1. Introduction to Bio-analytical Sensors by Alice J Cunningham New York, John Wiley, 1998.
2. Applied Biosensors by DolandL.Wise, 1989
3. Advances in Laboratory Automation – Robotics, Eds. J.R.Strimataitis and J.N. Little, Zymark Corporation, Hopkinton, MA 1991.

Reference Books-

1. Instrument methods of analysis by H W Willard, L LMerrit, J A Dean and F A Sttle. VI edition, East- West publishers. 1992.
2. Biosensors and their applications by C Yang Victor &TNgo That, Plenum Press NY, 2000.
3. Biosensors- An Introduction by R.Eggins Brain.
4. Automation technologies for genome characterization, edited by Tony J Beugelsdijk, John Wiley & Sons, Inc.2002.
5. Transducers and instrumentation by D V S Murthy, Prentice Hall, 1995.
6. Commercial sensors by Graham Ramasay, John Wiley & Son, INC, 1998.
7. Biosensors by Jon Cooper and Tony Cass, Oxford university Press, 2004.

MTBT-115	PROTEIN ENGINEERING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The course aims at imparting knowledge on protein structure characterization, structure prediction and strategies to design the novel protein of industrial importance						

Course Outcomes (CO)	
CO1	Students will learn about basics of protein engineering and various characterization techniques
CO2	Students will be able to predict and design novel protein structure
CO3	Students will learn about various protein engineering strategies
CO4	Students will have idea about applications of novel engineered protein

UNIT I

Protein Structure Characterization: Introduction to protein engineering, structure and properties of amino acids, primary, secondary, tertiary and quaternary structure of proteins, analysis of protein structure by CD spectroscopy, NMR, X ray diffraction crystallography,

UNIT II

Protein Structure Prediction: Protein prediction of protein structure using bioinformatics approach, protein sequence and structure relationship, predicting the conformation of proteins from sequence data Protein Folding – Molecular Energy and Forces,
Strategies for design of novel proteins-strategies for the design of structure and function, computer methods in protein modeling, mutations and their effects on protein folding,

UNIT III

Protein Engineering Strategies and Techniques: protein engineering - methodology, application and interpretation, Directed evolution and Rational design (Computer modeling).
Protein Evolution - Cell surface and phage display technologies, Cell-free protein engineering technologies

UNIT IV

Engineering the Proteins and Their Application: Effect of amino acids on structure of proteins, prediction of structure function relations of enzymes and other proteins, gene shuffling methods such as RACHITT, ITCHY, SCRATCHY

Examples of engineered proteins:, Engineering fluorescent proteins/molecular probes, Engineering multi-functional proteins, Antibody engineering

Text Books: 1. Cleland JL and Craik CS, Protein Engineering: Principles and Practice, WileyLiss. (1996).
2. Lutz S and Bornscheuer U T, Protein Engineering Handbook, Wiley-VCH (2009)
3. Paul R. Carey , Protein engineering and design, academic press, 1996, 361 pages.

Reference Books: 1. Primrose SB and Twyman RM, Principles of Gene Manipulation and Genomics, Blackwell Publishing (2006).

MTBT-117	BIOANALYTICAL TECHNIQUES LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
-	-	4	2	60	40	100	3 Hrs.
Program Objective (PO)	**To familiarize the students with various biophysical and bioanalytical techniques and their applications in Biotechnology**						
Course Outcomes							
CO1	**Learner will know about concept of pH, preparation of buffers and measurement of pH.**						
CO2	**Students will be able to learn about concept of centrifugation and various kinds of chromatographic techniques**						
CO3	**Students will understand the concept of electrophoresis and Immunochemical techniques**						
CO4	**Students will be able to learn about spectroscopy and biosensors**						

LIST OF EXPERIMENTS

1. Concept of pH, preparation of buffers, measurement of pH.

2. Centrifugation: Principle and technique.

3. Chromatographic techniques: TLC, Gel Filtration Chromatography, Ion exchange Chromatography, Affinity Chromatography.

4. Electrophoretic techniques - Agarose and PAGE (nucleic acids and proteins).

5. Immunochemical techniques – general principles and applications of immunodiffusion, immunoelectrophoresis, radioimmunoassay, enzyme linked immunosorbent assay, fluorescence immunoassay.

6. Spectroscopy Concepts of spectroscopy, Visible and UV spectroscopy, Laws of photometry. Beer-Lamberts law, Principles and applications of colorimetry.

7. Biosensors and their applications.

Text/ References-

1. Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA & Struhl K. 2002. *Short Protocols inMolecular Biology*. John Wiley.
2. Sambrook J, Russel DW & Maniatis T. 2001. *Molecular Cloning: A Laboratory Manual*. Cold Spring Harbour Laboratory Press.

MTBT-119	FERMENTATION TECHNOLOGY LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
-	-	4	2	60	40	100	3 Hrs.
Program Objective (PO)	**To familiarize the students with various experiments on microbial fermentation processes**						
Course Outcomes							
CO1	**Learner will know about concept of bioreactor and its operation.**						
CO2	**Students will be able to learn about techniques of isolation and screening of bacteria, actinomycetes and fungi for secondary metabolite production.**						
CO3	**To understand the effect of pH, temperature, Carbon and Nitrogen Sources on secondary metabolite production.**						
CO4	**Students will be able to learn the use of statistical tools in fermentation technology**						

LIST OF EXPERIMENTS

1. Study of bioreactor and its operations.
2. Isolation and screening of bacteria, actinomycetes and fungi for secondary metabolite production such as antimicrobial metabolites and enzymes.
3. Studying the effect of pH, temperature, C and N Sources on secondary metabolite production by microorganisms.
4. Partial Purification of secondary metabolite production by microorganisms.
5. Studying the statistical analysis of fermentation experiments by using various tools.
6. Isolation of genomic DNA of bacteria, fungi and actinomycetes.

Text/Reference Books-

1. Kun LY. 2006. *Microbial Biotechnology*. World Scientific.
2. Demain L. Manual of Industrial Microbiology and Biotechnology. ASM Press

MTRM-111	Research Methodology and IPR						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTBT-102	DRUG DISCOVERY AND DEVELOPMENT						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	**To familiarize the students with the concept of drug discovery and development**						
Course Outcomes							
CO1	**To understand the mechanism of action of drugs and lead optimization strategies**						
CO2	**To understand the concept of rational drug design**						
CO3	**To learn the concept of clinical research**						
CO4	**Students will be able to learn about assisted reproductive technologies.**						

UNIT I

Introduction to Drug Discovery and Development. Lead Optimization and validation strategies.
Mechanism of Drug Actions: Inter and intramolecular interactions: Weak interactions in drug molecules; Chirality and drug action; Covalent, ion, ion-dipole, hydrogen bonding, C-H hydrogen bonding, dihydrogen bonding, van der waals interactions and the associated energies. Cation-and OH- interactions. Drug-receptor interactions: Occupancy theory, rate theory, induced fit theory, macromolecular perturbation theory, activation-aggregation theory. Topological and stereochemical consideration.

UNIT II

Rational Drug Design: Structure activity relationships in drug design, Molecular modeling, Molecular docking and dynamics, Electronic structure methods and quantum chemical methods, De novo drug design techniques and Informatics methods in drug design. Optmization of ADME characteristics and physicochemical properties. Xenobiotic Drug Metabolism.

UNIT III

Clinical Research- definition and basic concept. Pharmacological Screening and Assays : General principles of screening, correlations between various animal models and human situations. Pharmacological screening models for therapeutic areas. Correlation between in-vitro and in-vivo screens; Special emphasis on cell-based assays, high through put screening, specific use of reference drugs and interpretation of results. Clinical trials and their regulations.

UNIT IV

Concept of Assisted Reproductive Technologies (Artificial Insemination, *In Vitro*Fertilziation, Gamete Intrafallopian Transfer and Zygote Intrafallopian Transfer), Gene Therapy- Concept and Applications. Concept of Eugenics.

Texts/References-

1. Hill, R. (2012). Drug Discovery and Development- Technology in Transition. 2nd Edition. Churchill Livingstone, London, UK.
2. Hinchliffe, A.(2003). Molecular Modelling for Beginners. John Wiley & Sons
3. Leach, AR (1996). Molecular Modelling: Principles and Applications. Longman.

MTBT-104	Medical Biotechnology						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	To enlighten the knowledge of the Students on different areas of Medical Biotechnology. To train the Students in a hospital based setup and familiarize them with the clinical diagnostics of diseases.						

Course Outcomes (CO)		
CO1	Students will be able to explain insights about genetic diseases and also about the molecular aspects related to human disease	
CO2	Students will be able to gain new insights into molecular mechanisms of nucleic acid and gene therapy	
CO3	Students will be able to gain knowledge about therapeutic recombinant proteins and immunotherapy	
CO4	Students will be able to study processes of treatment of Biomedical waste	

Unit 1

Introduction: Classification of genetic diseases: Chromosomal disorders – Chromosomal instability syndromes. Gene controlled diseases – Autosomal and X-linked disorders, Mitochondrial disorders. Molecular basis of human diseases: - Pathogenic mutations Gain of function mutations: Oncogenes, Huntingtons Disease, Pittsburg variant of alpha 1 antitrypsin. Loss of function - Tumour Suppressor. Genomic. Dynamic Mutations - Fragile- X syndrome, Myotonic dystrophy. Mitochondrial diseases

Unit 2

Gene therapy: Ex-vivo, In vivo, In situ gene therapy, Strategies of gene therapy: gene augmentation Vectors used in gene therapy Biological vectors – retrovirus, adenoviruses, Herpes Synthetic vectors– liposomes, receptor mediated gene transfer. Gene therapy trials – Familial Hypercholesterolemia, ADA, AIDS, Cystic Fibrosis, Solid tumors. Artificial organs and biocompatibility-Overview ,design consideration and evaluation process.

Unit 3

Recombinant & Immunotherapy; Clinical applications of recombinant technology; Erythropoietin; Insulin analogs and its role in diabetes; Recombinant human growth hormone; Streptokinase and urokinase in thrombosis; Recombinant coagulation factors, Monoclonal antibodies and their role in cancer; Role of recombinant interferons; Immunostimulants; Immunosupressors in organ transplants; Role of cytokine therapy in cancers; Clinical management and Metabolic syndrome: – PKU, Familial Hypercholesterolemia, Rickets, ADA, Congenital hypothyroidism.

Unit 4

Hazards of biomedical waste-Need for disposal specifically communicable diseases, Disease Epidemiology and mode of transmission of disease. Environment pollution by waste-CAUSES, Consequences, Mitigation and remedies. Treatment-Mechanical and chemical disinfection, Conventional treatments-Incineration, Microwave technology, Autoclave tech, Hydroclave system, Electro thermal reactivation- Pyrolysis/gasification WHO guidelines on management and disposal of biomedical waste from hospitals.

Text books 1. Diagnostic and Therapeutic Antibodies (Methods in Molecular Medicine by Andrew J.T. George (Editor), Catherine E. Urch (Editor) Publisher: Humana Press; edition (2000)
2. Molecular Diagnosis of Infectious Diseases (Methods in Molecular Medicine) by Jochen Decker, U. Reischl Amazon
Reference Book 1 Human Molecular Genetics by T. Strachan, Andrew

MTBT-106	METABOLIC ENGINEERING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe the improvement of primary and secondary metabolites production with various application of metabolic engineering						

Course Outcomes (CO)	
CO1	Students will learn about the Basic concepts of Metabolic engineering and synthesis of primary metabolites
CO2	Students will learn about synthesis of secondary metabolites and bioconversion
CO3	Students will learn about Regulation of Enzyme Production and Metabolic flux
CO4	Students will learn about Metabolic engineering with Bioinformatics and Applications of Metabolic Engineering

UNIT I

Introduction: Identification of metabolic regulation. Basic concepts of Metabolic Engineering – Overview of cellular metabolism – Different models for cellular reactions, induction – Jacob Monod model and its regulation, Feedback regulation. Synthesis of Primary metabolites. Amino acid synthesis pathways and its regulation at enzyme level and whole cell level, Alteration of feedback regulation, Limiting accumulation of end products.

UNIT II

Biosynthesis of Secondary Metabolites. Regulation of secondary metabolite pathways, precursor effects, prophase, idiophase relationship, Catabolite regulation by passing control of secondary metabolism, producers and applications of secondary metabolites.
Bioconversions: Applications of Bioconversions, Factors affecting bioconversions, Specificity, Yields, Cometabolism, Mixed or sequential bioconversions, Conversion of insoluble substances.

UNIT III

Regulation of Enzyme Production. Strain selection, Genetic improvement of strains, Gene dosage, metabolic pathway manipulations to improve fermentation, the modification of existing - or the introduction of entirely new metabolic pathways
Metabolic flux. Integration of anabolism and catabolism, metabolic flux analysis and its applications, Experimental determination method of flux distribution,

UNIT IV

Metabolic engineering with Bioinformatics. Metabolic pathway modeling, Analysis of metabolic control and the structure metabolic networks,
Applications of Metabolic Engineering. Application in pharmaceuticals, chemical bioprocess, food technology, agriculture, bioremediation and biomass conversion.

Text/References-

1. Wang.D.I.C Cooney C.L., Demain A.L., Dunnil.P. Humphrey A.E. Lilly M.D., Fermentation and Enzyme Technology, John Wiley and sons 1980.
2.Stanbury P.F.,andWhitakerA.,Principles of Ferment Technology, Pergamon Press1984.
3. Specific journals and published references.

MTBT-108	Biofuel Technology						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe the role of biotechnology in biofuel technology						

Course Outcomes (CO)	
CO1	Student will learn about Historical Development of Bioethanol and Chemistry of Lignocelluloses
CO2	Student will learn about the degradation of lignocelluloses by enzymes
CO3	Student will learn about Biochemical Engineering and Bioprocess Management for biofuel and their downstream processing.
CO4	Student will learn about the improvement of biofuel production by genetic manipulations

Unit 1

Historical Development of Bioethanol as a Fuel, Starch as a Carbon Substrate for Bioethanol Production, The Promise of Lignocellulosic Biomass, Thermodynamic and Environmental Aspects of Ethanol as a Biofuel, Effects on emissions of greenhouse gases and other pollutants, Ethanol as a First-Generation Biofuel: Present Status and Future Prospects. Lignocellulosic Biomass, Biomass as an Energy Source: Chemistry of Lignocellulosic Biomass, Lignocellulose as a chemical resource, Physical and chemical pretreatment of lignocellulosic biomass, Biological pretreatments, Acid hydrolysis to saccharify pretreated lignocellulosic biomass

Unit II

Enzymology of cellulose degradation, Cellulases in lignocellulosic feedstock processing, biotechnology of cellulase production, Hemicellulases and Lignin-Degrading Commercial Choices of Lignocellulosic Feedstocks for Bioethanol Production. Biotechnology of Bioethanol Production, Traditional Ethanologenic Microbes, Yeasts, Bacteria, Metabolic Engineering of Novel Ethanologens

Comparison of industrial and laboratory yeast strains for ethanol production, Improved ethanol production by naturally pentose-utilizing yeasts, Assembling Gene Arrays in Bacteria for Ethanol Production, Genetic and metabolic engineering of bacteria for bioethanol production, Candidate bacterial strains for commercial ethanol production, Trends for Research with Yeasts and Bacteria for Bioethanol Production, “Traditional” microbial ethanologens, “Designer” cells and synthetic organisms

UNIT III

Biochemical Engineering and Bioprocess Management for Fuel Ethanol, Biomass Substrate Provision and Pretreatment, Wheat straw — new approaches to complete saccharification, Switchgrass, Corn stover, Softwoods, Sugarcane bagasse, Other large-scale agricultural and forestry, Fermentation Media, Highly concentrated media developed for alcohol fermentations, Fermentor Design and Novel Fermentor Technologies, Continuous fermentations for ethanol production, Fed-batch fermentations, Immobilized yeast and bacterial cell production designs, Contamination events and buildup in fuel ethanol plants, Simultaneous Saccharification and Fermentation and Direct Microbial Conversion, Downstream Processing and By-Products, Ethanol recovery from fermented broths, Solid by-products from ethanol fermentations

UNIT IV

Genetic Manipulation of Plants for Bioethanol Production, Engineering resistance traits for biotic and abiotic stresses, Bioengineering increased crop yield, Optimizing traits for energy crops intended for biofuel production. Vegetable oils and chemically processed biofuels, Biodiesel composition and production processes, Biodiesel economics, Energetics of biodiesel production, Issues of ecotoxicity and sustainability with expanding biodiesel production, Biodiesel from Microalgae and Microbes, Biohydrogen, The hydrogen economy and fuel cell technologies, Bioproduction of gases, Microbial Fuel Cells

References:

1. David M. Mousdale, Biofuel-Biotechnology, Chemistry, and sustainable Development, 1st Ed., CRC Press Taylor & Francis Group, 2008.
2. Ayhan Demirbas, Green Energy and Technology, Biofuels, Securing the Planet’s Future Energy Needs, 1st edition, Springer, 2009.

MTBT-110	ADVANCED INDUSTRIAL BIOTECHNOLOGY						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to describe the various advance industrial application for the benefit of human life						

Course Outcomes (CO)	
CO1	Students will learn about microbial diversity and screening of microbes
CO2	Students will learn about the fermentation and its improvement
CO3	Students will learn about genetic analysis by using tools of recombinant DNA technology and various applications
CO4	Students will learn about Novel industrial applications, tracking of microbes and monitor their gene expression

UNIT I

Microbial diversity and strategies for its recovery. Bioprospecting for novel compounds. Screening of microbial isolates for bioactivity. Cultivation of hyperthermophilic and extremely thermo acidophilic microorganisms. Instrumentation and monitoring of bioreactors. Culture and analysis using gel microdrops.

UNIT II

Experimental design for improvement in fermentation processes. Software applications in fermentation processes. Methods for biocatalysis. Downstream processing. Introduction to bioprocess simulation. Quality assurance and quality control. Concepts of anaerobic fermentation and contract fermentations.

UNIT III

Introduction to genetic analysis of *Streptomyces* and *Bacillus* spp. using tools of recombinant DNA technology. Applications of rDNA technology in thermophiles. Design and assembly of polycistronic operons in *Escherichiacoli. In vivo* folding of recombinant proteins in *E. coli.* Expression of G protein coupled receptors inmicroorganisms. Selection of suitable hosts for *E. coli* optimized for expression of proteins. Mechanism of mRNA degradation in bacteria and their implication for stabilization of heterologous transcripts. Filamentous fungi in industrial biotechnology. Genetics and genomics of *Saccharomyces cerevisiae*.

UNIT IV

Methods for optimizing industrial enzymes. Cloning and analysis of genes for the biosynthesis of microbial secondary metabolites. Antibiotic resistance mechanisms of bacterial pathogens. Genetics of bacteriocins produced by Lactic acid bacteria and their use in novel industrial applications. Biomarkers and bioreporters to track microbes and monitor their gene expression. Biofilms. Future perspectives in industrial microbial technology.

Textbooks and Reference Books

1. Industrial Microbiology. Casida Jr. , L.E . (1968) New Age International (P)Ltd. New D elhi .
2. Prescott & Dunn's Industrial Microbiology. Ed. E. G. Reed (1987). CBS Publishers, New Delhi .
3. Biotechnology: A Textbook of Industrial Microbiology 2nd Edition. Crueger, W. and Crueger, A. (2000) Panima Publishing Corporation, New Delhi.
4. Demain, A.L. and Davies, 1.E. Manual ofIndustrial Microbiology and Biotechnology 2nd Ed. ASM Press, Washington DC.

MTBT-112	Biomedical Equipments						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	60	40	100	3 Hrs.
Program Objective (PO)	To enlighten student's knowledge about biomedical equipments and techniques involved						

Course Outcomes (CO)	
CO1	Students will learn about basics of bioelectric signals and electrodes
CO2	Students will learn about various equipments involved in diagnostic
CO3	Students will be able to understand the working principle of various therapeutic equipments
CO4	Students will have learn calibration and testing of equipments

UNIT I

Bioelectric Signals and Electrodes: Bio-potentials and their origin: ECG, EEG, EMG, ENG, ERG, EOG, MEG. Bio-potential electrodes, generalized medical instrumentation system-Man machine interface.

UNIT II

Diagnostic Equipments: ECG: normal and abnormal waveform, diagnosis interpretation, ECG leads connections, Einthoven triangle, Plethysmography, Blood pressure measurement: direct and indirect methods, Cardiac output measurements, Respiratory volume measurement, Impedance pneumograph, Spirometers, Pneumotachometers. EEG: signal amplitudes and frequency bands, EEG machine. Blood cell counter, Endoscopes, Laparoscopes and Camera pill.

UNIT III

Therapeutic Equipments: Heart lung machine, Dialyzers: basic principle of dialysis, different types of dialyzer, membranes, portable type. Cardiac pacemakers: external and Implantable pacemaker. Cardiac defibrillator: DC defibrillator, implantable defibrillator and defibrillator analyzer. Ventilators, Anesthesia machine, Short wave diathermy, microwave diathermy, ultrasonic therapy unit, electrotherapy

UNIT IV

Patient Safety: Electric shock hazards, leakage currents, electrical safety analyzer, testing of biomedical equipments. Calibration and testing of biomedical equipments. Modern biomedical equipments and systems: Market scenario.

Books Recommended:

1. John G. Webster, "Medical Instrumentation Application and Design" 4th Ed, Wiley, 2011.
2. Joseph J Carr, John M Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, NewDelhi, 2011.
3. L. J. Street, "Introduction to Biomedical Engineering Technology", 2 nd Ed, CRC Press, 2011
4. Khandpur R S, "Medical Instrumentation: Application and Design", 3Rd Ed, John Wiley & Sons, 2009.

MTBT-114	GENE THERAPY AND GENE EDITING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3 Hrs.**

Program Objective (PO)	To enable students to understand the role of gene therapy in treatment of severe diseases.
Course Outcomes (CO)	
CO1	Students will learn about basics of gene therapy
CO2	Students will learn about viral vectors used in gene therapy
CO3	Students will have knowledge about role of gene therapy in curing of diseases treatment
CO4	Students will have learn about gene editing and its application

UNIT I

Introduction: Basic concept of gene therapy. Somatic and germ line gene therapy. Gene replacement and gene addition. In vivo, ex vivo and in vitro gene therapy. Transgenic animal models. Vichels for gene transferviral vectors, reterovirus, adenovirus and adenoassociated virus.

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UNIT II

Viral Vectors: Lentivirus, Recombinant SV40 Virus, Non viral vectors, Naked DNA and Transposons., RNADNA chimera, Gene therapies for Crigler Najjar syndrome.

UNIT III

Gene Therapy and disease: Cystic fibrosis, Duchmne muscular dystrophy, Bleeding disorder, Tryosenemia. Cancer gene therapy

UNIT IV

Genome and Gene Editing: Introduction to Genome and Gene Editing, History of CRISPR, Components of CRISPR/CAS9 system, Editing with homology directed repair, Genome-wide Screening and Regulation of Gene Expression using Crispr/Cas9, CRISPR Purification, and Multiplexible Crispr Expression Systems

Text Books:

1. Gene therapy: TwentyFirst Century Medicine. Annu. Rev. Biochem. 2005. 74:71138
2. Gene therapy: Promises and Problems. Annu. Rev. Genomics Hum. Genet. 2001. 2:177211

Reference Books:

1. Primrose SB and Twyman RM, Principles of Gene Manipulation and Genomics, Blackwell Publishing (2006).
Reference Books:
2. Friedman T. 1999. *The Development of Human Gene Therapy* . Cold Spring Harbor,NY: Cold Spring Harbor Lab. Press.
3. Knipe DM, Howley PM, eds. 2001. *Fields Virology.* Philadelphia, PA: Lippincott Williams & Wilkins.
4. Hackett NR, Crystal RG. 2000. Adenovirus vectors for gene therapy. In *Gene Therapy* , ed. NS Templeton, DD Lasic, pp.1739. New York: Marcel Dekker
5. http://www.liebertpub.com/hum .
6. www.nature.com/gt/index.html

MTBT-116	METAGENOMICS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	60	40	100	3 Hrs.
Program Objective (PO)	The purpose of this course is to provide knowledge about how the metabolic functions, taxonomic distribution, diversity, evenness and species richness of microbial communities varies across environment.						

Course Outcomes (CO)	
CO1	Students will learn about basics of metagenomics and different approaches to metagenomics
CO2	Students will learn about probing of biomarkers and oligonucleotide microarrays
CO3	Students will learn about construction and analysis of metagenomic libraries
CO4	Students will learn about industrial application of metagenomics with case studies

UNIT -I

Environmental Metagenomics – Introduction; Pure culture and in consortium ; Cultivable and Non-cultivable microbial analysis; Molecular fingerprinting techniques (RFLP, T-RFLP, ARISA, DGGE, rDNA library, and FISH); Stable isotope probing (SIP); Suppressive subtractive hybridization (SSH); Differential expression analysis (DEA); Microarrays & Metagenome sequencing; Next-generation sequencing approaches to metagenomics

UNIT II

Stable isotope probing and oligonucleotide microarrays: Direct linking of microbial populations to specific biodegradation and biotransformation processes by stable isotope probing of biomarkers- PhyloChip & GeoChip-Detection of xenobiotic-degrading bacteria by using oligonucleotide microarrays.

UNIT III

Library construction and analysis of metagenomic Libraries: Library Cataloging microbes: phylogenetic tree and construction - Construction of a metagenomic library; Analysis of Metagenomic Libraries; Sequence-based Metagenomics Analysis; Function based Metagenomics Analysis; Phylogenetic analysis and Comparative genomics Softwares & Tools

Unit IV

Metagenomics case studies: Metagenomic analysis of soil microbial communities; marine microbial communities; Microbial Community in Acid Mine Drainage; Bacteriophage; Archaeal Metagenomics: Bioprospecting Novel Genes and Exploring New Concepts; Metagenomics and Its Applications to the Study of the Human Microbiome; Applications of Metagenomics for Industrial Bioproducts

References

1. Diana Marco Universidad Nacional de Cordoba, Argentina, “Metagenomics: Theory, Methods and Applications”, Caister Academic Press, 2010.
2. Diana Marco Universidad Nacional de Cordoba,Argentina “Metagenomics: Current Innovations and Future Trends”, Caister Academic Press, 2011.
3. Joanna R. Freeland, Heather Kirk, Stephen Petersen, “Molecular Ecology”, Mc Graw Hill, 2nd Edition “2012.
4. Beebee T.J.C., D G. Rowe,” An Introduction to Molecular Ecology”, Mc Graw Hill, 2004.

MTBT-118	Molecular Technique Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
-	**-**	4	4	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To provide hands on training on basic techniques.						

Course Outcomes (CO)	
CO1	Student will learn the basic techniques used in molecular biology
CO2	Student will learn PCR and detection of food borne pathogenic organisms

Note: A college must offer 4 of the below listed experiments. The remaining 2 experiments may be Modified by College according to facilities available.

Practical Exercises

1. Extraction of DNA from clinical samples followed by agarose gel electrophoresis.
2. Extraction of double stranded genomic RNA from viral samples.
3. Polyacrylamide gel electrophoresis (PAGE) for detection of segmented genomic RNA.
4. Polymerase chain reaction for detection of pathogens in blood/and other clinical samples.
5. RT-PCR for detection of RNA.
6. Detection of food borne pathogenic organisms from food samples using PCR technology.

Text/ References-

1. Kun LY. 2006. *Microbial Biotechnology*. World Scientific.
2. Sambrook J & Russel DW. 2001. *Molecular Cloning: a Laboratory Manual*. Cold Spring Harbour Lab. Press.
3. Twyman RM. 2003. *Advanced Molecular Biology*. Bios Scientific.
4. Specific journals and published references.

MTBT-120	Advance Molecular Technique Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
-	**0**	**4**	4	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To provide hands on training on advanced techniques.						
Course Outcomes (CO)							
CO1	Student will learn the advance techniques used in molecular biology						
CO2	Student will learn the hybridization and microarray						

Note: A college must offer 5 of the below listed experiments. The remaining 2 experiments may be modified by College according to facilities available.

Practical Exercises

1. Restriction endonuclease profile analysis.
2. Isolation of plasmid DNA from bacteria.
3. Cloning of PCR products followed by nucleic acid sequencing.
4. Analysis of sequenced data.
5. RFLP and RAPD.
6. Southern hybridization/ Northern hybridization.
7. Microarray.

Text/ References-

1. Kun LY. 2006. *Microbial Biotechnology*. World Scientific.
2. Sambrook J & Russel DW. 2001. *Molecular Cloning: a Laboratory Manual*. Cold Spring Harbour Lab. Press.
3. Twyman RM. 2003. *Advanced Molecular Biology*. Bios Scientific.
4. Specific journals and published references.

MTBT-201	Advanced Food Biotechnology						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	-	-	3	60	40	100	3 Hrs.
Objective	To acquaint with the fundamentals and application of biotechnology in relation to raw materials for food processing, nutrition, food fermentations, waste utilization						
Course outcomes							
CO1	To acquaint with principles of different techniques used in processing and preservation of food						
CO2	To acquaint the students with packaging methods, packaging materials, modern packaging techniques						
CO3	To acquaint with food quality parameters and control systems, food standards, regulations, specifications						
CO4	To develop an understanding of enzymes useful in food product technology and food processing						

UNIT I

Preservation and Processing : Scope of food processing; historical developments; principles of food processing and preservation. Processing and preservation by drying, concentration and evaporation-types of dryers and their suitability for different food products; ultra- filtration, reverse osmosis, convectional and adiabatic drying. Fruit powders using spray drying..

Processing and preservation by non-thermal methods, irradiation, high pressure, pulsed electric field, hurdle technology. Use and application of enzymes and microorganisms in processing and preservation of foods; food fermentations, pickling, smoking etc.

UNIT II

Food packaging systems: Different forms of packaging such as rigid, semirigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.

UNIT III

Quality management : Concept of quality, instrumental methods for testing quality.Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food adulteration. Food Safety and Standards Act, 2006; Domestic regulations; Global Food safety Initiative; Indian & International quality systems and standards like ISO and Food Codex. Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues.International scenario, International food standards. Quality assurance.

UNIT IV

Enzymes as processing aids: Role of enzymes in cheese making and whey processing; fruit juices (cell wall degrading enzymes for liquefaction,clarification, peeling, debittering, decolourization of very dark coloured juices such as anthocyanases); baking (fungal α-amylase for bread making; maltogenic α-amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes).

Text & References:

1. Microbiology 5th Edition. Prescott, L.M.; Harley, J.P. and Klein, D.A.(2003) McGraw Hill, USA
2. Food Microbiology: Fundamentals and Frontier 2nd Eds. Ed. Beuchat, Doyle & Montville. (2001). Blackwell Synergy.
3. Food Microbiology. Frazier, W.C. and Westhoff, D.C. (2010) Tata Mc-Graw Hill, New Delhi.
4. Modern Food Microbiology. Jay, J.M. (1996) CBS Publishers and Distributors, New Delhi.
5. Foods: Facts and Principles. (2012) N. Shakuntala Manay and M. Swami. New Age International (P) Ltd, Publishers
6. Biotechnology: Food Fermentation Vol. I & II. Eds. Joshi, V.K. & Pandey, A. (1999) Educational Publishers, Kerala.
7. Biotechnological Strategies in Agroprocessing. Eds. Marwaha S.S & Arora, J.K. (2003)
8. Ray, Bibek (1996). Fundamental Food Microbiology .CRC Press.
9. Food Microbiology 2nd ed, Adam, M. R. and Moss (2003) Panima Pub., New Delhi.

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.

3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development.*						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; Shrimad Bhagwad Geeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; Shrimad Bhagwad Geeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; Shrimad Bhagwad Geeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Dissertation Part – I and Dissertation Part - II

	Dissertation Part-I (MTBT-207) and Dissertation Part-II (MTBT-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.

The dissertation should have the following:

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain

The student should complete the following:

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part - II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.

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UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY
(A constituent Autonomous Institute and Recognized by UGC under Section 12(B) and 2(f))
KURUKSHETRA UNIVERSITY, KURUKSHETRA
Established by the state Legislature Act XII of 1956
('A+' Grade, NAAC Accredited)

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
(CREDIT BASED) (w. e. f. 2018-19)
SPECIALIZATION: INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER-I

Sr. No.	Course Code	Course Name	L	T	P	Hrs./ Week	Credits	Major Test	Minor Test	Practical	Total	Duration of Exam (Hrs.)
1	MTIP-101	Advanced Metal Casting	3	0	0	3	3	60	40	-	100	3
2	MTIP-103	Computer Aided Design and Manufacturing	3	0	0	3	3	60	40	-	100	3
3		*Programme Elective-I	3	0	0	3	3	60	40	-	100	3
4		**Programme Elective-II	3	0	0	3	3	60	40	-	100	3
5	MTRM-111	Research Methodology and IPR	2	0	0	2	2	60	40	-	100	3
6	MTIP-117	Advanced Metal Casting Lab	0	0	4	4	2	-	40	60	100	3
7	MTIP-119	Computer Aided Design and Manufacturing Lab	0	0	4	4	2	-	40	60	100	3
8		***Audit Course-I	2	0	0	2	-	-	100	-	100	3
					Total	**24**	**18**	**300**	**280**	**120**	**700**	

*PROGRAMME ELECTIVE- I (I&P) for 1st Semester		
1.	MTIP-105	Tool Engineering
2.	MTIP-107	Advanced Engineering Materials
3.	MTIP-109	Non-Conventional Machining

**PROGRAMME ELECTIVE- II (I&P) for 1st Semester		
1.	MTIP-111	Product Design and Development
2.	MTIP-113	Simulation of Industrial Systems
3.	MTIP-115	Supply Chain Management

***AUDIT COURSE – I		
1.	MTAD-101	English for Research Paper Writing
2.	MTAD-103	Disaster Management
3.	MTAD-105	Sanskrit for Technical Knowledge
4.	MTAD-107	Value Education

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*** **Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
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SPECIALIZATION: INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER-II

Sr. No.	Course Code	Course Name	L	T	P	Hrs./ Week	Credits	Major Test	Minor Test	Practical	Total	Duration of Exam (Hrs.)
1	MTIP-102	Mechatronics	3	0	0	3	3	60	40	-	100	3
2	MTIP-104	Industrial Tribology	3	0	0	3	3	60	40	-	100	3
3		*Programme Elective-III	3	0	0	3	3	60	40	-	100	3
4		**Programme Elective-IV	3	0	0	3	3	60	40	-	100	3
5	MTIP-118	Mechatronics Lab	0	0	4	4	2	-	40	60	100	3
6	MTIP-120	Industrial Tribology Lab	0	0	4	4	2	-	40	60	100	3
7#	MTIP-122	Mini Project	0	0	4	4	2	-	100	-	100	3
8		***Audit Course-II	2	0	0	2	-	-	100	-	100	3
					Total	**26**	**18**	**240**	**340**	**120**	**700**	

*PROGRAMME ELECTIVE-III (I&P) for 2nd Semester		
1.	MTIP-106	Advanced Welding Processes
2.	MTIP-108	Advanced Metal Cutting
3.	MTIP-110	Metrology

**PROGRAMME ELECTIVE - IV (I&P) for 2nd Semester		
1.	MTIP-112	Sequencing and Scheduling
2.	MTIP-114	Quality Engineering and Management
3.	MTIP-116	Reliability Engineering

***AUDIT COURSE–II		
1.	MTAD-102	Constitution of India
2.	MTAD-104	Pedagogy Studies
3.	MTAD-106	Stress Management by Yoga
4.	MTAD-108	Personality Development through Life Enlightenment Skills

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*** **Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

 # Note3: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING
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SPECIALIZATION: INDUSTRIAL & PRODUCTION ENGINEERING

SEMESTER-III

Sr. No.	Course Code	Course Name	L	T	P	Hrs./ Week	Credits	Major Test	Minor Test	Practical	Total	Duration of Exam (Hrs.)
1		*Programme Elective-V	3	0	0	3	3	60	40	-	100	3
2		**Open Elective	3	0	0	3	3	60	40	-	100	3
3	MTIP-207	Dissertation Phase-I	0	0	20	20	10	-	100	-	100	--
					Total	**26**	**16**	**120**	**180**		**300**	

*PROGRAMME ELECTIVE-V (I&P) for 3rd Semester		
1.	MTIP-201	Enterprise Resource Planning
2.	MTIP-203	Design of Experiments
3.	MTIP-205	Strategic Entrepreneurship

**OPEN ELECTIVE (I&P) for 3rd Semester		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER-IV

Sr. No.	Course Code	Course Name	L	T	P	Hrs./ Week	Credits	Major Test	Minor Test	Practical	Total	Duration of Exam (Hrs.)
1	MTIP-202	Dissertation Phase-II	0	0	32	32	16	-	100	200	300	--
					Total	**32**	**16**		**100**	**200**	**300**	

Total credits of all four semesters – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Broad area for the Dissertation Part-I is to be specified/submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of at least one paper in International/National reputed journals (SCI/Scopus indexed/ UGC approved journals) or reputed conferences with ISSN number.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTIP–101	**ADVANCED METAL CASTING**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of moulding and casting.						
Course Outcomes							
CO1	To impart knowledge about various functional requirements of moulding materials and specifications and testing of moulding sand properties.						
CO2	To acquaint students with the phenomenon of solidification and analytics involved in						
CO3	To impart knowledge to students about Gating system design and Riser design for getting an accurately designed defect free casting.						
CO4	To let student understand some special casting processes and testing of casting.						

UNIT-I

Functional Requirement of Moulding Materials: Principal ingredients of moulding Sands; Different Types of Sands; Clays, Different types of Clay structures, Moisture; Theories of Clay sand bonding, Sand system equipment, Flow of sand in a mechanized foundry, The Requirement of core sands,.

Specification and testing of Moulding Sands

Grain Size, Grain Shape, Clay content, Moisture Content, Bulk Density and Specific Surface Area, Acid Demand Value (ADV), Fines Content, Sintering Temperature, Mould hardness, Permeability, Strength, Deformation & toughness, Compactability, Mouldability, High Temperature Characteristics.

UNIT-II

Solidifications of Metals, Nucleation, free energy concept, critical radius of nucleus, Distribution coefficient and Constitutional Undercooling, Solidification in Pure Metals and Alloys, Directional Solidification, Casting Characteristics related to Solidification; Fluidity, Dendritic Growth, Dendrite coherency, Segregation, Inverse Segregation, Hot tearing, Hipping, Solidification under pressure.

Heat Transfer during casting process: Resistance to Heat Transfer, Centerline Feeding Resistance, Rate of solidification, Solidification of Large casting in an insulating mould, Solidification with predominant interface resistance, Solidification with constant casting surface temperature, Solidification with predominant resistance in mould and solidified Metal, Solidification Time and Chvorinov rule, Numerical Exercises.

UNIT-III

Gating System Design: Gating system defined, Types of Gating Systems, Types of Gates, Elements of Gating System, Gating System design, Factors involved in Gating design, Pouring time, Choke Area, Sprue design, Gating Ratio, Sprue runner gate ratio, Elimination of Slag and Dross, Filtration, Numerical exercises.

Riser Design: Need for riser, Basic requirements of an effective feeding system for a casting, Feeding Efficiency, Types of Risers, Effective feeding distances for simple and complex shapes. Use of chills, Directional solidification, Stresses in castings, Metal Mould reactions, Claine's Method, Modulus Method, Naval Research Laboratory (NRL) Method, Pouring rate and Temperature, Padding, Use of exothermic materials, Chills, Feeding Aids, Numerical exercises.

UNIT-IV

Special casting Processes: Shell Moulding, Investment Casting, Permanent Mould Casting, Diecasting, Centrifugal casting.

Inspection and testing of casting: Visual, Optical, Dimensional inspection, Laser Scanning, White light scanning, Radiographic Inspection, ultrasonic testing, Magnetic Particle Testing, dye penetration, Casting Defects; Classification, Causes and remedies.

RECOMMENDED BOOKS:

1. H.F. Taylor, "Foundry Engineering", John Wiley and Sons.
2. P.L. Jain, "Principles of Foundry Technology", Mc-Graw Hill.
3. Mahi Sahoo and Sudhari Sahu, "Principles of Metal Casting.
4. Amitabha Ghosh, " Manufacuring Science", Affliated East West Press.
5. P.N Rao, "Manufacturing Technology: Foundry, Forming and Welding" TMH.
6. K.P. Sinha,"Foundry Technology", Standard Publishers, Delhi.
7. Flinn, "Fundamentals of Metals Casting", Addison Wesley.
8. Heine Loper and Resenthal, "Principles of Metal Casting", Mc-Graw Hill.
9. Hielel and Draper, "Product Design & Process Engineering", Mc-Graw Hill.
10. Salman & Simans, "Foundry Practice", Issac Pitman.
11. ASME, "Metals Handbook- Metal Casting."
12. P.C. Mukharjee, Fundamentals of Metal casting Technology, Oxford, IBH.
13. P.R.Beeley, Foundry Technology , Butterworth Heinmann.

MTIP–103	COMPUTER AIDED DESIGN AND MANUFACTURING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The objective of the course is to understand about the technology of computers for the design, process planning and manufacturing the products.						
Course Outcomes							
CO1	To understand the fundamentals and applications of computers in the field of designing and manufacturing and the transformation of geometric models.						
CO2	To understand the concepts of G.T. and FMS.						
CO3	To know the use of computers in process planning and shop floor control.						
CO4	To learn the basics of AGV and coding systems for CNC.						

UNIT I

Fundamentals of CAD: Introduction to CAD/CAM, Historical Development, Industrial Look at CAD/CAM, Application of computers in design, Creating manufacturing database, Benefits of CAD. Computer Hardware, Graphic input devices, display devices, Graphics output devices, Central processing unit (CPU).

Geometric transformations: 2D and 3D; transformations of geometric models like translation, scaling, rotation, reflection, shear; homogeneous representations, concatenated representation; Orthographic projections, Numerical Problems

UNIT II

Group Technology and Cellular Manufacturing

Part families, parts classifications and coding, Production flow Analysis, cellular Manufacturing- composite part concept, machine cell design, applications of group technology, Grouping parts and machines by Rank order clustering technique, Arranging machines in a G.T. cell.

Flexible Manufacturing

Introduction, FMS components, Flexibility in Manufacturing – machine, Product, Routing, Operation, types of FMS, FMS layouts, FMS planning and control issues, deadlock in FMS, FMS benefits and applications.

UNIT III

Process Planning

Introduction, Manual process planning, Computer aided process planning – variant, generative, Decision logic-decision tables, decision trees, Introduction to Artificial intelligence.

Shop Floor Control

Introduction, Shop floor control features, Major displays, Major reports, Phases of SFC Order Release, Order Scheduling, Order Progress, Manufacturing control, Methodology, Applications, Shop floor data collections, Types of data collection system, Data input techniques, Automatic data, Collection system.

UNIT IV

CNC Basics and Part Programming

Introduction, Historical Background, Basic Components of an NC, Steps in NC, Verifications of Numerical control machine tool programs, Classification of NC Machine tool, Basics of motion control and feedback for NC M/C, NC part programming, Part programming methods, Modern Machining system, Automatically programmed tools, DNC, Adaptive control

Automated Guided Vehicle

Introduction, History, Features, Functions of AGV, Types of AGV, Safety consideration for AGV, Design of AGV.

RECOMMENDED BOOKS:

1. Chris McMahon and Jimmie Browne, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.
2. Ibrahim Zeid, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
3. Ibrahim Zeid, Mastering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Rogers, D.F. and Adams, A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
5. P. Radhakrishnan, S. Subramanayan and V.Raju, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
6. Groover M.P. and Zimmers E. W., CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
7. Dr. Sadhu Singh, Computer Aided Design and Manufacturing, Khanna Pub., New Delhi, Second Edition, 2000.
8. M.P. Groover, Automation, Productions systems and Computer-Integrated Manufacturing by Prentice – Hall
9. Chang, Wang & Wysk Computer Aided Manufacturing. Prentice Hall.
10. Kundra &Rao, Numerical Control and Computer Aided Manufacturing by, Rao and Tiwari, Tata Mc-Graw Hill.
11. Mattson, CNC programming Principles and applications, Cengage Learning India Pvt. Ltd. Delhi.

MTIP–105	TOOL ENGINEERING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The objective of the course is to impart the students with the knowledge of various aspects of design of different types of Tools and fixtures used in Industries.						
Course Outcomes							
CO1	To impart knowledge of materials for cutting tool and design of cutting tools.						
CO2	To acquaint students with various kinds of Gages and Work holding devices.						
CO3	To impart knowledge to students about Drill jigs and Fixtures.						
CO4	To let student understand the tool design process for NC Machine tools						

UNIT-I

Cutting Tool Materials: Introduction and desirable properties, Carbon and Medium-Alloy Steels, High-Speed Steels, Cast-Cobalt Alloys, Carbides, Coated Tools, Alumina-Based Ceramics, Cubic Boron Nitride, Silicon-Nitride Based Ceramics, Diamond, Reinforced Tool Materials, Cutting-Tool Reconditioning.

Design of Cutting Tools Basic Requirements, Mechanics and Geometry of Chip Formation, General Considerations for Metal Cutting, Design of single point Cutting Tools, Design of Milling Cutters, Design of Drills and Drilling, Design of Reamers, Design of Taps, Chip Breakers.

UNIT-II

Gages and Gage Design: Limits fits and tolerances, Geometrical tolerances-specification and measurement, Types of gages, Gage design, gage tolerances, Material for Gages.

Work Holding Devices: Basic requirements of work holding devices, Location: Principles, methods and devices, Clamping: Principles, methods and devices.

UNIT-III

Drill Jigs: Definition and types of Drill Jigs, Chip Formation in Drilling, General Considerations in the Design of Drill Jigs, Drill Bushings, Drill Jigs, and Modern Manufacturing

Design of Fixtures: Fixtures and Economics , Types of Fixtures , Milling Fixtures , Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Grinding

UNIT-IV

Tool Design for Numerically Controlled Machine Tools: Fixture Design for Numerically Controlled Machine Tools, Cutting Tools for Numerical Control, Tool-holding Methods for Numerical Control.

RECOMMENDED BOOKS:

1. ASTME, “Fundamentals of Tool Design”, Prentice Hall of India, 1983.
2. Donaldson, “Tool Design”, Tata-McGraw Hill, 3rd Edition, 2000.
3. Joshi P.H., “Jigs and Fixtures”, Tata-McGraw Hill, 2010.

MTIP–107	ADVANCED ENGINEERING MATERIALS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 hrs
Objective	The objective of the course is to impart the students with the knowledge of various advanced and smart materials.						
Course Outcomes							
CO1	To impart knowledge of Piezoelectric and shape memory alloys.						
CO2	To acquaint students with deep know how about Electro-rheological and composite materials						
CO3	To impart knowledge to students about MEMS systems and High temperature application materials.						
CO4	To let student understand the processing and characteristics of powder metallurgy processes and structural materials.						

UNIT-I

Introduction to advanced Engineering materials: Classes of Materials and their usage, Historical Perspective, Intelligent Materials, Structural Materials, Functional Materials, Primitive Functions of Intelligent Materials, Intelligence inherent in Materials, Materials Intelligently Harmonizing with humanity, Biomimetic.

Smart Materials and Structural Systems: Introduction, Actuator Materials, Sensing Technologies, Micro-sensors, Intelligent systems, Hybrid Smart Materials, Passive Sensory Smart Structures, Reactive Actuator based smart structures, Active Sensing and Reactive smart structures, smart skins, Aero-elastic tailoring of airfoils, Synthesis of future smart systems.

UNIT-II

Electrocaloric Effect: An Introduction, History of Electrocaloric Cooling, Mechanism of working of Electrocaloric Cooling, Electrocaloric Materials, Performance of Electrocaloric Materials.

Heat Resistant Steels: Conventional Heat-Resistant Steels, Silicon-Bearing High Chromium Heat-Resistant Steels, Nitride-Strengthened Reduced Activation Heat-Resistant Steels, China Low Activation Martensitic Steel Nitride-Strengthened Steels, Microstructural Stability

UNIT-III

Smart Micro-systems: Silicon Capacitive Accelerometer, Piezo-resistive Pressure sensor, Conductometric Gas sensor, An Electrostatic Comb-drive, Magnetic Microrelay, Portable Blood Analyser, Piezoelectric Inkjet Print Head.

Buckyballs to robotics: Bucky ball, Nano Structure of Fullerene, Carbon Nanotubes, Nano Diamond, Boron nitride nanotubes, Single electron transistors, Molecular machine, Nano Biometrics, Nano Robots,

UNIT-IV

Nano-Alloys: Introduction, Chemical Synthesis: General Concepts, Reduction of Metallic Salts, The Organometallic Route: Thermal Decomposition Method, Other Chemical Methods for synthesis of Nano-alloys, Physical Routes for synthesis of Nano-Alloys; Experimental Techniques and Examples.

Shape memory alloys (SMA): Shape memory effect and the metallurgical phenomenon of SMA, Types of SMA, One way and Two way Shape memory effect. Temperature assisted shape memory effect, Applications.

RECOMMENDED BOOKS:

1. Gandhi, M.V. and Thompson, B.S., Smart materials and Structures, Chapman & Hall, 1992.
2. Ananthasuresh G.K., Vinoy K.J., Micro and Smart Systems, Wiley India.
3. Wei Yan, Wei Wang, 9-12 Cr Heat Resistant Steels, Engineering Material series, Springer International.
4. Damien Alloyeau, Christine Mottet, Nanoalloys Synthesis, Structure and Properties, Springer International.
5. Tatiana Correia, Qi Zhang, Electrocaloric Materials: New Generation of Coolers
6. Otsuka, K. and Wayman, C. M., Shape memory materials, C.U.P, 1998
7. Taylor, W., Pizoelectricity, George Gorden and Breach Sc. Pub., 1985
8. Mallick, P.K., Fiber Reinforced Composites Materials, Manufacturing and Design. Marcel Dekker Inc, New York, 1993.
9. Rama Rao, P. (ed.), Advances in Materials and their applications, Wiley Eastern Ltd.

MTIP–109	NON-CONVENTIONAL MACHINING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	To acquaint the students with the advanced technologies and processes in various streams of Non-conventional machining.						
Course Outcomes							
CO1	To impart knowledge of Various Non-conventional Mechanical Working Processes, technology, process parameters and analysis for metal removal for these processes.						
CO2	To acquaint students with deep knowhow about chemical and electrochemical machining processes,						
CO3	To impart knowledge to students about various kinds of Electric discharge machining processes, process parameters associated with these processes and various process characteristics.						
CO4	To let student understand the working and technology associated with Laser Beam machining and Electron beam machining processes.						

UNIT-I

Introduction, Need of Non-conventional machining processes, Characteristics of conventional and Non-conventional Machining processes. **Mechanical Working Processes**: **Abrasive Jet Machining:** Machining setup, Abrasives, Process Parameters, Machining Characteristics, Material removal models in AJM, Process capability, Advantages, limitations, Applications

Water Jet Machining: Basic mechanism of Water jet machining setup, Process parameters, Catcher, Process capabilities, Advantages, limitations, Applications **Abrasive Water Jet Machining process:** Working Principle, AWJM Machine, Process Variables, Mechanism of Metal Removal, Cutting Parameters, Process capabilities, Applications, Environmental issues.

Ultrasonic Machining: Fundamental principles, Equipment, Magnetostriction, Elements of process, Mechanics of cutting, Analysis of Process Parameters, Process capabilities, Economic considerations. Applications, Limitations

UNIT-II

Chemical Machining: Introduction, Fundamental Principles, Process Parameters; Maskants and Etchants, Advantages, Limitations, Applications.

Electrochemical Machining Processes: Introduction, Classification of ECM Processes, Fundamentals Principles of ECM, Elements of ECM, ECM Machine Tool Process, Determination of Metal Removal Rate, Evaluation of Metal Removal of an alloy, Electrochemistry of ECM, Cathode and Anode reaction, Dynamics of ECM, Self-Regulating feature of ECM, Process Parameters, Process capabilities, Electrochemical Deburring. **Electrochemical Grinding:** Schematics, Electrochemistry, Process Parameters, Process capabilities, Applications, Advantages, Limitations.

UNIT-III

EDM: Introduction, Basic Principles & Schematics, Process Parameters, Characteristics of EDM, Dielectric, Electrode Material, Modelling of Material Removal, Spark Erosion Generators, Analysis and Metal Removal Rate in RC circuit, Selection of Tool Material and Tool Design, Di-Electric system, Process Variables, Dielectric Pollution and its effects, Process Characteristics, Applications, Electric Discharge Grinding and Electric Discharge Diamond Grinding; **Wire EDM**: Working Principle, Wire EDM Machine, Advances in Wire-cut EDM Process Variables, Process Characteristics, Applications.

UNIT-IV

Laser Beam Machining Back Ground, Production of Laser, Working Principle of LBM, Types of LASERS, Process Characteristics, Metallurgical effects, Advantages and Limitations, Applications.

Electron Beam Machining:

Electron Beam Action, Generation and control of Electron beam, Theory of Electron Beam Machining, Process Parameters, Process capabilities, Applications.

High Energy Rate Forming, Elctro-Hydraulic Forming, Explosive Forming, Hot Machining Analysis of the Process.

RECOMMENDED BOOKS:

1. V.K. Jain, Advanced Machining Processes, Allied Publishers Pvt Ltd
2. P.C. Pandey and H.S. Shan, Modern Machining Processes, Tata McGraw- Hill
3. M. K. Singh, Unconventional Manufacturing Process, New Age Publishers
4. J. A. Mcgeough, Advanced Methods of Machining, Springer.
5. Benedict, Non-Traditional Manufacturing Process, CRC pub.
6. P. K. Mishra, Nonconventional manufacturing, Narosa Publishers

MTIP-111	PRODUCT DESIGN AND DEVELOPMENT						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The objective of the course is to understand about the product design and developments with inputs from aesthetics, ergonomics, design for manufacturing ease and cost effectiveness apart from reliability and durability and other considerations.						
Course Outcomes							
CO1	To understand the concept of product design, design considerations, design practiced by the industry, production and marketing, and aesthetics.						
CO2	To provide a detailed fundamental approach to several primary processes and design guidelines for manufacturing, assembly and environment.						
CO3	To discuss the human factor engineering and the concept of value engineering.						
CO4	To study the modern approaches to product design, concept of product development and its manufacturing and economic aspects.						

UNIT-I

INTRODUCTION: Introduction to product design, Design by evolution and innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in production consumption cycle, Morphology of design.

PRODUCT DESIGN PRACTICE AND INDUSTRY: Product strategies, Time to market, Analysis of the product, Basic design considerations, Role of aesthetics in product design.

UNIT-II

DESIGN FOR MANUFACTURE AND ASSEMBLY: Overview and motivation, Basic method: Design guidelines: Design for assembly, Design for piece part production, Advanced method: Manufacturing cost analysis, cost driver modeling, Critique for design for assembly method.

DESIGN FOR THE ENVIRONMENT: Environmental objectives, Basic DFE methods, Design guidelines, Life cycle assessment, Techniques to reduce environmental impact.

UNIT-III

HUMAN ENGINEERING CONSIDERATIONS IN PRODUCT DESIGN: Human being as applicator of forces, Anthropometry, the design of controls, the design of displays, Man/Machine information exchange, Workplace layout from ergonomic considerations.

VALUE ENGINEERING: Value, Nature and measurement of value, Maximum value, Normal degree of value, Importance of value, value analysis job plan, creativity, steps to problem solving and value analysis, value analysis tests, value engineering idea generation check list, Cost reduction through value engineering-case study, materials and process selection in value engineering.

UNIT-IV

MODERN APPROACHES TO PRODUCT DESIGN: Concurrent design, Quality function deployment (QFD), Rapid prototyping, 3D printing, Introduction to 4D printing.

PRODUCT DEVELOPMENT: A modern product development process, reverse engineering and redesign product development process, product life cycle, product development teams, Product development planning, Manufacturing & economic aspects of product development.

RECOMMENDED BOOKS:

1. Kail T Ulrich and Steven D Eppinger, “Product Design and Development, TMH.
2. AK Chitale and Gupta, “Product Design and Engineering, PHI.
3. Niebel & Draper, “Product Design and Process Engineering”, McGraw-Hill.
4. Kevin Otto & Kristin Wood, “Product Design-Techniques in reverse engineering and new product development” Pearson.

MTIP–113	SIMULATION OF INDUSTRIAL SYSTEMS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of industrial systems and its simulation.						
Course Outcomes							
CO1	To explain the concept of industrial simulation systems and its models of simulation.						
CO2	To understand the simulation of discrete and queuing systems.						
CO3	To understand the simulation if inventory systems and design of simulation experiments.						
CO4	To simulate the industrial problems like reliability problems, computer time sharing problem and understand the simulation languages.						

UNIT-I

Introduction and overview: concept of system, system environment, elements of system, system modeling, types of models, Monte Carlo method, system simulation, simulation - a management laboratory, advantages & limitations of system simulation, continuous and discrete systems.

Simulation of continuous systems: characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formula.

UNIT-II

Simulation of discrete system: Time flow mechanisms, Discrete and continuous probability density functions. Generation of random numbers, testing of random numbers for randomness and for auto correlation, generation of random variates for discrete distribution, generation of random variates for continuous probability distributions-binomial, normal, exponential and beta distributions; combination of discrete event and continuous models.

Simulation of queuing systems: Concept of queuing theory, characteristic of queues, stationary and time dependent queues, queue discipline, time series analysis, measure of system performance.

Kendall's notation, auto covariance and auto correlation function, auto correlation effects in queuing systems, simulation of single server queues, multi-server queues, queues involving complex arrivals and service times with blanking and reneging.

UNIT-III

Simulation of inventory systems: Rudiments of inventory theory, MRP, in-process inventory. Necessity of simulation in inventory problems, forecasting and regression analysis, forecasting through simulation, generation of Poisson and Erlang variates, simulation of complex inventory situations.

Design of Simulation experiments: Length of run, elimination of initial bias, Variance, Variance reduction techniques, stratified sampling, antipathetic sampling, common random numbers, time series analysis, spectral analysis, model validation, optimization procedures, search methods, single variable deterministic case search, single variable non-deterministic case search, and regenerative technique.

UNIT-IV

Simulation of PERT: Simulation of - maintenance and replacement problems, capacity planning, production systems, reliability problems, computer time sharing problem, the elevator system.

Simulation Languages: Continuous and discrete simulation languages, block structured continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS SIMULA importance and limitations of special purpose languages.

RECOMMENDED BOOKS:

1. Loffick, Simulation and Modelling - Tata McGraw Hill
2. Deo Narsingh, System Simulation with Digital Computer - Prentice Hall
3. Hira, D.S., System Simulation-S. Chand & Co.
4. Meelamkavil, Computer Simulation and Modelling - John Willey
5. Gorden, System Simulation - Prentice hall
6. Jerry Banks and John, S. Carson II, 'Discrete – Event System Simulation', Prentice Hall Inc., NewJersey, 1984.
7. Geoffrey Gordon, 'System simulation', Prentice Hall, NJ, 1978.
8. Law, A.M. and W.D. Keltor, 'Simulation modelling analysis', McGraw Hill, 1982.

MTIP–115	SUPPLY CHAIN MANAGEMENT						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of Supply chain and different aspects of supply chain management.						
Course Outcomes							
CO1	To impart knowledge about basics of Supply chain management and Supply chain dynamics.						
CO2	To acquaint students with the different aspects involved in sourcing and procurement in supply chain management.						
CO3	To impart knowledge to students about Evaluating performance of Supply chain and decision making about Transportation, Storage and warehousing.						
CO4	To let student understand Quantitative tools for SCM, Information Technology in a Supply Chain:						

UNIT-I

Overview of supply chain management: Introduction, Definition, The Objective of a Supply Chain, The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process Views of a Supply Chain, Examples of Supply Chains.

Supply chain dynamics: Introduction, Coping with Dynamics in Supply chain. Bullwhip effect, Analysis of Bullwhip Effect, Impact of Lead time, Inventory management and Supply chain dynamics, offshoring and outsourcing Effect on SC dynamics and cost.

UNIT-II

Outsourcing and Make or Buy Decisions: Strategic Decisions and Core competencies, Tactical Decisions, Factors influencing make or buy decisions, Control of Production or Quality, Unreliable Suppliers, Suppliers Specialized knowledge and research, Small Volume Requirements, Limited Facilities, Workforce Stability, Multiple Sourcing Policy, Managerial and Procurement considerations, the Volatile nature of Make/Buy situation, Administration: Procedures and Personal.

Sourcing of Supply: Importance of Source Selection, Responsibilities for Source Selection, Evaluating a potential supplier, The criticality of Qualifying Sources, Competitive Bidding and Negotiation, Prerequisite for competitive bidding, Two step Bidding/Negotiation, Benefits and Risks of International Sourcing, Identifying and Qualifying an International Source.

UNIT-III

Supply Chain Performance: Achieving Strategic fit And Scope: Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope**,** Challenges to Achieving and Maintaining, Strategic Fit, Supply chain drivers and metrics, Financial Measures of Performance, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.

Transportation, storage and warehousing: Introduction, Transportation mode choice, Transport operator decisions, Trucking sectors in India, Rail transport, Air Transport, Water transport, Transport network, Storage and warehousing, types of warehousing, risk pooling, IT Integration: Supply chain information system, Role of IT in SCM process, Business process Re-engineering, Internet and its applications in SCM.

UNIT-IV

Quantitative tools for SCM: Introduction, Forecasting, Demand forecast, Forecasting strategy & technique, Management of Inventories in SC, Linear programming, Routing models, pricing decisions, Introduction to MCDM approach.

Information Technology in a Supply Chain: The Role of IT in a Supply Chain, The Supply Chain IT Framework Customer Relationship Management, Internal Supply Chain Management, Supplier Relationship Management, The Transaction Management Foundation, The Future of IT in the Supply Chain, Risk Management in IT, Supply Chain IT in practice.

RECOMMENDED BOOKS:

1. Chopra, S., and Meindl, P., Supply chain Management: Strategy, Planning and Operations. Second Edition, Pearson Education (Singapore) Pte. Ltd, 2004.
2. Rangaraj, Supply Chain Management for Competitive Advantage, TMH.
3. Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E., Designing & Managing the Supply Chain: Concepts, Strategies & Case studies. Second Edition, Tata McGraw-Hill Edition, 2003.
4. Doebler, D.W. and Burt, D.N., Purchasing and Supply Chain Management: Text and Cases, McGraw-Hill Publishing Company Limited, New Delhi, 1996.

MTIP-117	ADVANCED METAL CASTING LAB							
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**-**	**40**	**60**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of foundry shop							
Course Outcomes								
CO1	To impart knowledge of practical evaluation of sand grades and moisture content in the moulding sand.							
CO2	To acquaint students with the different aspects involved in testing ADV, Permeability and DCS of Moulding/Core sand.							
CO3	To impart knowledge to students about determining grain size Mould Hardness and Compressive strength of the Mould.							
CO4	To let student understand how to prepare MMCs using Stir Casting process.							

List of Experiments:

1. To perform grading of sand for foundry purpose.
2. Determination of optimum moisture content in Green Sand Practice.
3. Determination of DCS of core sand.
4. Determination of permeability for molding sand mixtures.
5. Determination of acid demand value in a moulding sand sample.
6. To determine mould hardness.
7. To determine grain size and gran fines content in moulding Sand.
8. To determine compressive strength of the given mould sample
9. To determine grain size distribution and grain fines number for a sand mix.
10. To prepare advanced Metal Matrix Composites using Stir Casting.

Note: At Least eight experiments need to be performed by the students from the above mentioned list.

MTIP-119	COMPUTER AIDED DESIGN AND MANUFACTURING LAB							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
0	0	4	2	-	40	60	100	3 hrs
Objective	To acquaint the students with 2-D and 3-D modeling using design softwares.							
Course Outcomes								
CO1	To understand the basic solid modeling and applied features of the softwares.							
CO2	To learn and practice of surface techniques and surface creations using software.							
CO3	To learn and practice of assembly and detailed drafting.							
CO4	To let student understand how to prepare MMCs using Stir Casting process.							

List of Experiments:

The students will be required to carry out the following exercises or their equivalent tasks using a 3-D modeling software package (e.g. Solid-works/ Creo/ Ideas/ Solid Edge/UG/CATIA/ etc.). Practical must be performed on licensed version (Preferably the latest version) of any one of above mentioned software.

1 BASIC SOLID MODELING

Introduction & sketcher tools

a) CAD Tools and Applications: CAD - CAM - CAE
b) Parametric Feature Based Modelling and Parent-Child Relation
c) Design Intent and Associativity between 3 Modes
d) Modelling Software - Getting Started & Graphical User Interface
e) Sketch Entities and Tools
f) Dimensioning and Adding Relations to define the Sketch

Sketched Features (Boss / Base and Cut)

a) Base Features
b) Extrude & Revolve
c) Reference Geometry, Curves & 3D Sketch
d) Sweep & Loft

Editing & Refining Model

a) Editing Sketch, Sketch Plane and Editing Feature
b) Suppress / Un-Suppress Feature and Reordering Feature

2 ADVANCE FEATURES APPLIED FEATURES

a) Patterns & Mirror
b) Fillet/Round & Chamfer
c) Hole & Hole Wizard
d) Draft, Shell, Rib and Scale
e) Dome, Flex and Wrap

Multi Body

a) Indent Tool
b) Combine Bodies – Boolean Operations
c) Split, Move/Copy and Delete Bodies

Other Tools & Options

a) Design Table and Configurations
b) Adding Equations and Link Values
c) Tools - Measure and Mass Properties
d) Appearance - Edit Material, Colour and Texture
e) Options - System and Document Properties

3 SURFACING TECHNIQUES BASIC SURFACE CREATIONS

a) Extrude & Revolve
b) Sweep & Loft
c) Boundary Surface
d) Planar Surface

Other Derived Techniques

a) Offset Surface
b) Radiate Surface

MTIP-119(Contd….):

c) Ruled Surface
d) Fill Surface
e) Mid Surface

Modify / Edit Surfaces

a) Fillet/Round
b) Extend
c) Trim & Untrim
d) Knit Surfaces
e) Delete and Patch

Surfaces for Hybrid Modelling

a) Thicken – Boss / Base and Cut
b) Replace face
c) End condition for Sketched feature - Up to Surface or Offset from Surface.
d) Solid body from closed surfaces

4 ASSEMBLY & MECHANISMS BOTTOM UP ASSEMBLY APPROACH

a) Inserting Components/Sub-Assemblies
b) Adding Mates - Standard & Advance
c) Editing Mates, Part and Replacing Components

Top down Approach & Mechanisms

a) Inserting New Part to Existing Assembly
b) Use of Layout Sketching
c) External References - In-context and Out-of-context, Locked and Broken

Assembly Features

a) Component Patterns & Mirrors
b) Cuts & Holes
c) Belt/Chain and Weld Bead

Representations of Assembly Components

a) Light Weight, Suppressed and Resolved
b) Hide, Transparency and Isolate
c) Exploded View

Assembly Check

a) Interference Detection,
b) Collision Detection and Physical Dynamics

Motion Study

c) Assembly Motion & Physical Simulation
d) Animation Wizard & Save as AVI file
e) Mechanism Analysis – Plot Displacement, Velocity and Acceleration Diagram

5 DETAILED DRAFTING

Introduction to Engineering Drawings

a) General Procedure for Drafting & Detailing
b) Inserting Drawing Views, Dimensioning and Adding Annotations
c) Drawing Templates & Sheet Format
d) Setting Options

Drawing Views

a) Model View & Standard 3 View
b) Projected View & Auxiliary View
c) Section & Aligned Section View
d) Detail View, Broken-out Section and Crop View.

Dimensioning

a) Standards, Rules and Guidelines
b) Dimension Insertion/Creation - Insert Model Items & Dimension tool

Annotations

a) Notes & Holes Callout
b) Datum & Geometric Tolerances
c) Surface Finish & Weld Symbols, Centre Mark & Centre line, BOM Balloon & Bill of Material

MTRM-111	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTIP-102	MECHATRONICS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 hrs
Objective	The objective of the course is to acquaint the knowledge of electronic devices and electromechanical systems, hydraulic and pneumatic systems, CNC, Robotics and PLC's.						
Course Outcomes							
CO1	To understand the concepts of Mechatronics, fundamental of electronics and digital circuits and electrical actuating circuits.						
CO2	To acquaint the knowledge of hydraulic system with its practical applications.						
CO3	To acquaint the knowledge of pneumatic system with its practical applications.						
CO4	To study the fundamentals of CNC, Robotics and programmable logic controllers (PLC's) and their use.						

UNIT-I

Introduction: The Mechatronics approach: A methodology for integrated design of Mechanical, Electronics and Electrical Control, Computer and Instrumentation.

Fundamentals of Electronics and digital circuits: Number systems: Binary, Octal, Hexadecimal, Conversion from Binary to Decimal, Octal and Hexadecimal and vice–versa, Binary arithmetic: Addition, subtraction, Multiplication and division, Boolean Algebra: Laws, De-Morgan's laws, Logic Gates, Truth tables, Karnaugh maps and logic circuits. Generation of Boolean function from truth tables and simplification, **Electrical actuating system:** Basic principle of electrical switching, Solenoids, Electrical relays, Representation of output devices, Electrical motors: A.C. motors, Stepper motors, Induction motor speed control.

UNIT-II

HYDRAULIC SYSTEMS:

Direction Control Valves: Poppet Valve, Spool Valve, Sliding Spool type DCV, Check Valve, Pilot operated check valve, Restriction check valve, 2 Way vale, 3 way valve, 4 way valve, Manually actuated valve, Mechanically actuated valve, Pilot operated DCV, Solenoid Actuated valve, Rotary Valve, Centre flow path configurations for three position four way valve, Shuttle valve

Pressure Control Valve: Simple and compound pressure Relief Valve, Pressure Reducing Valve, Unloading valve, sequence valve, counterbalance valve, Brake Valve

Flow Control Valves: Fixed and non-adjustable valve, adjustable, throttling, non-pressure compensated pressure control valve, Pressure/temperature compensated flow control valve, Shuttle and Fast exhaust valve, Time delay valve, Flow Control Valves, Fluid Conditioners, Hydraulic Symbols (ANSI), Hydraulic Circuit design: Control of Single and double acting cylinders, double pump Hydraulic System

UNIT-III

PNEUMATIC SYSTEM:

Air Generation and distribution: Air compressors, Air Receiver, Filters, intercoolers, After-coolers, Relief Valve, Air dryers, Primary and secondary lines, Piping layouts, Air Filters, Air Regulators, Air Lubricator, Actuators and output devices, Direction control valves, Flow control valves, junction elements, Pneumatic circuits, Control of Single and double acting cylinders.

UNIT-IV

INTRODUCTION TO CNC MACHINES AND ROBOTICS:

CNC Machines: NC machines, CNC machines, DNC machines, Machine structure, Slidways, Guideways, Slide Drives, Spindle, Robotics: Components of robots, Classification of robots, Robots application

PROGRAMMABLE LOGIC CONTROLLERS

Introduction - Principles of operation - PLC Architecture and specifications - PLC hardware Components, Analog & digital I/O modules, CPU & memory module - Programming devices - PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions - Manually operated switches - Mechanically operated Proximity switches - Latching relays, Applications of PLC.

RECOMMENDED BOOKS:

1. W. Bolton, Mechatronics, Pearson Education.
2. Majumdar, Pneumatic system, TMH.
3. Andrew Parr, Hydraulic and Pneumatic systems,TMH.
4. M.P. Groover, Automation, Production systems and computer integrated manufacturing, TMH.
5. Shetty and Kolk, Mechatronics system design, Thomson learning.
6. Mahalik, Mechatronics, TMH.
7. Anthony Esposito, Fluid power with application, Pearson Education.
8. K.P Ramachandran, M.S Balasundaram, Mechatronics, Wiley India.

MTIP-104	Industrial Tribology						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time (Hrs.)
3	0	0	3	60	40	100	3
Objective	To develop a solution oriented approach by in depth knowledge of Industrial Tribology and address the underlying concepts, methods and application of Industrial Tribology.						
Course Outcomes							
CO 1	Students will be able to understand the fundamentals of tribology, friction and wear processes in contacts between different materials.						
CO 2	Students will be able to understand the material requirements for tribological applications and different surface treatment techniques.						
CO 3	Students will be able to study different types of lubricants and testing techniques.						
CO 4	Students will be able to study the maintenance and conservation techniques, testing specifications and standards.						

UNIT-I

Fundamentals of Tribology: Introduction to tribology and its historical background, Economic Importance of Tribology.
Friction and Wear: Genesis of friction, friction in contacting rough surfaces, sliding and rolling friction, various laws and theory of friction. Stick-slip friction behavior, frictional heating and temperature rise. Friction measurement techniques.
Wear and wear types. Mechanisms of wear - Adhesive, abrasive, corrosive, erosion, fatigue, fretting, etc., Wear of metals and non-metals. Wear models - asperity contact, constant and variable wear rate, geometrical influence in wear models, wear damage. Wear in various mechanical components, wear controlling techniques.

UNIT-II

Materials for Tribological Applications: An overview of engineering materials having potential for tribological application. Characterization and evaluation of Ferrous and non-ferrous materials for tribological requirements/applications, Composite materials (PM, CMC and MMC) for tribological applications.
Surface treatment techniques: Surface treatment techniques such as carburising, nitriding, induction hardening, hard facing, laser surface treatments, etc with applications, Surface coating techniques such as electrochemical depositions, anodizing, thermal spraying, Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD), etc. and their applications.

UNIT-III

Lubrication and lubricants: Boundary Lubrication, Mixed Lubrication, Full Fluid Film Lubrication, Hydrodynamic, Elastohydrodynamic lubrication, Primary role of lubricants in mitigation of friction and wear & heat transfer medium, Composition and properties of lubricants, Fundamentals - Mineral oil based liquid lubricants, Synthetic liquid lubricants, Solid lubricants, greases and smart lubricants, Characteristics of lubricants and greases, Rheology of lubricants, Evaluation and testing of lubricants.

UNIT-IV

Lubricants additives and application: Introduction to lubricant additives, Antioxidants and bearing corrosion inhibitors, Rust inhibitors, Viscosity improvers, Extreme pressure additives.
Consumption and conservation of lubricants: Lubricants for industrial machinery, Maintenance and conservation of lubricating oils, Storage and Handling of lubricants, Used lubricating oil, Environment and health hazards, Disposability and Recycling, Technical regulation for lubricants, Test specifications and standards for maintenance and management of industrial lubricants including greases and used oils, Selection of optimum lubricant for given application.

RECOMMENDED BOOKS:

1. I.M. Hutchings, Tribology, "Friction and Wear of Engineering Material ", Edward Arnold.
2. Gwidon W. Stachowiak, Andrew W. Batchelor, “Engineering Tribology” Butter worth, Heinemann.
3. T.A. Stolarski, "Tribology in Machine Design ", Industrial Press Inc.
4. E.P. Bowden and Tabor. D., "Friction and Lubrication ", Heinemann Educational Books Ltd.
5. A. Cameron, "Basic Lubrication theory ", Longman, U.K.M.J. Neale (Editor), "Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K.

MTIP-106	ADVANCED WELDING PROCESSES						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of Welding metallurgy and welding processes.						
Course Outcomes							
CO1	To impart knowledge about various Weld metallurgy and Weld arc characteristics.						
CO2	To acquaint students with the various welding power sources and their applications.						
CO3	To impart knowledge to students about Electrode coatings and Metal transfer phenomenon in weld metal transfer.						
CO4	To let student understand the basics of Solid state welding processes and some of the latest welding techniques.						

UNIT-I

WELDING METALLURGY: Introduction, Weld Metal Zone, Theory of solidification of metals and alloys, Homogeneous Nucleation, Heterogeneous Nucleation, Freezing of alloys, Epitaxial Solidification; Effect of Welding speed on Grain structure, Fusion boundary zone, Heat affected zone, Under bead zone, Grain Refined Zone, Partial transformed zone, Properties of HAZ

WELDING ARC: Definition of Arc, Structure and characteristics, Arc efficiency, arc blow, Electrical Characteristics of arc, Types of Welding Arcs, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc. Arc length regulation in mechanized welding processes.

UNIT-II

WELDING POWER SOURCES: Requirement of an Arc welding power sources, basic characteristics of power sources for various arc welding processes, duty cycles, Selection of a static Volt-Ampere characteristic for a welding process, AC/DC welding power source, DC rectifiers, thyristor controlled rectifiers, transistorized units, inverter systems, Mathematical Problems on Static volt ampere characteristics

UNIT-III

COATED ELECTRODES: Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux ingredients and shielding gases, classification of solid and flux code wires.

METAL TRANSFER & MELTING RATE: Mechanism and types of metal transfer, forces affecting metal transfer, modes of metal transfer, metal transfer in various welding processes, effective of polarity on metal transfer and melting rate.

UNIT-IV

SOLID STATE WELDING: Theory and mechanism of solid state welding, techniques and scope of friction welding, diffusion welding, cold pressure welding and ultrasonic welding, high energy rate welding, analysis of the Process.

WELDING TECHNIQUES: Technique, scope and application of the electron beam and laser welding processes, under water welding - process & problem.

RECOMMENDED BOOKS:

1. Raymond Sacks, ―Welding: Principles & Practices‖ McGraw-Hill
2. R.S.Parmar, ―Welding processes & Technology‖, Khanna Publishers
3. R.S.Parmar, ―Welding Engineering & Technology‖, Khanna Publishers
4. S.V. Nandkarni, ―Modern Arc Welding Technology, Oxford & IBH publishing Co.
5. L.M.Gourd, ―Principles of Welding Technology‖, ELBS/ Edward Arnold.
6. Richard L. Little ―Welding & Welding Technology‖, Mc-Graw Hill.
7. Cary, Howard ―Modern Welding Technology‘, prentice Hall, 1998.
8. Rossi ―Welding Technology‖, Mc-Graw Hill.

MTIP–108	ADVANCED METAL CUTTING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of advanced cutting tools, tools geometry, mechanisms and analysis.						
Course Outcomes							
CO1	To impart knowledge about various functional related to tools geometry.						
CO2	To acquaint with the analysis of fundamental factors affecting tool forces						
CO3	To impart knowledge about cutting tool life and mathematical modelling for wear.						
CO4	To let student understand abrasive machining and its process simulation.						

UNIT-I

Introduction system of Tool nomenclature, Tool Geometry, Mechanism of Chip formation and forces in orthogonal cutting, Merchant's force diagram.

Oblique Cutting: Normal chip reduction coefficient under oblique cutting, true shear angle, effective rake, influx region consideration for deformation, direction of maximum elongation, effect of cutting variables on chip reduction co-efficient, forces system in oblique cutting, effect of wear land on force system, force system in milling, effect of helix angle.

UNIT-II

Fundamentals of Dynamometry, Theoretical determination of forces, angle relations, heat and temperature during metal cutting; distribution, measurement, analysis, theoretical estimation of work piece temperature, hot machining

Fundamental factors, which effect tool forces: Correlation of standard mechanized test. (Abuladze –relation), nature of contact and stagnant phenomenon, rates of strains, shear strain and normal strain distributions, cutting variables on cutting forces.

UNIT-III

Cutting Tools: Tools materials analysis of plastic failure (from stability criterion), Analysis failure by brittle fracture, wear of cutting tools, criterion, flank and crater wear analysis, optimum tool life, tool life equations, (Taylor's woxen etc) Tool life test, machining optimization, predominant types of wear; abrasive, adhesive, diffusion wear models, wear measurements and techniques, Major Test of tool wear oxidative mathematical modelling for wear, test of machinability and influence of metallurgy on machinability. Economics of metal machining

UNIT-IV

Abrasive Machining: Mechanics of grinding, cutting action of grit, maximum grit chip thickness, energy and grit force temperature during grinding, wheel wear, grinding, process simulation, testing of grinding wheels, mechanics of lapping and honing, free body abrasion.

RECOMMENDED BOOKS:

1. Sen & Bhattacharya, Principles of Machine tools, New Central Book Agency.
2. Brown, Machining of Metals, Prentice Hall.
3. Shaw, Principles of Metal cutting, Oxford I.B.H.
4. Arshimov & Alekree, Metal cutting theory & Cutting tool design, MIR Publications.
5. Machining Science & Application by Knowenberg Longman Press.

MTIP-110	Metrology						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs.**
Objective	The main objective of the course is to deal with the basic principles of dimensional measuring instruments and precision measurement techniques in achieving quality and reliability in the service of any product in dimensional control.						
Course Outcomes							
CO1	To understand the students about the requirement of metrology and the concepts of limit, fits and gauges.						
CO2	To study the linear and angular measurements and the optical measurement tools and techniques.						
CO3	To understand how to use surface roughness and thread measuring instruments.						
CO4	To study the comparators, measurement through comparators and the advanced metrology concepts.						

UNIT-I

Introduction to metrology: Definition, types, need of inspection, terminologies, methods of measurement, selection of instruments, measurement errors, units, Measurement standards, calibration, statistical concepts in metrology.

Systems of Limits and Fits: Introduction, nominal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – British standard system, International standard system for plain and screwed work.
Limit Gauges: Taylor's principle – Design of limit gauges, computer aided tolerancing.

UNIT-II

Linear Measurement: Length standard, line and end standards, slip gauges – calibration of the slip gauges, dial indicator, micrometres. Measurement of angles and tapers: Different methods – bevel protractor – angle slip gauges – spirit levels– sine bar – sine plate, rollers and spheres.
Flat Surface Measurement: Measurement of flat surfaces – instruments used – straight edges– surface plates – optical flat and auto collimator.

Optical Measuring Instruments: Tool maker's microscope and its uses, collimators, optical projector, optical flats and their uses, interferometer.

UNIT-III

Surface Roughness Measurement: Introduction, terminology, specifying roughness on drawings, surface roughness parameters, factors affecting surface roughness, ideal surface roughness, roughness measurement methods, precautions in measurement, surface microscopy, surface finish softwares.
Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.
Measurement through Comparators: Comparator: Features of comparators, classification of comparators, different comparators, advanced comparators, thread comparators.

UNIT-IV

Metrology of machine tools: Alignment and practical tests.
Gear Measurement: Gear measuring instruments, gear tooth profile measurement, measurement of diameter, pitch, pressure angle and tooth thickness.
Advanced Metrology: Advanced measuring machines, CNC systems, Laser vision, In-process gauging, 3D metrology, metrology softwares, Nano technology instrumentation, stage position metrology, testing and certification services, optical system design, lens design, coating design, precision lens assembly techniques, complex opto mechanical assemblies, contact bonding and other joining technologies.

RECOMMENDED BOOKS:

1. K.J. Hume, Engineering Metrology, Macdonald and Co. (publisher) London.
2. Czichos, The Springer handbook of metrology and Testing, 2011.
3. Jay. L. Bucher, The Metrology Hand book, American Society for Quality, 2004.
4. Smith GT, Industrial Metrology, Spinger.
5. John W. Greve, Frank W. Wilson, Hand book of industrial metrology, PHI – New Delhi.
6. D.M. Anthony, Engineering Metrology, Pergamon Press.
7. Khare MK, Dimensional Metrology, OXFORD-IBH Publishers.
8. I C Gupta, "Engineering Metrology", 5th Edition, Danapath Rai & Co, 2008.
9. R.K. Jain, "Engineering Metrology". 20th Edition, Khanna Publishers, 2007.
10. M. Mahajan, "Engineering Metrology", Dhanapati Rai publications, 2007.
11. BIS standards on Limits & Fits (IS 919), Surface Finish (IS 2073), Machine Tool Alignment, 1993.

MTIP–112	SEQUENCING AND SCHEDULING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of different production and machine models of sequencing and scheduling.						
Course Outcomes							
CO1	To understand the concept of sequencing and scheduling.						
CO2	To study and practice for the extension of basic models and parallel machine models.						
CO3	To understand the concepts of the flow shop scheduling and practice for the flow shop scheduling models.						
CO4	To understand the job shop problems and simulation models for dynamic job shop problem.						

UNIT-I

Single-Machine Sequencing: Introduction, Preliminaries, Problems without Due Dates, Problems with Due Dates
Optimization Methods for the Single-Machine Problem: Introduction, Adjacent Pairwise Interchange Methods, A Dynamic Programming Approach, Dominance Properties, A Branch and Bound Approach.
Earliness and Tardiness Costs: Introduction, Minimizing Deviations from a Common Due Date, The Restricted Version, Asymmetric Earliness and Tardiness Costs, Quadratic Costs, Job-Dependent Costs, Distinct Due Dates, Sequencing for Stochastic Scheduling.

UNIT-II

Extensions of the Basic Model: Introduction, Non-simultaneous Arrivals, Related Jobs, Sequence-Dependent Setup Times, Stochastic Models with Sequence-Dependent Setup Times.
Parallel machine models: Introduction, Minimizing the Makespan, Minimizing Total Flow time, Stochastic Models.

UNIT-III

Flow Shop Scheduling: Introduction, Permutation Schedules, The Two-Machine Problem, Special Cases of The Three-Machine Problem, Minimizing the Makespan, Variations of the *m*-Machine Model, Stochastic flow shop scheduling.

UNIT-IV

The Job Shop Problem: Introduction, Types of Schedules, Schedule Generation, The Shifting Bottleneck Procedure, Neighborhood Search Heuristics.
Simulation Models for the Dynamic Job Shop: Introduction, Model Elements, Types of Dispatching Rules, Reducing Mean Flowtime, Meeting Due Dates.

RECOMMENDED BOOKS:

1. Michael Pinedoo, Scheduling: theory, algorithms and systems, Prentice Hall, New Delhi, 1995.
2. King, J.R. Production planning and control, Pergamon International Library, 1975.
3. Kenneth R. Baker, Introduction to sequencing and scheduling, John Wiley and Sons, 1974.
4. Kenneth R. Baker and Dan Trietsch, Principles of sequencing and scheduling, John Wiley and Sons, 2009.

MTIP–114	QUALITY ENGINEERING AND MANAGEMENT						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	60	40	100	3 hrs
Objective	The main objective of the course is to impart the students with the knowledge of quality tools and engineering for the improvement of product quality.						
Course Outcomes							
CO1	To understand the statistical concepts of quality and quality statistics.						
CO2	To study the quality control charts in production process and practice for its use in problem solving.						
CO3	To understand the quality improvement tools.						
CO4	To study the ISO systems, failure analysis and testing.						

Unit-I

Introduction to Quality: An Historical Overview: Defining Quality, The Total Quality System, Total Quality Management, Economics of Quality, Quality, Productivity, and Competitive Position, Quality Costs, Success Stories.

Statistics for Quality: Variability in Populations, Some Definitions, Quality vs. Variability, Section I: Empirical Methods for Describing Populations, Section II: Mathematical Models for Describing Populations, Section III: Inference of Population Quality from a Sample.

Unit-II

Quality in Design: Planning for Quality, Product Planning, Product Design, Process Design.

Quality in Production-Process Control I: Process Control, The Control Charts, Measurement Control Charts, Attribute Control Charts, Summary on Control Charts, Process Capability, Measurement System Analysis,

Quality in Production-Process Control II: Derivation of Limits, Operating Characteristics of Control Charts, Measurement Control Charts for Special Situations.

Unit-III

Quality in Procurement: Importance of Quality in Supplies, Establishing a Good Supplier Relationship, Choosing and Certifying Suppliers, Specifying the Supplies Completely, Auditing the Supplier, Supply Chain Optimization Using Statistical Sampling for Acceptance,

Continuous Improvement of Quality: The Need for Continuous Improvement, The Problem-Solving Methodology, Quality Improvement Tools, Lean Manufacturing.

Unit-IV

A System for Quality: The Systems Approach, Dr. Deming's System, Dr. Juran's System, Dr. Feigenbaum's System, Baldrige Award Criteria, ISO 9000 Quality Management Systems, ISO 9001:2008 Requirements, The Six Sigma System.

RECOMMENDED BOOKS:

1. Grant & Leaveworth, Statistical Quality Control, McGraw Hill
2. Duncan, Quality Control & Industrial Statistics, Irwin Press
3. Juran, Quality Control Handbook, McGraw Hill.
4. Hansen, Quality Control, Prentice Hall
5. Thomason, An Introduction to reliability & control, Machinery Publishing.
6. A.V. Taylor, Total Quality Control, McGraw-Hill
7. K.S. Krishnamoorthi, V. Ram Krishnamoorthi, A First Course in Quality Engineering: Integrating Statistical and Management Methods of Quality, Second Edition, CRC Press.

MTIP–116	RELIABILITY ENGINEERING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	The main objective of the course is to impart the students with the knowledge of reliability analysis in industrial system. Students can get acquainted with different reliability calculation models.						
Course Outcomes							
CO1	To understand the concepts of reliability in industrial systems.						
CO2	To study the reliability determination methods and advanced evaluation techniques.						
CO3	To understand various reliability prediction and evolution methods.						
CO4	To acquaint the fundamentals of reliability management and risk assessment.						

UNIT-I

Reliability Engineering: Reliability function, failure rate, Mean time between failures (MTBF), Mean time to failure (MTTF), mortality curve, useful life availability, maintainability, system effectiveness. Introduction to probability distributions.

Time to failure distributions: Exponential, normal, Gamma, Weibull; ranking of data, probability plotting techniques, Hazard plotting Concept of Bathtub Hazard Rate curve, Reliability evaluation of two-state device networks-series, parallel, k-out-of-m systems; Standby redundant systems, Reliability evaluation of three-state device networks-series and parallel.

UNIT-II

Reliability Determination and Prediction: Reliability Determination Methods: Network reduction technique, Path tracing technique, Decomposition technique, Delta-Star method.

Advanced Reliability Evaluation Concepts: Supplementary variables technique, Interference theory, Human reliability, Common cause failures, Fault trees, Failure mode and effect analysis

UNIT-III

Reliability Prediction Models: Series and parallel systems - RBD approach - Standby systems - m/n configuration - Application of Baye's theorem - cut and tie set method - Markov analysis - FTA - Limitations.

UNIT-IV

Reliability testing: Time acceleration factor, influence of acceleration factor in test planning, application to acceleration test, high temperature operating life acceleration model, temperature humidity bias acceleration model, temperature cycle acceleration model, vibration accelerator model, failure free accelerated test planning. Accelerated reliability growth.

Risk Assessment: Definition and measurement of risk - risk analysis techniques - risk reduction resources - industrial safety and risk assessment.

RECOMMENDED BOOKS:

1. Charles E. Ebeling, “An introduction to Reliability and Maintainability engineering”, TMH, 2000.
2. Roy Billington and Ronald N. Allan, “Reliability Evaluation of Engineering Systems”, Springer, 2007.
3. Sharma S C, Inspection Quality Control and Reliability, Khanna Publishers.
4. Connor P.D.T.O. Practical Reliability Engineering”, John Wiley.
5. Naikan V N A Reliability Engineering and Life Testing”, PHI Learning Private Limited.
6. Prabhakar Murthy D N and Marvin R, “Product Reliability”, Springer-Verlag.
7. Dana Crowe and Alec Feinberg, Design for Reliability, CRC Press.

MTIP–118	MECHATRONICS LAB							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Practical	Total	Time
0	0	4	2	-	40	60	100	3 hrs
Objective	To practice on electrical circuits, hydraulic and pneumatic systems and PLC's for their practical implications.							
Course Outcomes								
CO1	To understand the PLC using PLC simulators.							
CO2	To demonstrate and actuate the positioning using sensors, actuators and programming.							
CO3	To study the pneumatic and electro-pneumatic training system with simulation software.							
CO4	To design and test on hydraulic and pneumatic circuits.							

List of Experiments

1. To study and conduct exercises on PLC Simulator.
2. Control of conveyor manually and through programming, also programming using sensors and conveyor.
3. To study and conduct exercise on CNC lathe.
4. To study and conduct exercises on Robotic simulation software.
5. To study and conduct exercises on Pneumatic & Electro-Pneumatic Training System.
6. To study the stepper motor interface with PLC.
7. **Design and testing of hydraulic circuits such as**
   i) Pressure control
   ii) Flow control
   iii) Direction control
   iv)Design of circuit with programmed logic sequence, using an optional PLC in hydraulic.
   Electro hydraulic Trainer.
8. **Design and testing of pneumatic circuits such as**
   i. Pressure control
   ii. Flow control
   iii. Direction control
   iv. Circuits with logic controls
   v. Circuits with timers
   vi. Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
9. To perform exercises on process control trainer.

Note: At least eight experiments should be performed from the above list.

MTIP–120	**INDUSTRIAL TRIBOLOGY LAB**							
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**-**	**40**	**60**	**100**	**3 hrs**
Objective	To study friction, wear mechanism of materials and performance of lubricants under various test conditions using concepts, methods and application of Industrial Tribology.							
Course Outcomes								
CO1	Students will be able to explain the friction phenomena and different wear processes in contacts between metallic, ceramic and polymeric surfaces.							
CO2	Students will be able to determine different types of lubricants, their grades, test standards and different properties of lubricants.							
CO3	Students will be able to understand the causes of tribological failures and surface characterization.							
CO4	Students will be able to use different types of tribo-test equipments and design of wear and friction test.							

List of Experiments

1. To study the friction and wear properties of a specimen (metallic/polymeric/ceramic surfaces) using wear and friction monitoring apparatus under dry sliding conditions.
2. To study the friction and wear properties of a specimen (metallic/polymeric/ceramic surfaces) using wear and friction monitoring apparatus under wet sliding conditions.
3. To study the effect of temperature on the friction and wear performance of composite materials using high temperature pin/ball on disc tester.
4. To study the variation of viscosity of lubricants with temperature.
5. To evaluate the wear and extreme pressure properties of a lubricating oil/ grease using four ball tester.
6. To study the surface characterization of wear components.
7. To study different types of industrial abrasives materials, properties and applications.
8. To determine abrasion index of a material with the help of dry abrasion test rig.
9. To access the adhesion and scratch resistance of surface coatings (hard or soft) using Scratch Tester.
10. To determine the erosive wear rate of different materials using Air Jet Erosion Tester under different conditions.
11. To demonstrate the pressure distribution of a lubricant in a journal bearing.

Note: At least eight experiments should be performed from the above list.

MTIP–201	ENTERPRISE RESOURCE PLANNING						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3
Objective	The main objective of the course is to impart the students with the knowledge of integrated applications to manage the business and automate many back office functions related to technology, services and human resources.						
Course Outcomes							
CO1	To study the basic principles and models of an enterprise.						
CO2	To understand the concepts of technology and architecture in ERP.						
CO3	To study ERP system packages.						
CO4	To study the ERP procurement issues.						

UNIT I

ENTERPRISE RESOURCE PLANNING:

Introduction, Evolution of ERP, Principle of ERP, Enabling Technologies, ERP Characteristics, Features of ERP, The advantages of ERP, Reasons for the Failure of ERP Implementation, Risk and governance issues in an ERP, ERP Framework, Business Blueprint, Business Engineering Vs. Business Process Re-Engineering, ERP Tools and Software, Demand Chain, Value Chain, and Supply Chain.

UNIT-II

ERP ARCHITECTURE: Need to Study ERP Architecture**,** Layered Architecture, Types of ERP Architecture: Two-tier Implementations, Three-tier Client/Server Implementations, Web-based architecture, Service-Oriented Architectures, Logical Architecture of an ERP System, Physical Architecture of an ERP System, Evaluation Framework for ERP Acquisition.

UNIT III

ERP PACKAGE INTEGRATION AND IMPLEMENTATION: ERP market, SAP, Peoplesoft, BAAN company, ORACLE corporation, A comparative assessment and selection of ERP packages and modules, Sales Force Automation, Integration of ERP, Integration of ERP and the Internet, ERP implementation strategies, Comparison of Big Bang vs. Phased Approach, Implementation Strategy in Small and Medium Enterprise, Post Implementation Issues.

UNIT IV

OVERVIEW OF ARCHITECTURE OF DIFFERENT ERP SOFTWARES:

Oracle overview, Architecture, A.I.M. and applications, SAP Software architecture overview, ERP before and after Y2K, Impact of Y2K on ERP Development, Risk and Governance Issues in an ERP

ERP MODULES: *Finance module, Sales & Distribution module, Human Resources module, Plant Maintenance module, Quality Management module, Material management module, manufacturing management module.*

RECOMMENDED BOOKS:

1. Sadagopan. S, ERP-A Managerial Perspective, Tata McGraw Hill, 1999.
2. Jose Antonio Fernandez, the SAP R/3 Handbook, Tata McGraw Hill, 1998.
3. Vinod Kumar Crag and N.K. Venkitakrishnan, Enterprise Resource Planning- Concepts and Practice, Prentice Hall of India, 1998.
4. Garg & Venkitakrishnan, ERPWARE, ERP Implementation Framework, Prentice Hall, 1999.
5. Thomas E Vollmann and Bery Whybark, Manufacturing and Control Systems, Galgothia Publications, 1998.
6. Alexis Leon, Enterprise resource planning, Tata Mcgraw-Hill

MTIP-203	DESIGN OF EXPERIMENTS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 hrs
Objective	To understand the various design of experiments techniques for optimization of problems.						
Course Outcomes							
CO1	To understand the concepts of Design of Experiment and statistical Methods.						
CO2	To understand the ANOVA and factorial design and fitting response curves and surfaces.						
CO3	To study the application of Taguchi Method and testing of hypothesis						
CO4	To study and implement the Response Surface Methodology.						

UNIT-I

Introduction to Designed Experiments: Introduction: Strategy of experimentation, Some typical applications of experimental design, Basic principles, Guidelines for designing experiments, Using statistical design in experimentation, A Checklist for Planning experiments, *Introduction to Minitab, Interface of Minitab, Customizing Minitab, Entering Data, Graphing Data, Printing Data and Graphs, Saving and Retrieving information.*

Basic Statistical Methods: Introduction, Basic statistical concepts, Types of Data, Graphical Presentation of Data. Descriptive Statistics: Measure of Location, Measure of Variation, The Normal Distribution, Counting, Minitab Commands to Calculate Descriptive Statistics.

Inferential Statistics: The Distribution of Sample Means (R Known), Confidence Interval for the Population Mean (σ Known), Hypothesis testing for one sample mean (σ Known), Hypothesis test for two sample means, Testing for Normality, *Hypothesis test and Confidence Intervals with Minitab.*

UNIT-II

Analysis of Variance: Introduction to Analysis of Variance, ANOVA assumptions and Validation, ANOVA Table, The sum of square approach to ANOVA calculations, Analysis of the fixed Effect model, Decomposition of the Total sum of squares. Statistical analysis, Estimation of the Model Parameters, Unbalanced Data, Model Accuracy Check, Practical interpretation of results. *ANOVA with Minitab*

Factorial Experiments: Basic definition and principles, Advantages of factorials, Two level factorial design, The 2^1 Factorial Experiment, The 2^2 Factorial Experiment, The 2^3 Factorial Design, Addition of Centre Cells to 2^k Designs. General Procedure for Analysis of 2^k designs. 2^k Factorial Designs in Minitab.

UNIT-III

Introduction to Taguchi Method: Introduction, Taguchi Quality loss function, Orthogonal Array, Properties of Orthogonal Array, Minimum number of experiments to be conducted, Static Problems, Dynamic Problems, Assumptions of the Taguchi method, Steps in Taguchi Method, Assessment of Factors and Interactions, Selection and Application of Orthogonal arrays, Data Analysis from Taguchi Experiments, Variable Data with main factors only, Variable Data with Interactions, Attribute Data Analysis, Confirmation Experiment, Confidence Intervals, Robust Design Approach. *Applications of Taguchi Method using Minitab*.

UNIT-IV

Introduction to Response Surface Methodology: Introduction, Terms in Quadratic Models, The method of steepest ascent, Analysis of Second order response surfaces, Experimental design for fitting response surfaces, 2k Designs with Centers, 3^k Factorial Designs, Box-Behnken Designs, Central Composite Designs, Analysis of Data from RSM Designs, Design Considerations for Response Surface Experiments. *Response Surface Designs in Minitab.*

RECOMMENDED BOOKS:

1. Douglas C Montgomery, Design and Analysis of Experiments, John Wiley
2. Paul G. Mathews, Design of Experiments with MINITAB, New Age International Publishers.
3. K. Krishnaiah, P. Shahabudeen, Applied Design of Experiments and Taguchi Methods, PHI.
4. Angela Dean and Daniel Voss, Design and Analysis of Experiments, Springer.
5. John P.W.M., Statistical Design and Analysis of Experiments, John Wiley
6. Montgomery D.C., Runger G. C., Introduction to Linear Regression Analysis, John Wiley
7. Myres R.H. and Montgomery D.C., Response Surface Methodology Process and Product Optimization Using Designed Experiments, Wiley
8. G UNIPUB, White Plains, Introduction to Quality Engineering Taguchi, New York.
9. https://www.ee.iitb.ac.in/~apte/CV_PRA_TAGUCHI_INTRO.htm
10. www.ecs.umass.edu/mie/labs/mda/fea/sankar/chap2.html

MTIP–205	STRATEGIC ENTREPRENEURSHIP						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 hrs**
Objective	To provide knowledge to the students about entrepreneurship concepts and various development programmes and policies.						
Course Outcomes							
CO1	To know about the small scale industries, scopes and the causes of their sickness.						
CO2	To know about the EDP and different government policies.						
CO3	To learn about business incubations and its future perspectives.						
CO4	To learn E-business marketing and developments.						

UNIT-I

Small Scale Industries: Definition and types of SSI's; Role, scope and performance in national economy; Problems of small scale industries.

Industrial Sickness: Definition; Causes of sickness; Indian scenario, Government help; Management strategies; Need for trained entrepreneurs

UNIT-II

Entrepreneurship Development Programmes: Introduction, Origin of EDP's , Organizations involved in EDP's, Objectives of EDPs, Implementation of EDP's, Short comings of EDP's, Role in entrepreneurship development.

Step: Introduction, Origin, Status in India, Success and failure factors, Govt. polices and incentives, future prospects in India.

UNIT-III

Business Incubation: Introduction, Origin and development of business incubators in India and other countries, types of incubators, success parameters for a business incubator, Benefits to industries, institutes, government and society; future prospects. A few case studies (at least 2).

Project Management: Concept, Characteristics and Significance of Project Management. Components of Project Management. Project Life Cycle. Project Identification and Selection. Project Formulation and Appraisal.

UNIT-IV

Special Aspects of Entrepreneurship: Entrepreneurship, Social entrepreneurship, International entrepreneurship, Rural entrepreneurship, Community Development, Women entrepreneurship.

Network Marketing: Introduction, E-business, E-commerce, E-auction, A basic internet e-business architecture, A multi-tier e-business architecture.

RECOMMENDED BOOKS:

1. P.K. Gupta, Strategic Entrepreneurship, Everest Publishing House.
2. David Cleland, Project Management –Strategic Design and Implementation, McGraw Hill.
3. David H Holl, Entrepreneurship-New Venture Creation, Prentice Hall of India.
4. Steed & Steed, Sustainable Strategic Management, Prentice Hall of India.
5. Kotler, Marketing Management by Prentice Hall of India.
6. Tarek Khalil, Management of Technology, McGraw Hill.
7. Henry Steiner, Engineering Economic Principles, McGraw Hill.

MTOE-201	**Business Analytics**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development.*						

Course Outcomes (CO)	
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*
CO4	*What is the importance of identifying research gaps?*

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	**Personality Development through Life Enlightenment Skills**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; Shrimad Bhagwad Geeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; Shrimad Bhagwad Geeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; Shrimad Bhagwad Geeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

MTIP-207	**DISSERTATION PART – I**							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical Marks**	**Total**	**Time (Hrs.)**
0	**0**	**20**	**10**	**-**	**100**	**-**	**100**	**-**
Objective	The main objective of this course is to plan a research work (which includes the problem formulation/literature review, proposed objectives, proposed methodologies and references) in the field of Industrial and Production Engineering or interrelated fields of applications.							
Course Outcomes								
CO 1	Students will be exposed to various self-learning topics.							
CO 2	Students will be exposed to an exhaustive survey of the literature such as books, national/international refereed journals, resource persons and industrial surveys for the selection/ identification of engineering/research problem.							
CO 3	Students will be able to set the research objectives of the identified engineering/research problem.							
CO 4	Students will learn modern tools/techniques related to the identified engineering/research problem for the solution and able to learn technical report writing skills.							
CO 5	Students will develop oral and written communication skills to present and defend their work in front of technically qualified audience.							

The students will start their research work in third semester with a research problem having research potential involving scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his/her supervisor and the topic of dissertation must be mutually decided by the supervisor and student.
The students will be required to submit a progress report related to their dissertation work by the end of September. The progress report will cover the following:

- The goal set for the period.
- Research papers studied.
- Methodology used in achieving the goal.
- The extent of fulfillment of the goal.

The progress report must be at least of 3-4 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, period of progress report, signature of candidate and supervisor.
The students will be required to appear for comprehensive Seminar & Viva-voce and submit a synopsis report based on their progress related to the dissertation as per the presentation date mentioned in the academic calendar for the session. The synopsis report will be submitted in the same format as that of the thesis and will contain the following:

1. Introduction
2. Literature Survey
3. Gaps in Literature
4. Objectives of the Proposed Work
5. Methodology
6. References

*** Student will choose (be offered) his/her guide in the end of second semester.**

MTIP-202	DISSERTATION PART -II							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time (Hrs.)**
0	**0**	**32**	**16**	**-**	**100**	**200**	**300**	**-**

Objective	The main objective of the course is to make the students able to do some good research in the field of their interests related to Industrial and Production Engineering or interrelated fields of applications.
Course Outcomes	
CO 1	Students will be able to design solutions for engineering problems that meet the specified needs with appropriate considerations.
CO 2	Students will be able to conduct investigations of engineering problems using research-based knowledge and experimental/research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
CO 3	Students will be able to apply resources and modern engineering tools and techniques with an understanding of the limitations.
CO 4	Students will be able to either work in a research environment or in an industrial environment.
CO 5	Students will be conversant with technical report writing, professional ethics, responsibilities and norms of the engineering practice.
CO 6	Students will be able to present and convince their topic of study to the engineering community.

The students are required to continue Analytical/Experimental/Computational/Industrial Problems or Case studies investigations in the field of Industrial and Production Engineering or other related fields which have been finalized in the third semester. They would be working under the supervision of a faculty member.
The students will be required to submit a progress report duly signed by their respective supervisors to the department, related to their dissertation work in the last week of March. The progress report will cover the following:

- The goal set for the period.
- Research papers studied.
- Methodology used in achieving the goal.
- The extent of fulfillment of the goal.
- References

The progress report must be of at least of 3-4 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, period of progress report, signature of candidate and supervisor.
The candidate has to prepare a detailed dissertation report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up/numerical details/industrial case study etc. as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study.
The final dissertation will be submitted in the end of semester as per academic calendar for the session, which will be evaluated by internal as well as external examiners based upon his/her research work. At least one publication is expected before final submission of the dissertation from every student in peer reviewed referred journals or reputed conference from the work done by them in their dissertation. The dissertation should be presented in standard format as provided by the department.
The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a supervisor, co- supervisor etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his supervisor.

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
KURUKSHETRA UNIVERSITY, KURUKSHETRA
('A+' Grade, NAAC Accredited)

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (CREDIT BASED)
(With specialization in Thermal Engineering)
SEMESTER-I

S.No.	Course No.	Course Name	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1.	MTTH-101	Advanced Fluid Dynamics	3:0:0	3	3	60	40	-	100	3
2.	MTTH-103	Advanced Heat Transfer	3:0:0	3	3	60	40	-	100	3
3.	*	Programme Elective - I	3:0:0	3	3	60	40	-	100	3
4.	**	Programme Elective - II	3:0:0	3	3	60	40	-	100	3
5.	MTRM-111	Research Methodology and IPR	2:0:0	2	2	60	40	-	100	3
6.	MTTH-117	Advanced Heat Transfer Lab	0:0:4	4	2	-	40	60	100	3
7.	MTTH-119	Refrigeration and Cryogenics Lab	0:0:4	4	2	-	40	60	100	3
8.	***	Audit Course –I	2:0:0	2	-	-	100*	-	100*	3
		Total	**16:0:8**	**24**	**18**	**300**	**280**	**120**	**700**	

*LIST OF PROGRAMME ELECTIVE – I			**LIST OF PROGRAMME ELECTIVE – II		
1.	MTTH-105	Advanced Thermodynamics	1.	MTTH-111	Refrigeration and Cryogenics
2.	MTTH-107	Design of Thermal Systems	2.	MTTH-113	Air Conditioning System Design
3.	MTTH-109	Energy Conservation and Management	3.	MTTH-115	Gas Turbines

***LIST OF AUDIT COURSES – I					
1.	MTAD-101	English for Research Paper Writing	3.	MTAD-105	Sanskrit for Technical Knowledge
2.	MTAD-103	Disaster Management	4.	MTAD-107	Value Education

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*** **Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (CREDIT BASED)
(With specialization in Thermal Engineering)

SEMESTER-II

S. No.	Course No.	Course Name	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1.	MTTH-102	Advanced Internal Combustion Engines	3:0:0	3	3	60	40	-	100	3
2.	MTTH-104	Steam Engineering	3:0:0	3	3	60	40	-	100	3
3.	*	Programme Elective - III	3:0:0	3	3	60	40	-	100	3
4.	**	Programme Elective - IV	3:0:0	3	3	60	40	-	100	3
5.	MTTH-118	Advanced Internal Combustion Engines Lab	0:0:4	4	2	-	40	60	100	3
6.	MTTH-120	Computational Fluid Dynamics Lab	0:0:4	4	2	-	40	60	100	3
7.#	MTTH-122	Mini Project	0:0:4	4	2	-	100	-	100	3
8.	***	Audit Course -II	2:0:0	2	-	-	100*		100*	3
		Total	**14:0:12**	**26**	**18**	**240**	**340**	**120**	**700**	

*LIST OF PROGRAMME ELECTIVE – III			**LIST OF PROGRAMME ELECTIVE – IV		
1.	MTTH-106	Design of Solar and Wind Systems	1.	MTTH-112	Computational Fluid Dynamics
2.	MTTH-108	Nuclear Engineering	2.	MTTH-114	Design of Heat Transfer Equipments
3.	MTTH-110	Convective Heat Transfer	3.	MTTH-116	Compressible Flow Machines

***LIST OF AUDIT COURSES – II (Thermal Engg.)					
1.	MTAD-102	Constitution of India	3.	MTAD-106	Stress Management by Yoga
2.	MTAD-104	Pedagogy Studies	4.	MTAD-108	Personality Development through Life Enlightenment Skills

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*****Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

#Note3: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING (CREDIT BASED)
(With specialization in Thermal Engineering)
SEMESTER-III

S. No.	Course No.	Course Name	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1.	*	Programme Elective-V	3:0:0	3	3	60	40	-	100	3
2.	**	Open Elective	3:0:0	3	3	60	40	-	100	3
3.	MTTH-207	Dissertation Phase - I	0:0:20	20	10	-	100	-	100	-
		Total	**6:0:20**	**26**	**16**	**120**	**180**	**-**	**300**	

*PROGRAMME ELECTIVE – V	
MTTH-201	Advanced Computational Fluid Dynamics
MTTH-203	Finite Element Methods
MTTH-205	Thermal Modeling and Analysis

**LIST OF OPEN ELECTIVES			
MTOE-201	Business Analytics	MTOE-207	Cost Management of Engineering Projects
MTOE-203	Industrial Safety	MTOE-209	Composite Materials
MTOE-205	Operations Research	MTOE-211	Waste to Energy

SEMESTER-IV

S. No.	Course No.	Course Name	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1.	MTTH-202	Dissertation Phase - II	0:0:32	32	16	-	100	200	300	-
		Total	**0:0:32**	**32**	**16**	**-**	**100**	**200**	**300**	

Total credits of all four semesters – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Broad area for the Dissertation Part-I is to be specified/submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of at least one paper in International/National reputed journals (SCI/Scopus indexed/ UGC approved journals) or reputed conferences with ISSN number.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTTH-101	ADVANCED FLUID DYNAMICS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To understand fluid flow problems & regimes, governing parameters, industrial applications, laminar, turbulent & compressible flows, experiments in the field of fluid mechanics.						
Course Outcomes							
CO1	Enabling the understanding of fluid flow problems along with range of governing parameters.						
CO2	Enabling the understanding of flow patterns and ability to differentiate between various flow regimes and its effects & take up related problems of industrial base.						
CO3	Creating an understanding about turbulent & compressible flows.						
CO4	Enabling the students to devise the experiments in the field of fluid mechanics.						

UNIT-I

Basic equations of fluid flow: Reynold's transport theorem, continuity, momentum and energy equations in integral form and their applications, differential form of these equations, Euler's equation, Bernoulli's equation, Navier Stokes equation.

Ideal flow: Kinematics of fluid flow; potential flow; sources, sinks and vortices; superimposition of uniform stream with above, doublets; Rankine ovals; flow around uniform cylinders with and without circulation; pressure distribution on the surface of these bodies and D'Alembert's paradox.

UNIT-II

Exact solution of N-S equations: Navier Stokes equation, Plane Poiselle and Coutte flows; Hagen-Poiselle flow through pipes; elements of hydrodynamic theory of lubrication; Flows with very low Reynold's numbers; Stokes flow around a sphere.

Boundary layer flows: Elements of two-dimensional boundary layer theory; displacement thickness and momentum thickness; skin friction; Blasius solution for boundary layer on a flat plate; Karman-Pohlhausen integral method for obtaining approximate solutions, boundary layer separation & control.

UNIT-III

Turbulent Flow: Characteristics of turbulent flow, laminar-turbulent transition, Turbulent boundary layer equation, Time mean motion and fluctuations, derivation of governing equations for turbulent flow, Reynold's stresses: shear stress models, universal velocity distribution.

Introduction to Compressible flows: Speed of sound and Mach number, basic equations for one dimensional compressible flow, isentropic relation, propagation of infinitesimal and finite disturbances, stagnation and critical conditions, effect of variable flow area, converging and converging-diverging nozzles and diffusers.

UNIT-IV

Experimental Techniques: Role of experiments in fluid mechanics, Sources of error in experiments, Sources of Error in Measurement, Data analysis: Classification of Data, Analysis of Random Signals, Fourier Transform Technique, Probability Density Function Approach; Introduction to design of experiments; Review of probes and transducers: Introduction to Hot wire Anemometry; Single & double wire measurement; Laser Doppler Velocimetry: Light Sources & LDV; Particle Image Velocimetry: Particle Image Velocimetry, Seeding Arrangement for PIV, Particle Dynamics, Generating a Light Sheet, Synchronizer.

Reference/Text Books:

1. Muralidhar and Biswas, "Advanced Engineering Fluid Mechanics", Alpha Science International, 2005.
2. Irwin Shames, "Mechanics of Fluids", McGraw Hill, 2003
3. R.W., McDonald A.T., "Introduction to Fluid Mechanics", John Wiley and Sons Inc, 1985
4. Pijush K. Kundu, Ira M Kohen and David R. Dawaling, "Fluid Mechanics", Fifth Edition, 2005
5. I.G. Currie, "Fundamentals of Mechanics of Fluid", McGraw-Hill.
6. Yuan, "Foundation of Fluid Mechanics", Prentice Hall.
7. R.W. Fox, P.J. Pritchard & A.T. McDonald, "Introduction to Fluid Mechanics", Wiley India.
8. S.K. Som and G. Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw.
9. Gupta and Gupta, "Fluid Mechanics and its applications", Willey Easter.

MTTH-103	ADVANCED HEAT TRANSFER						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To understand the subject of Heat Transfer in detail with capability to solve Industrial Problems. This will also create the base and interest among the students to carry out the Future Research.						
Course Outcomes							
CO 1	After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer.						
CO 2	The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer						
CO 3	The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.						

UNIT-I

Conductive Heat Transfer: Review of the basic laws of conduction, convection and radiation. General heat conduction equation in different co-ordinates. One dimensional steady state conduction with variable thermal conductivity and with internal distributed heat sources. Extended surfaces review, tapered fins, design considerations.
Two and three dimensional steady-state conduction, method of separation of variables, graphical method, relaxation technique.

Unsteady heat conduction: lumped capacitance method, validity of lumped capacitance method, general lumped capacitance analysis, spatial effects, plane wall with convection, radial systems with convection, semi-infinite solid, constant surface temperature and heat fluxes, periodic heating, solutions using Heisler's charts.

UNIT-II

Convective Heat Transfer: Introduction to convection boundary layers, local and average convection coefficients, laminar and turbulent flow, boundary layer equations, boundary layer similarity, boundary layer analogies – heat and mass transfer analogy, Reynold's and Colburn analogies.

Forced convection: external forced convection - empirical method, flat plate in parallel flow, cylinder in cross flow, flow over a sphere; internal forced convection – hydrodynamic and thermal considerations, energy balance, laminar flow in circular tubes, convection correlations.

Natural Convection: physical considerations, governing equations, laminar free convection on vertical surface, empirical correlations, free convection within parallel plate channels, empirical correlations, combined free and forced convection. Special topics: transpiration cooling, ablation heat transfer, fluidized bed combustion.

UNIT-III

Heat Transfer with Phase Change: dimensionless parameters in boiling and condensation, boiling modes, pool boiling, correlations, forced convection boiling, physical mechanism of condensation, laminar and turbulent film condensation, film condensation in tubes, dropwise condensation.

Exchangers: Basic design methodologies – LMTD and effectiveness NTU methods, overall heat transfer coefficient, fouling of heat exchangers, classification of heat exchangers according to constructional features: tubular, plate type, extended surface heat exchanger, compact heat exchangers, design of double pipe heat exchangers, plate and heat pipe type, heat transfer enhancement - Passive and active techniques.

MTTH-103 (contd….):

UNIT-IV

Radiation Heat Transfer: Fundamental concepts, radiation intensity, irradiation, radiosity, black body radiation, Basic laws of radiation, emission from real surfaces, absorption, reflection and transmission by real surfaces, Kirchoff's law, Gray surface, radiative heat exchange between two or more surfaces, view factor, radiation exchange between opaque, diffuse, gray surface in an enclosure; net radiation exchange at a surface, radiation exchange between surfaces, blackbody radiation exchange, two-surface enclosure, radiation shields, multimode heat transfer, radiation exchange with participating media, radiation of gases and vapour.

Mass Transfer: physical origins and rate equations, mixture composition, Fick's law of diffusion, mass transfer in stationary media, steady state diffusion through a plane membrane, equimolal diffusion, diffusion of water vapours through air, mass transfer coefficient, convective mass transfer, correlations.

Reference/Text Books:

1. Incropera, Dewitt, Bergmann and Levine, "Fundamentals of Heat and Mass Transfer", Wiley India, 2006.
2. J.P. Holman, "Heat Transfer", McGraw Hill, 1996.
3. Y.V.C. Rao, "Heat and Mass Transfer", Universities Press, 2001.
4. D.S. Kumar, "Heat and Mass Transfer", Katson Publication, 2013.
5. Kreith and Bohn, "Principles of Heat Transfer", Cengage Learning, Inc. 7th Edition, 2009.
6. N.H. Afgan and Schliinder, "Heat Exchangers Design and Theory", McGraw Hill.

MTTH-117	ADVANCED HEAT TRANSFER LAB							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical Marks	Total	Time (Hrs.)
-	-	4	2	-	40	60	100	3
Objective	To design and conduct experiments, and acquire, analyze and interpret data.							
Course Outcomes								
CO 1	Study the heat pipe and demonstrate its super thermal conductivity.							
CO 2	Understand the unsteady state heat conduction.							
CO 3	Analyze the heat transfer characteristics in convective heat transfer.							
CO 4	Analyze the heat transfer characteristics for different heat exchangers.							

List of Experiments

1. Study of variation of emissivity of test plate with absolute temperature.
2. To demonstrate the super thermal conductivity of heat pipe.
3. To determine natural convective heat transfer coefficient and to calculate and to plot variation of natural convective heat transfer coefficient along the vertical tube.
4. To determine the LMTD, overall heat transfer coefficient and effectiveness of evaporative heat exchanger.
5. To find out heat transfer coefficient of drop wise and film wise condensation at various flow rates of water.
6. To study different types of heat enhancement techniques.
7. To determine the Biot number, Fourier number and heat transfer coefficient for unsteady heat transfer.
8. To calculate heat transfer coefficient of the fluidized bed.
9. To find out the overall heat transfer coefficient and LMTD of a finned tube heat exchanger.
10. To find out the overall heat transfer coefficient and LMTD of a plate type heat exchanger.
11. To find out the heat flux and temperature difference between metal & liquid in a two phase transfer unit.
12. To determine the overall heat transfer co-efficient under unsteady state conditions at different temperatures and heat transfer coefficient at boiling point.

Note: Total eight experiments are to be performed selecting at least six from the above list.

MTTH-119	REFRIGERATION AND CRYOGENICS LAB							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical Marks	Total	Time (Hrs.)
-	-	4	2	-	40	60	100	3
Objective	To make students understand the applications of refrigeration and cryogenics.							
Course Outcomes								
CO 1	Students will understand about the basics and working of refrigeration and cryogenics systems.							
CO 2	Students will be able to identify the different cycle of operation in refrigeration.							
CO 3	Students will know the working principle to achieve very low temperature and its importance in air-conditioning.							
CO 4	Student will learn about the various working and design of different types of refrigeration systems.							

List of Experiments

1. To study and perform experiment on compound vapour compression Refrigeration Cycle.
2. To study and perform experiment on Solar Air-conditioner based on vapour absorption cycle.
3. To study and perform experiments on multi-load systems.
4. To study and perform experiment on vapour absorption apparatus.
5. To find the performance parameter of cooling tower.
6. To study various components in room air conditioner.
7. To find performance of a refrigeration test rig system by using different expansion devices.
8. To study and perform experiments on cascade system.
9. To study and perform experiments on dry ice machine.
10. To study and perform experiments on gas liquefaction system.

Note: Total eight experiments are to be performed selecting at least six from the above list.

MTTH-105	ADVANCED THERMODYNAMICS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To acquaint the students with fundamentals of advanced thermodynamics.						
Course Outcomes							
CO 1	Student will get knowledge of exergy, basic laws governing energy conversion in multicomponent systems and application of chemical thermodynamics.						
CO 2	Student will be aware about advanced concepts in thermodynamics with emphasis on thermodynamic relations, equilibrium and stability of multiphase multi-component systems.						
CO 3	To present theoretical, semi-theoretical and empirical models for the prediction of thermodynamic properties.						
CO 4	Student will acquire the confidence in analyze the motion of combusting and non-combusting fluids whilst accounting for variable specific heats, non-ideal gas properties, chemical non-equilibrium and compressibility.						

UNIT – I

Basic Concepts: Thermodynamics - Zeroth law of thermodynamics – first law of thermodynamics - limitations of first law - Corollaries. Concept of internal energy Transient Flow Analysis - second law of thermodynamics - Corollaries. Concept of entropy- Availability and unavailability – availability function of the closed system - availability of steady flow system Irreversibility.

Thermodynamic Relations: Introduction Thermodynamic Potentials – Maxwell Relations – Specific Heat Relations – Mayer's relation –General relations for du, dh, ds.

UNIT – II

Perfect Gases: P.V.T. surface – Equations of state – Real Gas Behavior – Vander Waal's equation - Generalized compressibility Factor – Energy properties of Real Gases – Vapour pressure – Clausius – Clapeyron Equation – Throttling – Joule – Thompson coefficient.

Non-reactive Mixture of perfect Gases – Governing Laws – Evaluation of properties –Psychrometric Mixture properties and psychrometric chart – Air conditioning processes – Real Gas Mixture.

UNIT – III

Reactive Gas Mixtures: Combustion: Introduction-– Combustion Reactions – Enthalpy of Formation – Entropy of Formation - Adiabatic flame Temperature -first and second law analysis of reacting systems.

Thermodynamic cycles: Vapor power cycles: Second law analysis of vapor power cycles, cogeneration, Binary vapor cycles, and combined gas vapor power cycles. Gas power cycles: Ideal jet propulsion cycles-Second law analysis of gas power cycles.

UNIT – IV

Statistical thermodynamics: Statistical interpretations of first and second law and Entropy, Nernst heat theorem.

Kinetic theory of gases: Molecular model, Clausius equation of state, van der waals equation of state, Maxwell Boltzmann velocity distribution

Reference/Text books:

1. Cengel, "Thermodynamics", Tata McGraw Hill Co., New Delhi, 1980.
2. Howell and Dedcius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Inc., U.S.A.
3. Van Wylen & Sonntag, "Thermodynamics", John Wiley and Sons Inc., U.S.A.
4. Jones and Hawkings, "Engineering Thermodynamics", John Wiley and Sons Inc., U.S.A, 2004.
5. Holman, "Thermodynamics", McGraw Hill Inc., New York, 2002.
6. Faires V.M. and Simmag, "Thermodynamics", Macmillan Publishing Co. Inc., U.S.A.
7. Rao Y.V.C., "Postulational and Statistical Thermodynamics", Allied Publishers Inc, 1994.

MTTH-107	DESIGN OF THERMAL SYSTEMS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3

Objective	This course provides the mathematical modelling and analysis for designing the thermal systems. Also students will be able to understand the dynamic behaviour of thermal systems.
Course Outcomes	
CO 1	Enable the students to understand the basic concepts for designing the thermal systems. Also to discuss mathematical modelling of thermal systems using computer programmes.
CO 2	Equip the students for modelling the thermal systems like heat exchangers, evaporators, condensers etc. Also to understand their solution procedures.
CO 3	Students will understand the concepts of optimization and its various methods for solving the thermal problems. Also to study geometric, linear and dynamic programming.
CO 4	Students will learn the dynamic behaviour of thermal systems. Also to learn stability analysis and non-linearity.
CO 5	Enable the students to understand the basic concepts for designing the thermal systems. Also to discuss mathematical modelling of thermal systems using computer programmes.

UNIT-I

Design of Thermal System: Design Principles, Workable systems, Optimal systems, Matching of system components, Economic analysis, Depreciation, Gradient present worth factor.

Mathematical Modeling: Equation fitting, Empirical equation, Regression analysis, Different modes of mathematical models, Selection, Computer programmes for models.

UNIT-II

Modeling Thermal Equipments: Modeling heat exchangers, Evaporators, Condensers, Absorption and rectification columns, Compressor, Pumps, Simulation studies, Information flow diagram, Solution procedures.

UNIT-III

Systems Optimization: Objective function formulation, Constraint equations, Mathematical formulation, Calculus method, Dynamic programming, Geometric programming, Linear programming methods, Solution procedures.

UNIT-IV

Dynamic Behavior of Thermal System: Steady state simulation, Laplace transformation, Feedback control loops, Stability analysis, Non-linearties.

Reference/Text Books:

1.Hodge, B.K. and Taylor, R. P., “Analysis and Design of Energy Systems”, Prentice Hall (1999).
2.Bejan, A., Tsatsaronis, G. and Michel, M., “Thermal Design and Optimization”, John Wiley and Sons (1996).
3.Jaluria, Y., “Design and Optimization of Thermal Systems”, CRC Press (2008).
4.Ishigai, S., “Steam Power Engineering Thermal and Hydraulic Design Principle”, Cambridge University Press (1999).

MTTH-109	ENERGY CONSERVATION AND MANAGEMENT						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To understand the method of utilization of energy, types, site selection & other important aspects of Solar, wind, hydro, ocean, wave, tidal, geothermal, bio-mass & energy management.						
Course Outcomes							
CO 1	Understanding of methods of utilization, types, site selection & surveys etc. of Solar, Wind, Chemical, MHD sources of energy.						
CO 2	Understanding of methods of utilization, types, site selection & surveys etc. regarding Energy from Oceans and Hydropower.						
CO 3	Understanding of methods of utilization, types, site selection & surveys etc. regarding Bio-energy and Geothermal energy.						
CO 4	Understanding of generation of scenarios of energy consumption and predict the future trend. The student should be able to suggest and plan energy conservation solutions.						

UNIT-I

Alternative Sources of Energy:

Solar Energy: Introduction; direct solar energy utilization; solar thermal applications. **Chemical Energy Sources:** Introduction, Fuel cells: Design, Principle, operation, classification, types. **Magneto Hydro Dynamic Power Generation:** Introduction, Principle of MHD power generation, MHD Systems.

Wind energy: Introduction, Basic principles of wind energy conversion: Nature of wind, Power in the wind, forces on blades, wind energy conversion, design of windmills; wind data and energy estimation; site selection considerations, Basic components of WECS.

UNIT-II

Energy from Oceans: Wave energy generation – energy from waves; wave energy conversion devices; advantages and disadvantages of wave energy; Tidal energy – basic principles; tidal power generation systems; estimation of energy and power; advantages and limitations of tidal power generation; ocean thermal energy conversion (OTEC); methods of ocean thermal electric power generation.

Hydro power: Classification of small hydro power (SHP) stations; description of basic civil works design considerations; turbines and generators for SHP; advantages and limitations.

UNIT-III

Biomass and bio-fuels: Energy plantation; biogas generation; types of biogas plants; applications of biogas; energy from wastes.

Energy conservation in Industries: Cogeneration, Combined heating and power systems, Relevant international standards and laws.

UNIT-IV

Energy conservation management: General principles of energy management and energy management planning; application of Pareto's model for energy management; obtaining management support; establishing energy data base; Energy economics.

Energy Auditing: Conducting energy audit; identifying, evaluating and implementing feasible energy conservation opportunities; energy audit report; monitoring, evaluating and following up energy saving measures/projects.

Reference/Text Books:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilization", Hemispherical Publication, 1988.
2. Paul W. O'Callaghan, "Design and Management for Energy Conservation" Pergamon Pr; 1st edition (December 1, 1981)
3. D.A. Reeg, "Industrial Energy Conservation", Pergamon Press, 1980.

4. T.L. Boyen, "Thermal Energy Recovery" Wiley, 1980.
5. L.J. Nagrath, "Systems Modeling and Analysis", Tata McGraw Hill, 1982.
6. W.C. Turner, "Energy Management Handbook ", Wiley, New York, 1982.
7. I.G.C. Dryden, "The Efficient Use of Energy ", Butterworth, London, 1982.
8. Godfrey Boyle (Edited by), "Renewable energy – power for sustainable future", Oxford University Press in association with the Open University, 1996.
9. S.A. Abbasi and Naseema Abbasi, "Renewable energy sources and their environmental impact" Prentice-Hall of India, 2001.
10. G.D. Rai, "Non-conventional sources of energy" Khanna Publishers, 2000.
11. G.D. Rai, "Solar energy utilization" Khanna Publishers, 2000.
12. S.L.Sah, "Renewable and novel energy sources", M. I. Publications, 1995.
13. S.Rao and B.B. Parulekar, "Energy Technology", Khanna Publishers, 1999.

MTTH-111	REFRIGERATION AND CRYOGENICS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To acquaint the students with fundamentals of refrigeration and cryogenics.						
Course Outcomes							
CO 1	Students will learn the basics of refrigeration and cryogenics and its application area.						
CO 2	Students will be able to design the refrigeration systems for domestic and industrial applications like cold storages.						
CO 3	Students will learn about ODP, GWP and related environment issues.						

Unit-I

Vapour compression system: Vapour compression refrigeration, Ewing's construction, Standard rating cycle and effect on operating conditions, actual cycle, standard rating cycle for domestic refrigerator, second law efficiency,

Multi-pressure systems: Working and analysis of Multi-stage compression with inter-cooling, Multi-evaporator systems, Cascade systems.

Unit-II

Refrigerant Compressors: Performance characteristics and capacity control of reciprocating and centrifugal compressors, screw compressor and scroll compressor,

Components of Vapor compression system: Design, selection of evaporators, condensers, control systems, motor selection.

Unit-III

Refrigerants: Introduction, designation of refrigerants, alternative refrigerants, CFC/HCFC phase-out regulations, atmospheric gases as substitute for CFC refrigerants, Binary and Azeotropic mixtures.

Refrigeration applications: food preservation, cooling and heating of foods, freezing of foods, freeze drying and heat drying of foods, transport refrigeration

Unit-IV

Vapour absorption system: Introduction to Vapor absorption refrigeration, common refrigerant-absorbent systems, single effect and double effect systems, new mixtures for absorption system.

Gas liquefaction systems: Linde-Hampson, Linde dual pressure, Claude cycle.

Reference/Text Books:

1. R. J. Dossat, "Principles of Refrigeration", Pearson Education Asia, 2001.
2. C. P. Arora, "Refrigeration and Air-conditioning", Tata McGraw-Hill, 2000.
3. Stoecker & Jones, "Refrigeration and Air-conditioning", McGraw Hill Book Company, New York, 1982.
4. A. R. Trott, "Refrigeration and Air-conditioning", Butterworths, 2000.
5. J. L. Threlkeld, "Thermal Environmental Engineering", Prentice Hall, 1970.
6. R. Barron, "Cryogenic systems", McGraw–Hill Company, New Yourk, 1985.
7. G. G. Hasseldon. "Cryogenic Fundamentals", Academic Press.
8. Bailey, "Advanced Cryogenics", Plenum Press, London, 1971.
9. W. F. Stoecker, "Industrial Refrigeration Handbook", McGraw-Hill, 1998.
10. John A. Corinchock, "Technician's Guide to Refrigeration systems", McGrawHill.
11. P. C. Koelet, "Industrial Refrigeration: Principles, Design and Applications", Macmillan, 1992.
12. ASHRAE HANDBOOKS (i) Fundamentals (ii) Refrigeration.
13. Graham Walker, "Miniature Refrigerators for Cryogenic Sensors and Cold Electronics", Clarendon Press, 1989.

MTTH-113	AIR CONDITIONING SYSTEM DESIGN						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To acquaint the students with fundamentals of heating, ventilation and air-conditioning.						
Course Outcomes							
CO 1	Student should be able to understand construction and design features of Air-conditioning system.						
CO 2	Student should be able to understand various types and its adoptability in the various environment and application areas.						
CO 3	Student should be able to understand various health issues						
CO 4	Student should be able to design seasonal energy efficient system						

Unit-I

Air conditioning systems: the complete system, System selection and arrangement, HVAC components and distribution system, All-air, Air-water and All-water systems, decentralized cooling and heating.
Various air-conditioning processes: Moist air and standard atmosphere, Adiabatic saturation, classic moist air processes, Space air conditioning: design conditions, off-design conditions.

Unit-II

Comfort and health-Indoor air quality: Enthalpy deviation curve, psychrometry, SHF, dehumidified air quantity, human comfort, indoor air quality.
Heat transmission in building structures: Basic heat transfer modes, Tabulated overall heat-transfer coefficient.

Unit-III

Design conditions and load calculations: Space heating load: outdoor and indoor design conditions, transmission heat losses, infiltration, heat losses from air duct. Solar radiation
The cooling load: Design conditions, Internal heat gain, Transient conduction heat transfer, Fenestration: Transmitted solar radiations.

Unit-IV

Fan and Building air distribution: fan performance and selection, Fans and variable-air-volume systems, Air flow in ducts and fittings, pressure drop, duct design, & blowers, Performance & selection, noise control.

Reference/Text Books:

1. ASHRAE Handbook.
2. "Handbook of air-conditioning system design", Carrier Incorporation, McGraw Hill Book Co., U.S.A, 1965.
3. Norman C. Harris, "Modern Air Conditioning", McGraw-Hill, 1974.
4. Jones W.P., "Air Conditioning Engineering", Edward Arnold Publishers Ltd., London, 1984.
5. Hainer R.W., "Control Systems for Heating, Ventilation and Air-Conditioning", Van Nostrand
6. Reinhold Co., New York, 1984. 7. Arora C.P., "Refrigeration & Air Conditioning", Tata Mc Graw Hill, 1985.
7. Manohar Prasad, "Refrigeration & Air Conditioning", New Age Publishers.
8. Stoecker, "Refrigeration & Air Conditioning", Mc Graw Hill, 1992.
9. Stoecker, "Design of Thermal Systems", Mc Graw Hill, 1992.
10. F. C. McQuiston, J. D Parker, J. D. Spitler "Heating, Ventilation and Air-conditioning", Wiley publications.

MTTH-115	GAS TURBINES						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	Design and analyze the performance of gas turbines and propulsion devices.						

Course Outcomes	
CO 1	Understand the ideal and real thermodynamic cycles of air-breathing engines and Industrial gas turbines
CO 2	Design the blading, study the velocity triangles and estimate the performance of centrifugal and axial flow compressors.
CO 3	Understand the combustion process and design the combustion chamber of a gas Turbine.
CO 4	Design the blading, study the velocity triangles and estimate the performance of axial and radial in-flow turbines
CO 5	Analyze the off-design performance and matching of the components of a gas turbine

UNIT-I

Introduction: Classification of Turbomachines, Applications of Gas Turbines, Assumptions for Air-Standard Cycles, Simple Brayton Cycle, Heat Exchange Cycle, Inter-cooling and Reheating Cycle, Comparison of Various Cycles.

Ideal Shaft Power Cycles and their Analysis: Assumptions for Air-Standard Cycles, Simple Brayton Cycle, Heat Exchange Cycle, Inter-cooling and Reheating Cycle, Comparison of Various Cycles.

UNIT-II

Real Cycles and their Analysis: Methods of Accounting for Component Losses, Isentropic and Polytropic Efficiencies, Transmission and Combustion Efficiencies, Comparative Performance of Practical Cycles, Combined Cycles and Cogeneration Schemes.

Jet Propulsion Cycles and their Analysis: Criteria of Performance, Simple Turbojet Engine, Simple Turbofan Engine, Simple Turboprop Engine, Turbo-shaft Engine, Thrust Augmentation Techniques.

Combustion System: Operational Requirements, Classification of Combustion Chambers, Factors Effecting Combustion Chamber Design, The Combustion Process, Flame Stabilization, Combustion Chamber Performance, Some Practical Problems Gas Turbine Emissions

UNIT-III

Fundamentals of Rotating Machines: General Fluid Dynamic Analysis, Euler's Energy Equation, Components of Energy Transfer, Impulse and Reaction Machines.

Centrifugal Compressors: Construction and Principle of Operation, Elementary Theory and Velocity Triangles, Factors Effecting Stage Pressure Ratio, The Diffuser, The Compressibility Effects, Pre-rotation and Slip Factor, Surging and Choking, Performance Characteristics.

UNIT-IV

Flow Through Cascades: Cascade of Blades, Axial Compressor Cascades, Lift and Drag Forces, Cascade Efficiency, Cascade Tunnel.

Axial Flow Compressors: Construction and Principle of Operation, Elementary Theory and Velocity Triangles, Factors Effecting Stage Pressure Ratio, Degree of Reaction, Work done factor, Three Dimensional Flow, Design Process, Blade Design, Stage Performance, Compressibility Effects, Off-Design Performance.

Axial and Radial Flow Turbines: Construction and Operation, Vortex Theory, Estimation of Stage Performance, Overall Turbine Performance, Turbine Blade Cooling, The Radial Flow Turbine.

Off-Design Performance: Off-Design Performance of Single Shaft Gas Turbine, Off-Design Performance of Free Turbine Engine, Off-Design Performance of the Jet Engine, Methods of Displacing the Equilibrium Running Line

Reference/Text Books:

1. Sarvana Muttoo, H.I.H., Rogers, G. F. C. and Cohen, H., "Gas Turbine Theory", 6th Edition, Pearson 2008.
2. Dixon, S.L., "Fluid Mechanics and Thermodynamics of Turbomachinery", 7th Edition, Elsevier, 2014.
3. Flack, R.D., "Fundamentals of Jet Propulsion with Applications", Cambridge University Press, 2011.
4. Ganesan, V., "Gas Turbines", 3rd Edition, Tata McGraw Hill, 2010.

5. Yahya, S. M., "Turbines, Compressors and Fans", 4th Edition, McGraw Hill.

MTRM-111	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*						
Course Outcomes (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTTH-102	ADVANCED INTERNAL COMBUSTION ENGINES						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	Enable the students to understand the various theories, cycles and processes of Internal Combustion Engines. Also to understand the various devices and types of emission associated with engines.						
Course Outcomes							
CO 1	Student will be able to analyze the cycles, operating variables and the basic concepts of internal combustion engines. Also to learn various processes and comparison of real and fuel air cycles. To understand the thermo-chemistry of fuel-air mixtures. Also to study the combustion charts of the fuel-air mixture in internal combustion engines.						
CO 2	Students will understand the gas exchange processes and motion of charge in the cylinder and its effects on combustion process in SI and CI engines and control the pollutant formation.						
CO 3	Understand the combustion in SI and CI engine with the thermodynamics of the combustion.						
CO 4	Understand modern concepts like Lean burn, HCCI, GDI, MPFI and evaluate method for pollution control.						

UNIT-I

Cycle Analysis: Fuel-air cycles, variable specific heats, dissociation, effect of operating variables, comparison with air standard cycle. Actual cycles, time and heat loss factors, exhaust blow down, comparison of real engine cycle and fuel air cycle, availability analysis of engine processes.

Thermochemistry of fuel-air mixtures: composition of air and fuels, first law and second law applied to combustion, unburned mixture composition, combustion charts.

UNIT-II

Heat Transfer: Heat transfer and engine energy balance, parameters affecting heat transfer, convective and radiative heat transfer, measurement of instantaneous heat transfer rate, thermal loading.

Gas Exchange Processes: flow through valves and ports, exhaust gas flow rate, scavenging in two stroke engines, scavenging models, actual scavenging processes, supercharging and turbocharging, types and methods of supercharging, basic relationships, compressors, turbines, wave-compression devices, effects and limitations, charge cooling.

UNIT-III

Combustion: combustion in SI engines, thermodynamic analysis of SI engine combustion, burned and unburned mixture states, flame structure and speed, cycle variations, spark ignition, abnormal combustion, combustion in CI engines, types, CI engine combustion model, analysis of cylinder pressure data, fuel spray behavior, ignition delay, mixing controlled combustion.

UNIT-IV

Fuel Injection: fuel injection systems, mechanism of spray formation, electronic injection systems, MPFI system, feedback systems, flow in intake manifolds, design requirements.

Pollution Formation and Control: trends in vehicle emission standards, unburned hydrocarbon emissions, nitrogen oxides, CO, particulate emissions, exhaust gas treatment, non-exhaust emissions.

Reference/Text Books:

1. J.B. Heywood, "Internal Combustion Engine Fundamentals" McGraw Hill.
2. C.P. Taylor, "I.C. Engine Vol. I & II", MIT press.
3. V. Ganesan, "Internal Combustion Engines", Tata McGraw Hill.
4. Rowland S. Benson, J. H. Horlock & D E Winterbone, "Thermodynamics and Gas Dynamics of I.C. Engine, Vol. I & II", Oxford University press.
5. Campbell, A. S., "Thermodynamic Analysis of Combustion Engines" Krieger Publishing Company.

MTTH-104	STEAM ENGINEERING						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To familiarize the students with the fundamentals of steam engineering and thermal systems for energy conservation and waste heat recovery.						

Course Outcomes	
CO 1	Students will have the ability to explain working of different boilers and significance of mountings and accessories, usage of techniques, skills, and modern engineering tools necessary for boiler performance assessment.
CO 2	Students will have a theoretical and practical background in thermal systems and will have a good understanding of energy conservation fundamentals. Students will have the ability to analyze thermal systems for energy conservation.
CO 3	Students will have the ability to design a steam piping system, its components for a process and also design economical and effective insulation.
CO 4	Students will have the ability to analyze a thermal system for sources of waste heat design a system for waste heat recovery. Students will have the ability to design and develop controls and instrumentation for effective monitoring of the process.

UNIT-I

Fundamentals of steam generation: Introduction, Quality of steam, Use of steam table, Mollier Chart.
Boilers: Types, Mountings and Accessories, Combustion in boilers, Determination of adiabatic flame temperature, quantity of flue gases, Feed Water and its quality, Blow down; IBR, Boiler standards.
Piping & Insulation: Water Line, Steam line design and insulation; Insulation-types and application, Economic thickness of insulation, Heat savings and application criteria, Refractory-types, selection and application of refractory, Heat loss.

UNIT-II

Steam Systems: Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Steam Engineering Practices; Steam Based Equipments / Systems.
Boiler Performance Assessment: Performance Test codes and procedure, Boiler Efficiency, Analysis of losses; performance evaluation of accessories; factors affecting boiler performance.

UNIT-III

Boiler Performance Assessment Performance: Test codes and procedure, Boiler Efficiency, Analysis of losses; performance evaluation of accessories; factors affecting boiler performance.
Energy Conservation and Waste Minimization: Energy conservation options in Boiler; waste minimization, methodology; Economical viability of waste minimization.

UNIT-IV

Instrumentation & Control: Process instrumentation; control and monitoring. Flow, pressure and temperature measuring and controlling instruments, its selection.

Reference/Text Books:

1. T. D. Estop, A. McConkey, “Applied Thermodynamics”, Parson Publication.
2. Domkundwar; “A Course in Power Plant Engineering”, Dhanapat Rai and Sons.
3. Yunus A. Cengel and Boles, “Engineering Thermodynamics”, Tata McGraw-Hill Publishing Co. Ltd.
4. Book II - Energy Efficiency in Thermal Utilities; Bureau of Energy Efficiency.
5. Book IV - Energy Performance Assessment for Equipment & Utility Systems; Bureau of Energy Efficiency.
6. Edited by J. B. Kitto & S C Stultz, “Steam: Its Generation and Use”, The Babcock and Wilcox Company.
7. P. Chatopadhyay, “Boiler Operation Engineering: Questions and Answers”, Tata McGraw Hill Education Pvt Ltd, N Delhi.

MTTH-118	ADVANCED INTERNAL COMBUSTION ENGINES LAB							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical Marks	Total	Time (Hrs.)
-	-	4	2	-	40	60	100	3
Objective	To make the students aware of petrol and diesel engines along-with multi fuels based engines using different experiments.							
Course Outcomes								
CO 1	Ability to analyze the performance curves of SI and CI engines.							
CO 2	Ability to determine the exhaust emissions from engines using gas analyzer.							
CO 3	To understand the Wankel engine, bomb calorimeter.							
CO 4	To perform test on reciprocating air compressor unit.							
CO 5	Ability to analyze smoke emissions through smoke meter.							

List of Experiments

1. To analyze the performance of single cylinder VCR Engine [Computerised],
2. To evaluate the Performance of Reciprocating Air-Compressor unit.
3. To analyze the Valve / Port Timing Diagrams of IC engines.
4. To study the sectional light weight models of IC Engine, injection system and carburetor, sectional working model for 4 stroke petrol engine.
5. Study of sectional light weight models of IC Engine, injection system and carburetor, sectional working model for 2 stroke petrol engine.
6. To study sectional working model for four stroke cycle diesel engine.
7. To study Wankel engine model.
8. To analyze the smoke emissions of microprocessor based Smoke meter.
9. To analyze the various exhaust gases of IC Engines through five gas analyzer.
10. To study hydraulic dynamometer.
11. To analyze the performance of four Cylinder 4 stroke Multi-fuel diesel Engine [Computerised].

Note: Total eight experiments are to be performed selecting at least six from the above list.

MTTH-120	COMPUTATIONAL FLUID DYNAMICS LAB							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical Marks**	**Total**	**Time (Hrs.)**
-	-	4	2	-	40	60	100	3
Objective	**To acquaint the students with fundamentals of programming of 1 D and 2 D heat transfer and fluid flow problems using finite differencing.**							
Course Outcomes								
CO 1	**Develop an understanding of the difference between dimensional and non-dimensional programming techniques.**							
CO 2	**Understanding of fundamentals of programming of heat transfer in pin fin problems.**							
CO 3	**Understanding of fundamentals of programming of fluid flow problems.**							
CO 4	**Understanding of fundamentals of programming of steady and transient heat conduction problems.**							

List of Experiments

1. To make and validate a computer programme for the one dimensional pin fin steady state heat conduction when fin is insulated at tip.
2. To make and validate a computer programme for the one dimensional pin fin steady state heat conduction when fin is losing heat at tip.
3. To make and validate a computer programme for the one dimensional transient heat conduction.
4. To make and validate a computer programme for the plate in two dimensions in steady state conduction.
5. To make and validate a computer programme for the plate in two dimensions in transient state.
6. To make and validate a computer programme for the comparison of explicit, implicit, semi- implicit method of computation of heat transfer equation.
7. To make and validate a computer programme for the fully developed laminar flow in circular pipe.
8. To make and validate a computer programme for the Coutte flow.
9. To make a project by using MAC /SIMPLER method

Note: Total eight experiments are to be performed selecting at least six from the above list. The programs may be validated using any software.

MTTH-106	DESIGN OF SOLAR AND WIND SYSTEMS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To acquaint the students with fundamentals of solar and wind systems and devices.						
Course Outcomes							
CO 1	Students will learn about the technological status of implementation of NCES in India						
CO 2	Student should be capable to analyze various techno economical obstacles in the commercial development of NCES in India						
CO 3	Student should be capable to conceptually model and design general NCES systems and predict the long term performance.						
CO 4	Student should suggest and plan hybrid NCES solutions to conventional energy systems						

Unit-I

Fundamental of energy science and technology: energy, economy and social development, classification of energy sources, energy scenario in India.

Conventional sources of energy: Consumption trend of primary energy sources, energy-environment economy, Nuclear, Alternative energy sources.

Unit-II

Solar Radiation: Estimation, prediction & measurement, solar energy utilization, extraterrestrial and terrestrial radiations, spectral power distribution of solar radiation, solar time, and solar radiation geometry, Estimation of solar radiation on horizontal and tilted surface.

Solar Thermal Systems: Solar water heater, Solar cooker, Solar furnace, Solar dryer, Solar distillation, Solar greenhouse.

Unit-III

Solar radiation collector: Performance of Solar flat plate collectors, concentrating collectors.

Thermal storage: Sensible, latent and chemical heat storage. Solar air heaters, solar air-conditioning systems.

Unit-IV

Wind energy: Direct Energy conversion- PV, MHD.

Non-conventional Energy Technologies: Fuel cells, thermionic, thermoelectric, Biomass, biogas, hydrogen, Geothermal.

Reference/Text Books:

1. D.Y. Goswami, F. Kreith and J.F. Kreider, “Principle of Solar Engineering”, Taylor and Francis, 2000.
2. Sukhatme S.P., “Solar Energy”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1994.
3. J.F. Kreider, F. Kreith, “Solar Energy Handbook”, McGraw Hill, 1981
4. J.A. Duffie and W.A. Beckman, “Solar Engineering of Thermal Processes”, John Wiley, 1991.

MTTH-108	NUCLEAR ENGINEERING						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To understand Nuclear Reactor: inside processes, energy release, criticality, types, dimensions, materials, control, behavior, heat removal, safety, radiation protection, isotopes.						

Course Outcomes	
CO 1	Student will understand the basic concepts and processes taking place inside a nuclear reactor, such as nuclear fission, neutron production, scattering, diffusion, slowing down and absorption.
CO 2	Student will also be familiar with concepts of energy release, reactor criticality, the relationship between the dimension and fissile material concentration in a critical geometry.
CO 3	Student will also be familiar with Time dependent (transient) behavior of power reactor in non-steady state operation and the means to control the reactor & types of nuclear reactors.
CO 4	Student will also be familiar with concepts of heat removal from reactor core, reactor safety and radiation protection. Applications of radio-isotopes.

UNIT-I

Concepts of Nuclear Physics: The atom, structure, the nucleus, nuclear structure, atomic transmutation of elements, detection of radio-activity, particle accelerator, decay, natural of elements, nucleus interactions, decay rates, half-life, transuranic elements, Radioactivity, nuclear reactions, cross sections, nuclear fission, power from fission, conversion and breeding.

Neutron transport and diffusion: Neutron transport equation, diffusion theory approximation, Fick's law, solutions to diffusion equation for point source, planar source, etc., energy loss in elastic collisions, neutron slowing down.

UNIT-II

Energy Release: Mass energy equivalence, mass defect, binding energy, energy release in fission & fusion, thermonuclear reaction, fusion bomb.

Multi-group, multi-region diffusion equation, concept of criticality: Solution of multigroup diffusion equations in one region and multi-region reactors, concept of criticality of thermal reactors, Reactor Materials Fissile & fertile materials, cladding & shielding materials, moderators, coolants.

UNIT-III

Reactor kinetics and control: Basic principles, fuel assembly, Neutron balance, Reactor kinetics, Derivation of point kinetics equations, in-hour equation, Solutions for simple cases of reactivity additions, Excess reactivity, Reactivity control, Reactor stability, Fission product poison or Xenon poisoning, Reactivity coefficients, Burnable absorbers.

Nuclear Reactors: Types of nuclear reactors, pressurized water reactors, boiling water reactors, CANDU type reactors, gas cooled & liquid metal cooled reactors, fast breeder reactors.

UNIT-IV

Heat removal from reactor core: Solution of heat transfer equation in reactor core, temperature distribution, critical heat flux, heat balance, production & transfer of heat to the coolant, structural considerations.

Reactor safety, radiation protection: Reactor safety philosophy, defense in depth, units of radioactivity exposure, radiation protection standards, Waste Disposal Hazards, plant site selection, safety measures incorporated in; plant design, accident control, disposal of nuclear waste, Health Physics & Radio-isotopes Radiation: units, hazards, prevention, preparation of radio-isotopes & their use in medicine, agriculture & industry.

Reference/Text Books:

1. M.M. El-Wakel, 'Nuclear Power Engineering". McGraw-Hill Inc., US
2. John R Lamarsh, "Introduction to nuclear engineering", Pearson Publication
3. J.J. Duderstadt, L. J. Hamilton, "Nuclear reactor analysis" Wiley publication

MTTH-110	CONVECTIVE HEAT TRANSFER						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To impart an in depth knowledge about the fundamentals and applications of the convective heat transfer.						
Course Outcomes							
CO 1	Students will be able to differentiate between laminar forced convection external and internal flows.						
CO 2	Students will develop an understanding of boundary layer flow in external and internal natural convection.						
CO 3	Students will be able to analyze the turbulent boundary layer and duct flows.						
CO 4	Students will understand the mechanism of phase change and convection in porous media.						

UNIT-I

Fundamental Principles: Continuity, momentum and energy equations, Second law of thermodynamics, Rules of Scale analysis, Concept of Heat line visualization.

Laminar Forced Convection-External Flows: Boundary layer concept, velocity and thermal boundary layers, governing equations, similarity solutions, various wall heating conditions, Flow past a wedge and stagnation flow, blowing and suction, entropy generation minimization, heat lines in laminar boundary layer flow.

Laminar Forced Convection-Internal Flows: Fully developed laminar flow, heat transfer to fully developed duct flow, constant heat flux and constant wall temperature, heat transfer to developing flow, heat lines in fully developed duct flow. .

UNIT-II

External Natural Convection: Boundary layer equations, Scale analysis, Low and high Prandtl number fluids, integral solution, similarity solution, uniform heat wall flux, conjugate boundary layers, vertical channel flow, combined natural and forced convection, vertical walls, horizontal walls, inclined walls, horizontal and vertical cylinder, sphere.

Internal Natural Convection: transient heating from side, boundary layer regime, isothermal and constant heat flux side walls, partially divided and triangular enclosures, and enclosures heated from below, inclined enclosures, annular space between horizontal cylinders and concentric spheres.

.UNIT-III

Transition to Turbulence: empirical transition data, scaling laws of transition, buckling of inviscid streams, instability of inviscid flow.

Turbulent Boundary Layer Flow: Boundary layer equations, mixing length model, velocity distribution, heat transfer in boundary layer flow, flow over single cylinder, cross flow over array of cylinders, Natural convection along vertical walls.

Turbulent duct flow: velocity distribution, friction factor and pressure drop, heat transfer coefficient, isothermal wall, uniform wall heating, heat lines in turbulent flow near a wall, optimal channel spacing.

UNIT-IV

Convection with Change of Phase: Condensation, laminar and turbulent film on a vertical surface, film condensation, drop condensation, Boiling, pool boiling regimes, nucleate boiling, film boiling and flow boiling, contact melting and lubrication, melting by natural convection.

Convection in Porous Media: Mass conservation, Darcy and Forchheimer flow models, enclosed porous media heated from side, penetrative convection, enclosed porous media heated from below.

Reference/Text Books:

1. A. Bejan, "Convection Heat Transfer", Wiley Publications.
2. Louis C. Burmeister, "Convective Heat Transfer", Wiley Publications.
3. W.M. Kays and M.E. Crawford, "Convective Heat and Mass Transfer", McGraw Hill.

MTTH-112	COMPUTATIONAL FLUID DYNAMICS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To familiarize the students with the basic concepts of Computational Fluid Dynamics and problem solving approach using CFD.						

Course Outcomes	
CO 1	After completion of the course students will be able to model the basic equations which govern the fluid flow and heat transfer phenomena and analyze their mathematical behaviour.
CO 2	The students will understand the basic concepts of discretization and error analysis. Also develop the understanding of some simple CFD techniques.
CO 3	The students will be able to analyze the steady and unsteady heat conduction & combined conduction diffusion problems using control volume formulation.
CO 4	The students will be able to apply CFD to actual fluid flow problems.

UNIT-I

Introduction: Introduction to C.F.D., comparison of the three basic approaches in engineering problem solving-analytical, experimental and computational; models of the flow, substantial derivative, governing equations – continuity equation, momentum equation, energy equation, Navier-Stokes equation; physical boundary conditions.

Mathematical behavior of governing equations: classification of quasi linear partial differential equations, general method of determining the classification of partial differential equations, general behavior of hyperbolic, parabolic, elliptic equations.

UNIT-II

Discretization: Introduction, finite difference method, difference equations, explicit and implicit approaches, error and stability analysis, Practical aspects of computational modeling of flow domains, Grid Generation, Types of mesh and selection criteria, Mesh quality, Key parameters and their importance.

UNIT-III

Heat Conduction: control volume formulation of one-dimensional steady state diffusion, unsteady one-dimensional diffusion, two and three dimensional diffusion problems, over and under relaxation.

Convection & Diffusion: Steady one-dimensional convection and diffusion, central differencing scheme, upwind differencing scheme, exact solution, exponential, hybrid, and power law schemes, discretization equations for two dimensions & three dimensions.

UNIT-IV

Simple CFD Techniques: Lax-Wendroff technique, MacCormack's technique, space marching, relaxation technique, pressure correction technique, SIMPLE algorithm.

Fluid Flow: CFD solution of subsonic-supersonic isentropic nozzle flow, solution of incompressible Couette flow problem by F.D.M., solution of Navier-Stokes equations for incompressible flows using MAC and SIMPLE methods.

Reference/Text Books:

1. Suhas V. Patankar, "Numerical Heat Transfer and Fluid Flow", CRC Press (Reprint 2017).
2. John D.Anderson, Jr, "Computational fluid dynamics", McGraw Hill Education, 1 July, 2017.
3. H. Versteeg & W. Malalasekra, "An Introduction to Computational Fluid Dynamics", Pearson; 2 edition (2008).
4. Atul Sharma, "An Introduction to CFD: Development, Application & Analysis", Ane/Athena Books, Wiley, November, 2016.
5. K. Muralidhar & T. Sundararajan, "Computational Fluid Flow & Heat Transfer", Alpha Science Intl Ltd.
6. Anil W. Date, "Introduction to Computational fluid dynamics" Cambridge University Press, August, 2005.
7. J.C. Tannehill, D. A. Anderson and R.H. Pletcher, "Computational Fluid Dynamics", CRC Press; 3rd edition (April 15, 2011).
8. J. Blazek, "Computational Fluid Dynamics: Principles and Applications", Elsevier Science & Technology, 2001.
9. T.J. Chung, "Computational Fluid Dynamics", Cambridge University Press (7 February 2002).

MTTH-114	DESIGN OF HEAT TRANSFER EQUIPMENTS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To familiarize the students with different types of heat exchangers used in industries and their design parameters.						
Course Outcomes							
CO 1	Students will demonstrate a basic understanding of several types of heat exchangers that will include shell-and-tube, double pipe, plate-and-frame, finned tube, and plate-fin heat exchangers, Heat pipes.						
CO 2	Students will design and analyses of shell-and-tube double pipe, compact, plate heat exchangers.						
CO 3	Students will demonstrate the performance degradation of heat exchangers subject to fouling.						

Unit-I

Heat Exchangers – Classification according to transfer process, number of fluids, surface compactness, and construction features. Tubular heat exchanger, plate type heat exchangers, extended surface heat exchangers, heat pipe, Regenerators. Classification according to flow arrangement: counter flow, parallel flow, cross flow exchanger.

Heat exchanger design methodology- assumption for heat transfer analysis, problem formulation, e-NTU method, *P*-NTU method, Mean temperature difference method, fouling of heat exchanger, effects of fouling, categories of fouling, fundamental processes of fouling.

Unit-II

Double Pipe Heat Exchangers: Thermal and Hydraulic design of inner tube, Thermal and hydraulic analysis of Annulus, Total pressure drop.

Compact Heat Exchangers: Thermal and Hydraulic design of compact heat exchanger Shell and Tube heat exchangers – Tinker's, kern's, and Bell Delaware's methods, for thermal and hydraulic design of Shell and Tube heat exchangers.

Unit-III

Heat Exchanger Pressure Drop Analysis: Importance of Pressure Drop, Devices, Extended Surface Heat Exchanger Pressure Drop, Tubular Heat Exchanger Pressure Drop, Tube Banks, Shell-and-Tube Exchangers, Plate Heat Exchanger Pressure Drop, Pipe Losses, Non-dimensional Presentation of Pressure Drop Data

Heat Transfer Characteristics: Dimensionless Surface Characteristics, Experimental Techniques for Determining Surface Characteristics, Steady-State Kays and London Technique, Wilson Plot Technique, Transient Test Techniques, Friction Factor Determination, Hydrodynamic ally Developing Flows, Thermally Developing Flows, Extended Reynolds Analogy, Heat Exchanger Surface Geometrical Characteristics, Selection of Heat Exchangers and Their Components, Temperature Difference Distributions

Unit-IV

Mechanical Design of Heat Exchangers – Design standards and codes, key terms in heat exchanger design, material selection, and thickness calculation for major components such as tube sheet, shell, tubes, flanges and nozzles. Introduction to simulation and optimization of heat exchangers, flow induced vibrations.

Hair-Pin Heat Exchangers: Introduction to Counter-flow Double-pipe or Hair-Pin heat exchangers, Industrial versions of the same, Film coefficients in tubes and annuli, Pressure drop, Augmentation of performance of hair-pin heat exchangers, Series and Series-Parallel arrangements of hair-pin heat exchangers, Comprehensive Design Algorithm for hair-pin heat exchangers, Numerical Problems.

Reference/Text Books:

1. Shah and Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design" John Wiley & sons Inc., 2003.
2. D.C. Kern, "Process Heat Transfer", McGraw Hill, 1950.
3. Sadik Kakac and Hongton Liu, "Heat Exchangers: Selection, Rating and Thermal Design" CRC Press, 1998.
4. A .P. Frass and M.N. Ozisik, "Heat Exchanger Design", McGraw Hill, 1984
5. Afgan N. and Schlinder E.V. "Heat Exchanger Design and Theory Source Book".
6. T. Kuppan, "Hand Book of Heat Exchanger Design".
7. "T.E.M.A. Standard", New York, 1999.

8.G. Walkers, "Industrial Heat Exchangers-A Basic Guide", McGraw Hill, 1982.

MTTH-116	COMPRESSIBLE FLOW MACHINES						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3**
Objective	**Students can able to understand the various fluid devices like turbine, compressors, pumps etc. Also to understand the concepts of shock waves and their properties.**						
Course Outcomes							
CO 1	**Enable the students to understand the basic concepts of fluid machines. Also to learn the concepts of various turbines along with their general equations of power developed.**						
CO 2	**Students will able to understand the various types of pumps along with their advantages, disadvantages and applications.**						
CO 3	**Students will study the various compressors and diffusers. Also to learn the various terms and parts related to these devices.**						
CO 4	**Enable the students to understand the basic concepts of shock waves. Also to learn the various types of shock waves through various equations.**						
CO 5	**Enable the students to understand the basic concepts of fluid machines. Also to learn the concepts of various turbines along with their general equations of power developed.**						

UNIT-I

Introduction*:* Introduction to Fluid Machines, Energy Transfer in Fluid Machines, Energy Transfer-impulse and Reaction Machines, efficiencies of Fluid Machines, Principles of Similarity in Fluid Machines, Concept of Specific Speed and introduction to Impulse Hydraulic Turbine.

Turbines: Analysis of Force on the Bucket of Pelton wheel and Power Generation, Specific Speed, Governing and Limitation of a Pelton Turbine, Introduction to reaction Type of Hydraulic Turbine- A Francis Turbine, Analysis of Force on Francis Runner and Power Generation, Axial Flow machine and Draft Tube, Governing of Reaction Turbine.

UNIT-II

Pumps: Introduction to Rotodynamic Pumps, Flow and Energy Transfer in a Centrifugal Pump, Characteristics of a Centrifugal Pump, Matching of Pump and System Characteristics, Diffuser and Cavitation, Axial Flow Pump, Reciprocating Pump.

UNIT-III

Compressors: Centrifugal and Axial Flow Compressor, their characteristics.

Flow through Diffusers: Classification of diffusers, internal compression subsonic diffusers, velocity gradient, effect of friction and area change, the conical internal-compression Subsonic diffusers, external compression subsonic diffusers, supersonic diffusers, Normal shock supersonic diffusers, the converging diverging supersonic diffusers.

UNIT-IV

Shock wave: Introduction to Compressible Flow, Thermodynamic Relations and Speed of Sound, Disturbance propagation, Stagnation and Sonic Properties, Effects of Area variation on Properties in an Isentropic Flow, choking in a Converging nozzle, Isentropic Flow Through Convergent-Divergent Duct, Normal Shock, Oblique Shock**,** Introduction to Expansion Wave and Prandtl Meyer Flow**.**

Reference/Text Books:

1. S. M. Yahya, "Fundamentals of Compressible Flow", New Age International.
2. S.M. Yahya, "Turbines, Compressors and Fans", Tata McGraw Hill.
3. P.H. Oosthvizen and W.E. Carscallen, "Compressible Fluid Flow", McGraw Hill.

MTTH-201	ADVANCED COMPUTATIONAL FLUID DYNAMICS						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	-	-	3	60	40	100	3
Objective	To familiarize the students with the advanced concepts of Computational Fluid Dynamics.						
Course Outcomes							
CO 1	Develop the understanding of the modeling of turbulence and its effects.						
CO 2	Analyze the convection diffusion problems and develop algorithms for pressure velocity coupling in steady flows and unsteady flows.						
CO 3	Develop skills to implement and handle boundary conditions; errors and uncertainty; and complex geometries.						
CO 4	Able to model the combustion phenomenon and radiative heat transfer using CFD.						

UNIT-I

Introduction: Revision of pre-requisite courses, finite differences and finite volume methods.
Turbulence and its modeling: transition from laminar to turbulent flow, descriptors of turbulent flow, characteristics of turbulent flow, effect of turbulent fluctuations on mean flow, turbulent flow calculations, turbulence modeling, Large eddy simulation, Direct Numerical Simulation.

UNIT-II

Finite volume method for convection-diffusion problems: Steady 1-D convection-diffusion, Conservativeness, Boundedness and Transportiveness, Central, Upwind, Hybrid and Power law schemes, QUICK and TVD schemes.
Pressure - velocity coupling in steady flows: Staggered grid, SIMPLE algorithm, Assembly of a complete method, SIMPLER, SIMPLEC and PISO algorithms, Worked examples of the above algorithms.
Finite volume method for unsteady flows: 1-D unsteady heat conduction, Explicit, Crank-Nicolson and fully implicit schemes, Transient problems with QUICK, SIMPLE schemes.

.UNIT-III

Implementation of boundary conditions: Inlet, Outlet, and Wall boundary conditions, Pressure boundary condition, Cyclic or Symmetric boundary condition.
Errors and uncertainty in CFD modeling: Errors and uncertainty in CFD, Numerical errors, Input uncertainty, Physical model uncertainty, Verification and validation, Guide lines for best practices in CFD, Reporting and documentation of CFD results.
Methods for Dealing with complex geometries: Introduction, body-fitted co-ordinate grids, curvilinear grids, block structured and unstructured grids, discretization in unstructured grids, diffusion and convective term, treatment of source term, assembly of discretized equations, pressure-velocity coupling, extension of face velocity interpolation method to unstructured meshes.

UNIT-IV

CFD modeling of combustion: Enthalpy of formation, Stoichiometry, Equivalence ratio, Adiabatic flame temperature, Equilibrium and dissociation, governing equations of combusting flows, modeling of a laminar diffusion flame, SCRC model for turbulent combustion, probability density function approach, eddy break up model.
CFD for radiation heat transfer: Governing equations for radiation heat transfer, popular radiation calculation techniques using CFD, The Monte Carlo method, the discrete transfer method, Ray tracing, the discrete ordinates method.

Reference/Text Books:

1. H. Versteeg & W. Malalasekra, “An Introduction to Computational Fluid Dynamics”, Pearson; 2 edition (2008)
2. Suhas V. Patankar, “Numerical Heat Transfer and Fluid Flow”, CRC Press (Reprint 2017).
3. J.C. Tannehill, D. A. Anderson and R.H. Pletcher, “Computational Fluid Dynamics”, CRC Press; 3rd edition (April 15, 2011).
4. J. Blazek, “Computational Fluid Dynamics: Principles and Applications”, Elsevier Science & Technology, 2001.

5. T.J. Chung, “Computational Fluid Dynamics”, Cambridge University Press (7 February 2002).

MTTH-203	**FINITE ELEMENT METHODS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3**
Objective	**To acquaint the students with fundamentals and various methods for solving the finite element problems. Also FDM, convergence and stability of FD scheme.**						
Course Outcomes							
CO 1	**Students will be able to understand the basic steps in FEM formulation. Also to study various concepts associated and assembly along with the boundary conditions in FEM formulation.**						
CO 2	**Students will be able to understand how FEM problem is formulated in 1-D elements. Also to discuss shape functions, h and p approximations; and various solvers associated in FEM.**						
CO 3	**Students will study FEM formulation of 2-D element using various methods like Galerkin approach, Weighted Residual etc. Also to understand the natural co-ordinates, numerical integration and various other concepts related to 2-D FEM formulation.**						
CO 4	**Students will be able to understand the axi-symmetric problems along with plane stress and plane strain problems with regards to solid mechanics. Also to discuss various elements of FEM, FEM with CI continuity and FDM problems.**						

UNIT-I

Basic Steps in FEM Formulation, General Applicability of the Method; Variational Functional, Ritz Method.
Variational FEM: Derivation of Elemental Equations, Assembly, Imposition of Boundary Conditions, Solution of the Equations.

UNIT-II

1-D Elements, Basis Functions and Shape Functions, Convergence Criteria, h and p Approximations. Natural Coordinates, Numerical Integration, Gauss Elimination based Solvers. Computer implementation: Pre-processor, Processor, Post-processor.

UNIT-III

Alternate Formulation: Weighted Residual Method, Galerkin Method; Problems with C1 Continuity: Beam Bending, Connectivity and Assembly of C1 Continuity Elements.
Variational Functional; 2-D Elements (Triangles and Quadrilaterals) and Shape Functions. Natural Coordinates, Numerical Integration, Elemental Equations, .Connectivity and Assembly, Imposition of Boundary Conditions.

UNIT-IV

Axisymmetric (Heat Conduction) Problem, Plane Strain and Plane Stress Solid Mechanics Problems. Sub-parametric, Iso-parametric and Super-parametric Elements; Elements with C1 Continuity. Free Vibration Problems, Formulation of Eigen Value Problem, FEM Formulation. Time-dependent Problems, Combination of Galerkin FEM and FDM (Finite Difference Method), Convergence and Stability of FD Scheme.

Reference/Text Books:

1. C. S. Krishnamoorty, “Finite element analysis”, Tata McGraw Hill
2. J. N Reddy, “An introduction to Finite element method”, Tata Mc. Graw Hill
3. Y. M. Desai, “Finite Element Method with applications in engineering”, Pearson Education India
4. Ted Belytschko, W.K. Liu and Brian Moran, “Nonlinear Finite Elements for Continua and Structures (Paperback)” Wiley-Blackwell (16 August 2000)
5. Guido Dhondt, “The Finite Element Method for Three-Dimensional Thermomechanical Applications”, Wiley; 1 edition (June 18, 2004).

6. Claes Johnson, "Numerical Solution of Partial Differential Equations by the Finite Element Method", Dover Publications (January 15, 2009).

MTTH-205	THERMAL MODELING AND ANALYSIS						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**-**	**-**	**3**	**60**	**40**	**100**	**3**
Objective	**This course provides the mathematical modelling and analysis for designing the thermal systems. Also students can able to understand the dynamic behaviour of thermal systems.**						
Course Outcomes							
CO 1	**Enable the students to understand the basic concepts for designing the thermal systems. Also to discuss mathematical modelling of thermal systems using computer programmes.**						
CO 2	**Equip the students for modelling the thermal systems like heat exchangers, evaporators, condensers etc. Also to understand their solution procedures.**						
CO 3	**Understand the concepts of optimization and its various methods for solving the thermal problems. Also to study geometric, linear and dynamic programming.**						
CO 4	**Learn the dynamic behaviour of thermal systems. Also to learn stability analysis and non-linearity.**						
CO 5	**Enable the students to understand the basic concepts for designing the thermal systems. Also to discuss mathematical modelling of thermal systems using computer programmes.**						

UNIT-I

Design of Thermal System: Design Principles, Workable systems, Optimal systems, Matching of system components, Economic analysis, Depreciation, Gradient present worth factor.

Mathematical Modeling: Equation fitting, Empirical equation, Regression analysis, Different modes of mathematical models, Selection, Computer programmes for models.

UNIT-II

Modeling Thermal Equipments: Modeling heat exchangers, Evaporators, Condensers, Absorption and rectification columns, Compressor, Pumps, Simulation studies, Information flow diagram, Solution procedures.

UNIT-III

Systems Optimization: Objective function formulation, Constraint equations, Mathematical formulation, Calculus method, Dynamic programming, Geometric programming, Linear programming methods, Solution procedures.

UNIT-IV

Dynamic Behavior of Thermal System: Steady state simulation, Laplace transformation, Feedback control loops, Stability analysis, Non-linearties

Reference/Text Books:.

1. Hodge, B.K. and Taylor, R. P., "Analysis and Design of Energy Systems", Prentice Hall (1999).
2. Bejan, A., Tsatsaronis, G. and Michel, M., "Thermal Design and Optimization", John Wiley and Sons (1996).
3. Jaluria, Y., "Design and Optimization of Thermal Systems", McGraw-Hill (1998).
4. Jaluria, Y., "Design and Optimization of Thermal Systems", CRC Press (2008).
5. Ishigai S., "Steam Power Engineering Thermal and Hydraulic Design Principle", Cambridge University Press (1999).

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development*.						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	0	-	100	100	3 Hrs.
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yog asan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; Shrimad Bhagwad Geeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; Shrimad Bhagwad Geeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; Shrimad Bhagwad Geeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

MTTH-207	DISSERTATION PART – I							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical Marks**	**Total**	**Time (Hrs.)**
0	**0**	**20**	**10**	**-**	**100**	**-**	**100**	**-**
Objective	The main objective of this course is to plan a research work (which includes the problem formulation/literature review, proposed objectives, proposed methodologies and references) in the field of Industrial and Production Engineering or interrelated fields of applications.							
Course Outcomes								
CO 1	Students will be exposed to various self-learning topics.							
CO 2	Students will be exposed to an exhaustive survey of the literature such as books, national/international refereed journals, resource persons and industrial surveys for the selection/ identification of engineering/research problem.							
CO 3	Students will be able to set the research objectives of the identified engineering/research problem.							
CO 4	Students will learn modern tools/techniques related to the identified engineering/research problem for the solution and able to learn technical report writing skills.							
CO 5	Students will develop oral and written communication skills to present and defend their work in front of technically qualified audience.							

The students will start their research work in third semester with a research problem having research potential involving scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his/her supervisor and the topic of dissertation must be mutually decided by the supervisor and student.

The students will be required to submit a progress report related to their dissertation work by the end of September. The progress report will cover the following:

- The goal set for the period.
- Research papers studied.
- Methodology used in achieving the goal.
- The extent of fulfillment of the goal.

The progress report must be at least of 3-4 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, period of progress report, signature of candidate and supervisor.

The students will be required to appear for comprehensive Seminar & Viva-voce and submit a synopsis report based on their progress related to the dissertation as per the presentation date mentioned in the academic calendar for the session. The synopsis report will be submitted in the same format as that of the thesis and will contain the following:

1. Introduction
2. Literature Survey
3. Gaps in Literature
4. Objectives of the Proposed Work
5. Methodology
6. References

*** Student will choose (be offered) his/her guide in the end of second semester.**

MTTH-202	DISSERTATION PART -II							
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Practical	Total	Time (Hrs.)
0	0	32	16	-	100	200	300	-

Objective	The main objective of the course is to make the students able to do some good research in the field of their interests related to Industrial and Production Engineering or interrelated fields of applications.
Course Outcomes	
CO 1	Students will be able to design solutions for engineering problems that meet the specified needs with appropriate considerations.
CO 2	Students will be able to conduct investigations of engineering problems using research-based knowledge and experimental/research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
CO 3	Students will be able to apply resources and modern engineering tools and techniques with an understanding of the limitations.
CO 4	Students will be able to either work in a research environment or in an industrial environment.
CO 5	Students will be conversant with technical report writing, professional ethics, responsibilities and norms of the engineering practice.
CO 6	Students will be able to present and convince their topic of study to the engineering community.

The students are required to continue Analytical/Experimental/Computational/Industrial Problems or Case studies investigations in the field of Industrial and Production Engineering or other related fields which have been finalized in the third semester. They would be working under the supervision of a faculty member.

The students will be required to submit a progress report duly signed by their respective supervisors to the department, related to their dissertation work in the last week of March. The progress report will cover the following:

- The goal set for the period.
- Research papers studied.
- Methodology used in achieving the goal.
- The extent of fulfillment of the goal.
- References

The progress report must be of at least of 3-4 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, period of progress report, signature of candidate and supervisor.

The candidate has to prepare a detailed dissertation report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up/numerical details/industrial case study etc. as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study.

The final dissertation will be submitted in the end of semester as per academic calendar for the session, which will be evaluated by internal as well as external examiners based upon his/her research work. At least one publication is expected before final submission of the dissertation from every student in peer reviewed referred journals or reputed conference from the work done by them in their dissertation. The dissertation should be presented in standard format as provided by the department.

The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a supervisor, co- supervisor etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his supervisor.

B.A Final
English Compulsory
For DDE/Private Candidates
Session 2019-20

Scheme of Examination **Total Marks: 100**

Theory : 80
Internal Assessment : 20
Time : 3 hrs.

Prescribed Texts:

1. *Kanthapura & Art Exercise in Language Use* edited by Umed Singh, Pankaj Sharma, Deepti Dharmani
2. *The Merchant of Venice and Developing Compositions* by Deepti Dharmani, Pankaj Sharma, Umed Singh

Instructions for Paper-setter and Students

Note: All questions are compulsory.

1. Explanation of two extracts out of the two texts (with internal choice) with reference to the context. 5x2=10
2. Short answer-type questions: Students will be required to answer any five questions out of the given eight based on the prescribed texts. 2x5=10
3. Based on the prescribed texts, a candidate is required to attempt two long answer-type questions out of the given two (with internal choice) 5x2=10
   The questions will be designed to test the candidate's critical understanding of the texts.
4. Students are required to write a business/official letter out of the given two. 10
5. Students are required to write a precis of the given passage of about 300 words. 8

6 a) Students will be required to write one word substitutions of any five expressions out of the given eight. 2x5=10

b) Students will be required to attempt two questions on Email/Memo/Circular/RTI out of the given four topics. The questions intend to test the understanding of the basic modes of communication. 2x5=10

c) Students will be required to transcribe and mark the primary stress on any five out of the given eight 1x5=05

(For blind students only)

There will be 10 idioms/ pairs of words out of which a candidate will be required to attempt any five.

D) Students will be required to identify and transform any seven sentences (From one type to another, i.e., simple, compound and complex) out of the given ten. 7x1=7

B. A. I
English (Additional)
Semester-I
Session 2019-20

Scheme of Examination **Total Marks: 100**

Theory : 80
Internal Assessment : 20
Time : 3 hrs.

Section A

Prescribed Texts:

1. *Let's Go Home and other Stories* by Meenakshi Mukherjee.
2. *A Remedial English Grammar for Foreign Students* by F.T. Wood (Chapters 1 to 16)

Section **B**

Essay writing (both descriptive and reflective type)

Instructions for Paper-setter and Students

1. Explanation with reference to the context. The students will be required to attempt one passage (with internal choice) from the prescribed book of prose. 10

2. One Comprehension question (with internal choice) based on a passage from the prescribed book of prose. 10

3. Short-answer type questions based on the book of prose (*four* questions to be attempted out of the given *seven*). 10

4. One essay-type question (with internal choice) from the prescribed book of prose. 10

5. An Essay on any one of the *five* given topics in about 400 words. 10

6. Letter/Application 10

7. The students will be required to attempt twenty out of the given thirty items based on the examples/exercises given in the prescribed book of grammar. 20

B.A. I
English (Additional)
Semester-II
Session 2019-20

Scheme of Examination **Total Marks: 100**

Theory : 80
Internal Assessment : 20
Time : 3 hrs.

Section A

Prescribed Texts:

1. *Selected College Poems* by Ambika Sen Gupta.
2. *A Remedial English Grammar for Foreign Students by* F.T. Wood (Chapters 17 to 37)

Section B

Precis Writing

Instructions for Paper-setter and Students

1. Explanation with reference to the context. The students will be required to attempt one passage (with internal choice) from the prescribed book of poems. 10

2. One Comprehension question (with internal choice) based on a passage from the prescribed book of poems. 10

3. Short-answer type questions on the book of poems (*four* questions to be attempt out of the given *seven*) 10

4. One question on theme, story, summary etc. on the prescribed book of poems. (with internal choice). 10

5. Precis of a given passage in about 200 words. 10

6. One comprehension question (with internal choice) based on an unseen passage. 10

7. The students will be required to attempt twenty out of the given *thirty* items based on the examples/exercises given in the prescribed book of grammar. 20

INDEX

(TOTAL : 92 PAGES).

KURUKSHETRA UNIVERSITY, KURUKSHETRA
SCHEME OF EXAMINATION AND SYLLABUS FOR B.ED. TWO YEAQR REGULAR COURSES TO BE IMPLEMENTED FROM THE SESSION 2015-16

Year - 1								
Paper	Nomenclature	Maximum Marks			Periods per week**	Exam Hour	Hours per Year	Credits
		Total	External	Internal/ Practicum				
Course-1	Childhood and Growing Up	100	80	20	6	3 hrs	137-6	10
Course-2	Contemporary India and Education	100	80	20	6	3 hrs	137.6	10
Course-3	Learning and Teaching	100	80	20	6	3 hrs	137.6	10
Course-4 (A)	Language across Curriculum	50	40	10	3	1:30 hrs	68.8	5
(B)	Understanding , Disciplines and Subjects	50	40	10	3	1:30 hrs	68.8	5
Course-5	Gender, School and Society	50	40	10	3	1:30 hrs	68.8	5
Course-6	Pedagogy of a School Subjects-I	100	80	20	6	3 hrs	137.6	10
Course-7	Pedagogy of a School Subjects-I	100	80	20	6	3 hrs	137.6	10
Course EPC 1	Reading and Reflecting on Text	50	40	10	3	1:30 hrs	68.8	5
Course EPC 2	Drama and Art in Education	50	40	10	3	1:30 hrs	68.8	5
	School Internship							
	Total	750	600	150				75

* **Engagement with the field: Tasks and assignment for Courses 1-7.**
** **One period is of 45 minutes**

Year - 2								
Paper	**Nomenclature**	**Maximum Marks**			**Periods per week****	**Exam Hour**	**Hours per Year**	**Credits**
		Total	**External**	**Internal/ Practicum**				
Course-8	Knowledge and Curriculum	100	80	20	12	3 hrs	156	10
Course-9	Assessment for Learning	100	80	20	12	3 hrs	156	10
Course-10	Creating an Inclusive School	50	40	10	6	1:30 hrs	78	5
Course-11	**Optional Course**	**(Any one of the following)**						
i	Environment Education	50	40	10	6	1:30 hrs	78	5
ii	Health and Physical Education	50	40	10	6	1:30 hrs	78	5
iii	Peace Education	50	40	10	6	1:30 hrs	78	5
iv	Guidance and Counseling	50	40	10	6	1:30 hrs	78	5
EPC-3	Critical Understanding of ICT	50	40	10	6	1:30 hrs	78	5
EPC-4	Understanding the Self	50	40	10	6	1:30 hrs	78	5
	*** School Internship	250	200	50				25
	Total	650	520	130				65

* **Engagement with the field: Tasks and assignment for Courses 1-7.**

** **One period is of 45 minutes**

Course 1

CHILDHOOD AND GROWING UP

Max. Marks: 100

Time: 3 Hours **(Theory: 80, Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**

ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.**

iii. **Two long answer type questions will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale:

The course on "Childhood and Growing Up" offers an introduction to the study of childhood, child development and adolescence from diverse socio-economic and cultural backgrounds. The main focus in the course would be to enable student teachers to arrive at an understanding of how different socio-political realities construct different childhoods within children's lived context: family, schools and community**.**

Learning Outcomes

After transaction of the course, student teachers will be able to:

- Explain the concept of growth & development in relation to characteristics of various stages of growth & development.
- Become familiar with theories of child development and their educational implications.
- Understand the role of family, school, society in child development.
- Describe the role of contemporary issues (issue of marginalization: class, poverty, gender, issues of urbanization and economic change) in child development.
- Describe the role of media in deconstruction of significant events.

Existing	Corrected
Unit-I **1. Child Development** • Growth & Development:- Concept, Principle, Factors, & Stages. • Characteristics of stages of development with special reference to Childhood and Adolescence. • Adolescents: Understanding their needs and Problems in Indian context. **Unit-II** **2. Theories of Child Development** • Theory of Cognitive Development by Piaget: Concept, Stages and Implications with special reference to Indian Context.	**Unit-I** **1. Child Development** • Growth & Development:- Concept, Principle, Factors, & Stages. • Characteristics of stages of development with special reference to Childhood and Adolescence. • Adolescents: Understanding their needs and Problems in Indian context. **Unit-II** **2. Theories of Child Development** • Theory of Cognitive Development by Piaget: Concept, Stages and Implications with special reference to Indian Context.

• Theory of Social & Emotional Development by Erickson: Concept, Stages and Implications with special reference to Indian Context. • Kohlberg theory of Moral Development: Concept, Stages and Implications with special reference to Indian Context. **Unit-III** **3. Social Contexts of Development** • Agencies of Socialization: Family, School, Society and their role in Child Development. • Social and Cultural Change and their Impact on child development. • Economic Change :Impact of urbanization and Economic change on child development **Unit-IV** **4. Contemporary Issues** • Marginalization & Stereotyping with special reference to Gender, Social Class, Poverty. • Impact of marginalization & Stereotyping on child development and related outcomes. • Role of media in constructing & deconstructing perceptions & ways of dealing with above issues.	• Theory of Social & Emotional Development by Erickson: Concept, Stages and Implications with special reference to Indian Context. • Kohlberg theory of Moral Development: Concept, Stages and Implications with special reference to Indian Context. **Unit-III** **3. Social Contexts of Development** • Agencies of Socialization: Family, School, Community and their role in Child Development. • Parenting styles: Concept and its impact on Child Development. • Play: Concept, characteristics and developmental functions. • Social & Cultural Change as factors influencing Child Development. **Unit-IV** **4. Contemporary Issues** • Marginalization & Stereotyping with special reference to Gender, Social Class & Poverty. • Impact of marginalization & Stereotyping on child development and related outcomes. • Role of media in constructing & deconstructing perceptions & ways of dealing with above issues.

Practicum/ Sessionals

Any one of the following:

i. Case-study of an adolescent: Problems and Needs.
ii. Seminar/ Presentation on educational implications of One Learning theory of child development.
iii. Survey report on impact of socio-economic status of a family on child.
iv. Content Analysis of Media coverage on the following:
   a. Child labour.
   b. Gender bias.
   c. About Disability.
v. Play/drama on value orientation & character building and preparing a report.
vi. Protecting the culture and indigenous practices: Compilation of local folk songs, folk tales, riddles and toys.
vii. Observation of children during their playtime in a rural school and preparing a report .

Suggested Readings:

Aggarwal, J.C. (1995). *Essentials of Educational Psychology*, New Delhi: Vikas Publishing House Private Limited,
Allport, G.W. (1961). *Pattern and Growth in Personality*:New York.
Chauhan, S.S. (2002). *Advanced Educational Psychology*. New Delhi: Vikas Publishing
Gore, M.S.(1984). *Education and Modernization in India*. Jaipur:Rawat Publishers.

H.Havighurtst, R. et al.(1995). *Society and Education*. Baston: Allyen ad Bacon
H.P.BWheldall, K. (2006). *Developments in Educatonal psychology*. New York: Routledg
Kamat, A.R.(1985). *Education and Social Change in India*. Bombay: Samaiya Publishing Co.
Bhatia, K.K. (2008). *Basis of Educational Psychology*.Ludhiana:Kalyani Publishers.
Sharma, K.N. (1990). *Systems, Theories and Modern Trends in Psychology*.Agra:
Woolfork, A (2004). *Educational Psychology: Reason Education (Singapore)*. New Delhi: Indian Branch.

Course: 2
CONTEMPORARY INDIA AND EDUCATION

Max. Marks: 100

Time: 3 Hours **(Theory:80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale

The course on "Contemporary India and Education" shall develop a conceptual understanding about issues of diversity, inequality and marginalization in Indian society and the implication for education with analyses of significant policy debates in Indian education.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- understand emerging societal issues and their implication for education
- understand various provision concerning education in Indian Constitution.
- identify the concerns related to socially disadvantaged segments of the society.
- understand the policies on education before and after independence related to secondary education programmes.
- evaluate the govt. policies in the context of Universalisation of school education.

Course Contents

Unit – I

1. Indian Constitution and Status of Education:

- Equality of opportunities in education: Article 28, 29, 350 and 351 and their issues.
- Education and Fundamental Rights and Duties: Article 14, 15, 16, 21-A,30 and 51A.
- Directive Principles of state policies

2. Diversity in Society and Implications for Education:

- Social diversities based on Castes, Languages, Religions and Regions,.
- Status of Education of Socially disadvantaged segments namely SC, ST, OBC, Women, PWD'S and minorities.
- Right to Education Act 2009: right of children to free and compulsory education

Unit – II

3. Educational Committees and Commission before independence with special reference to:

- Maculay's minutes: Its features and recommendations
- Adam's Report: features and its recommendations.
- Woods Despatch of 1854: Recommendations Merits and demerits
- Basic Scheme of Education 1937: objective, merits and demerits ; Concept & need of Nai Talim and philosophy of work education and experiential learning for rural reconstruction.

Unit – III

4. Educational Committees and Commission after independence with special reference to:

- Secondary Education Commission (1952-53): objectives and recommendations.
- Indian Education Commission (1964-66): objectives and recommendations.
- National policy on Education (1986)): objectives and recommendations
- Revised National Policy 1992
- POA: Major features.

Unit – IV

5. Contemporary Issues in Indian Education

- Universalization of school Education and DPEP, MDM, SSA, RMSA and IEDSS
- Vocationalization of Secondary Education: need and implications.
- Emotional Integration and international understanding in the context of globalization.
- Modernization: Concept, merits and demerits.

Practicum/Sessionals

Any one of the following:

i. Revisiting educational policies framed for the education of different sections of the society SC/ BC/Minorities/ Women.
ii. Prepare a report on problems of secondary education.
iii. Review educational policies for vocational education.
iv. Review of Policies related to universalization of school education.
v. Case study of a school on Community Engagement, Conduct & Outcome of SMC meetings.
vi. Panel Discussion on Gandhi's idea on Education and their relevance in present day context.
vii. Survey on literacy levels and out of school children in any locality.

Suggested Readings:

Bhattacharya & Sriniwas. (1977). *Society and Education*, Calcutta: Academic Publications.
Deshpande, S.(2004). *Contemporary India: A sociological view.* New Delhi: penguin.Dubey,

S.C. (2001). *Indian Society*, New Delhi: National Book trust.
Government of India (GOI) (2009). *Right to education Act*. New Delhi: MHRD.
Ghanta, R. & Dash, B. N. (2005). *Foundations of Education*, Hyderadbad: Neelkamal Publications.
Kashyap, S.C. (2009). *The constitution of India,* New Delhi: National Book latest edition.
Mishra, B.K. & Mohanty, R.K. (2003). *Trends and issues in India Education,* Meerut: Surya publications.
Ministry of Human Resource Development of India (1986).*National policy on education.*
NCERT,91964-1966). Educational and national Development: report of the education commission, New Delhi: NCERT.
Rajput, J.S. (1994). *Universalisation of Elementary Education*, New Delhi: Vikas Publishing House.
Right to education Act, (2009). *Gazette.* Notification of central Government.
Sachdeva,M.S. et.al (2011). *Philosophical, Sociological and Economic bases of Education*, Patiala: Twenty First Century Publications.
Shankar Mukharji. (2007*). Contemporly issues in modern Indian education*, Authors Press.
Stormquist, Nelly P.(2002). *Education in a Globalised world.* New York: Rowman & Little field publishers.
Walia,J.S.(1979). *Modern Indian Education and its Problems,* Jalandhar City: Paul Publishers, Gopal Nagar.
Walia,J.S(2014). *Philosophical, Sociological and Economic Bases of Education.* Jalandhar: Ahim Paul Publishers.
http:/www.gandhi-manibhawan.org/gandhicomsalive/speech8.html
http:/www.mkgandhi.org/speeches/speech Main.html

Course 3
LEARNING & TEACHING

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**

ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.**

iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale:

Teaching & Learning will focus on aspects of social & emotional development; self & identity, cognition & learning. It offers a site for perspective teachers to reflect on and critique notions of learning & teaching

Learning Outcomes

After transaction of the course, student teachers will be able to:

- Understand the Concept of learning.
- Explain the strategies and paradigms of learning.
- To identify the individual differences among the learners.
- To describe the educational implications of different theories of learning.
- Understand the Concept of teaching.
- To differentiate the relation with the modalities & variables in the teaching Process.
- To describe the phases & models of teaching.
- To understand the Strategies of Teaching.

Course Contents

Existing	Corrected
Unit-I	**Unit-I**
1. Understanding Learning	**1. Understanding Learning**
• Learning : Concept, Nature, types of learning & Factors influencing learning,.	• Learning: Concept, Nature, types of learning & Factors influencing learning,.
• Learning strategies : Co-operative learning, peer-tutoring & collaborative & group learning; Role of Teacher & School in relation to learning strategies.	• Learning strategies: Co-operative learning & Collaborative learning, peer-tutoring, group learning.
	• Role of Teacher & School in relation to learning strategies.
• Individual Differences: Concept, Types, Causes & Educational implications.	• Individual Differences: Concept, Types, Causes & Educational implications.
Unit-II	**Unit-II**
2. Learning Paradigm	**2. Learning Paradigm**
• Theories of Learning :	• Theories of Learning :
– Connectionism theory (Trial & Error: Thorndike), concept, laws of learning & Educational Implications.	– Connectionism theory (Trial & Error: Thorndike), concept, laws of learning & Educational Implications.
– Conditioning theories: Classical conditioning (Pavlov) & Operant Conditioning (Skinner): Concept,	– Conditioning theories: Classical conditioning (Pavlov) & Operant Conditioning (Skinner): Concept,

characteristics and Educational Implications. – Social constructivist theory (Vygotsky & Bandura): Concept, nature & Educational Implications. **Unit-III** **3. Understanding Teaching** • Teaching: Concept, characteristic, features and levels of teaching. • Related concepts of Teaching (Training, conditioning, instruction & indoctrination) • Variables in the Teaching Process: The Learning task (Instructional Objectives), Learning Behaviour (Entry behaviours & Learner's characteristics) Teacher Behaviour: (Competence, Personality, Teaching Style). • Social-constructivist approach in teaching (Applications of Bruner, Ausubel & Vygotsky's ideas in teaching). **Unit-IV** **4. Phase & Models of Teaching** • Phase of Teaching: Pre-active, Interactive and Post-active. • Models of Teaching: Meaning, Need & Elements, Basic Teaching Model (Glaser), Concept Attainment Model (Bruner). • Teaching Strategies: Brain-Storming, Simulation, Role-playing, Gaming, Remedial teaching & Enrichment Programme.	characteristics and Educational Implications. – Social-constructivist theory (Vygostky & Bandura): Concept, Nature and Educational implications. **Unit-III** **3. Understanding Teaching** • Teaching: Concept, characteristic, features and levels of teaching. • Related concepts of Teaching (Training, conditioning, instruction & indoctrination) • Variables in the Teaching Process: The Learning task (Instructional Objectives), Learning Behaviour (Entry behaviours & Learner's characteristics) Teacher Behaviour: (Competence, Personality, Teaching Style). • Social-constructivist approach in teaching (Applications of Bruner, Ausubel & Vygotsky's ideas in teaching). **Unit-IV** **4. Phase & Models of Teaching** • Phase of Teaching: Pre-active, Interactive and Post-active. • Models of Teaching: Meaning, Need & Elements, Basic Teaching Model (Glaser), Concept Attainment Model (Bruner). • Teaching Strategies: Brain-Storming, Simulation, Role-playing, Gaming, Remedial teaching & Enrichment Programme.

Practicum/ Sessional

Any one of the following

i. Group Projects: Observation report on Teaching-learning transaction process in School teaching practice.

ii. Seminar/ Presentation on learning theories.

iii. Application of teaching strategies (Brain-Storming, Simulation, Role-playing, Gaming, Remedial teaching) on any current/ social issue.

iv. Case-study on Individual differences.

v. Application of participatory learning and action techniques of resource mapping and social mapping.

Suggested Readings:

Chauhan, S.S. (2014). "*Innovations in Teaching Learning Process*", Noida: Vikas Publishing House Private Ltd.

Dececco, J.P. (1988) "*The Psychology of Learning and Instruction*", New Delhi: Prentice Hall.

Gagne, R.M. (1977). "*The conditions of learning*", New York, Chicago: Holt, Rinchart and Winston.

Joyce, B. & Weil, M. (1992). "*Models of Teaching*", New Delhi, Prentice Hall.

Kulkarni, S.S. (1986). "*Introduction to Educational Technology*", New Delhi: oxford & IBH Publishing Company.

Pandey, K.P.(1983). "*Dynamics of Teaching Behaviour*", Ghaziabad: Amitash Parkashan.

Pandey, K.P. (1980). "*A First Course in Instructional Technology*", Delhi: Amitash Parkashan.

Skinner, B.F.(1968). "*The Technology of teaching*", New York: Appleton Century Crofts.

Sharma, R.A. (1991). "*Technology of Teaching"*, Meerut: R. Lall Book Depot.
Sharma, S.K. (2005). "*Learning and Teaching: Learning process*", Delhi: Gyan Books Private Ltd.
Srivastava, D.S. and Kumari, S. (2005). "*Education: Understanding the learner*", Delhi: Gyan Books Private Ltd.
Walia, J.S. (2011). "*Technology of Teaching",* Jalandhar: Ahim Paul Publishers.
Walia, J.S. (2012). "*Teaching Learning Process*", Jalandhar: Ahim Paul Publishers.

Course 4(a)

LANGUAGE ACROSS THE CURRICULUM

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER

- i. **Paper setter will set five questions in all, out of which students will be required to attempt three questions.**
- ii. **Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.**
- iii. **Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale

The course on "Language across the curriculum" will focus on the language background of the students and know how the oral and written language can be used in the classroom to ensure optimal learning of the subject area.

Learning Outcomes:

After transaction of the course, student teachers will be able to:

- Know the concept of language, multilingualism and language diversity.
- Learn about communicative approach.
- Understand the ways of integrating speaking with other skills.
- Understand the nature of classroom discourse and develop strategies for using oral language i.e. discussion, questioning etc.
- Understand the nature of reading in different subjects.
- Familiarize with different types of writing that would be useful for learners.

Course Contents

Existing	**Corrected**
UNIT-I 1. **Language** : Meaning, nature and linguistic principles **2. Functions of language:** • Communicative functions of language & its basic assumptions • Learning language and learning through language 3. **Development of Listening skill:** • Characteristics of good listening material, • Different kind of listening materials and activities. 4. **Development of Speaking skill:** • Need and objectives of developing speaking skills, • Techniques of learning speaking skills-conversational/oral skills, • Importance of group work in developing oral work and role of teacher. **UNIT-II**	**UNIT-I** 6. **Language** • Concept of Language: Meaning & nature of language • Linguistic principles: Process of acquisition of language **7. Language in Curriculum** • Functions of language & its basic assumptions: Receptive & expressive functions • Multilingualism and language diversity in the classroom • Relationship of language with society **UNIT-II** **3. Listening & Speaking skill** • Different kinds of listening material and activities & techniques of learning • Listening & speaking skill as tool of learning: conversational/oral skill; discussion; questioning etc.

5. **Development of Reading skill**: • Meaning, need and importance of developing reading skill, • Reading mechanics and process of reading. • Stages of reading, types of reading, reading problems of learners. 6. **Development of Writing skill**: • Types of writing skill & writing scripts • Importance and need of developing writing skill, • Characteristics of good handwriting and techniques of improving handwriting. 7. **Language in Education and Curriculum**	**4. Reading & Writing skill** • Concept, need & importance of reading & writing skill • Reading & Writing skill as tool of learning: i. Reading mechanics and process of reading ii. Characteristics & techniques of good writing

Practicum/Sessionals

Existing	Corrected
Practicum/Sessionals **Any one of the following:** **i.** Subject wise group discussion, preparation of report and presentation before the group. **ii.** Prepare and present a report on Introduction of yourself to other in different situations i.e. facing interviews, in the class room etc.	**Any one of the following:** i. Subject wise group discussion, preparation of report and presentation before the group. ii. Prepare a Diagnostic test to identify reading and writing problems of the school students. iii. Prepare a representative sample of advocacy on rural issues / problems iv. Letter writing, Notice, email messages representation on local issues and local challenges. v. Reflections on Gandhian thoughts : Panel discussion and preparation of report

Suggested Readings:

Agnihotri, R.K. (1995). *Multilingualism as a classroom resource*. In K. Heugh, A. Siegruhn, & P. Pluddemann (Eds.), *Multilingual Education for South Africa* (pp. 3-7), Heinemann Education Groups.

Freedman, S.W. & Dyson, A.H. (2003). *Handbook of Research on Teaching English language Arts*. Lawreuel Erlbaum Associates Inclave, USA: New Jersey.

Government of india. (1986). *National Policy on Education*. GOI.

Grellet, F. (1981) *Developing Reading Skills: A practical guide to Reading Comprehension exercises*. Cambridge University Press.

Kumar, Krishna. (2007). *The child's language and the Teacher*. New Delhi: National Book.

Mangal, U.(2010). *Teaching of Hindi*, New Delhi: Arya Book Depot.

National Curriculum Framework (2005), New Delhi: NCERT.

Sachdeva, M.S. (2013). *Teaching of English*. Patiala: Twenty First Century Publications.

Safaya, Raghunath. *Methods of Teaching of Hindi.* Jalandhar :Punjab Book Depot.

Sinha, S. (2009). *Roseublatt's Theory of Reading*. Explaining Literature contemporary education dialogue. 6(2), PP223-237.

Sullivan, M. (2008). *Lessons for Guided writing*. scholastic. National curriculum framework. (2005).

www.ncert.nic.in.

http://www.usingenglish.com/handouts/

Course 4(b)

UNDERSTANDING DISCIPLINES AND SUBJECTS

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER
i. Paper setter will set five questions in all, out of which students will be required to attempt five questions.
ii. Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.
iii. Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.

Learning Outcomes

Existing	**Corrected**
After the transaction of the course, student teachers will be able to: ▪ Analyse and evaluate changes in the perspectives in school curriculum, text books and syllabus on socio-cultural basis. ▪ Compare and evaluate the perspective of NCERT on the required changes in knowledge base in school subjects- Mathematics, science, languages and social science.	After the transaction of the course, student teachers will be able to: ▪ Describe the characteristics and nature of discipline ▪ Understand emergence of discipline and subjects in philosophical, social and political contexts ▪ Understand theory of subject content, selection of content, curriculum, syllabus and text books ▪ Paradigm shifts in the nature of disciplines: Mathematics, science, languages and social science.

Course Content

Existing	**Corrected**
Unit-I 1. **Socio-cultural perspectives of disciples and school subjects (theory of school content)** • Evolution of socio –cultural perspectives in school level knowledge base; • Social history of school contents • Emergence of school subjects and disciplines from social, political and intellectual contexts; • History of emergence of methods of methods of teaching; • NCERT Position paper on change in curriculum, syllabus and textbooks. **Unit-II** 2. **Changes in theory of content in school**	**Unit-I** 1. **Emergence of Disciplinary Knowledge** • Meaning, nature and types of discipline. • Role of disciplinary knowledge in the school curriculum. • Emergence of school subjects and disciplines from philosophical, social and political contexts; • emergence of teaching methods **Unit-II** 2. **Disciplinary Knowledge: Related Issues** • Difference and relationship between curriculum & syllabus; • A criteria for selection of textbooks, magazine & journals as source of knowledge.

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education after independence in India

- Needed changes in discipline –oriented school textbooks;
- Steps needed to redesign text books for school education
  a) Focus on drawing upon the experiences of children;
  b) Focus on the diverse community background of students;
  c) Focus on natural curiosities of students Focus on learner –centred methods of teaching-constructivist approach;
- Paradigm shift in teaching of social science in schools
- Paradigm shift in teaching of science in schools
- Paradigm shift in teaching of Mathematics in schools
- Paradigm shift in teaching of Indian languages in schools

</td><td>

- Role of different agencies and their functions in shaping the syllabus and text books at national & state level.
- Paradigm shifts in the nature of disciplines: Social Science, Mathematics, Science, Language

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<tr><td>Existing</td><td>Corrected</td></tr>
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Practimum/ Sessional

Any one of the following:

i. Critical analysis of a curriculum/ syllabus of particular school subjects.
ii. Evaluate a text book of secondary classes with reference to its adequacy and in achieving expected learning outcome.
iii. Review of text book in the light of connecting knowledge to life outside the school.
iv. Readings and group discussions on NCF-2005, NCFTE-2010, RTE-2009

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Suggested Readings:

Bonrs, J.A. (2001). Cultural diversity and Education. Foundations curriculum and teaching (4th Ed) Boston: Allyn and Bacon.

Deng, Z (2013) school subjects and academic disciplines. In A. Luke , A. Woods, & Wer (Eds.), Curriculum syllabus design and equity: A primer and model. Routledge.

Krishna, A. (2009). What are Academic Disciplines? University of Southampton,NCRM E Prints Respositiry *eprints,ncrm.ac.uk/783/1/what_are_academic_disciplines.pdf*.

NCERT(2006). Position paper national focus group on curriculum, syllabus and textbooks. New Delhi: author. Available from http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/cst_final.pdf

NCERT (2006). Position paper national focus group on teaching of social sciences. New Delhi: Author Retrieved on April 21, 2015 from http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/social_sciencel.pdf

NCERT(2006). Position paper national focus group on teaching of Indian languages. New Delhi: Author Available from

http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/Indian_Languages.pdf

NCERT (2006). Position paper national focus group on teaching of mathematics. New Delhi: Author Available from

http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/math.pdf

NCERT(2006). Position paper national focus group on teaching of science. New deli: Author.

Available from http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/science.pdf

Course-5

GENDER, SCHOOL AND SOCIETY

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER

- **i. Paper setter will set five questions in all, out of which students will be required to attempt five questions.**
- **ii. Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.**
- **iii. Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale

The course on “Gender, School and Society gendered roles in society, through a variety of institutions such as family, caste, religion, culture, the media and popular culture (films, advertisements, songs etc.), law and the state.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- Understand the basic terms, concepts used in gender studies.
- To describe equity and equality in relation with different aspects of society.
- To understand psychological and sociological perspectives of sex and gender.
- To understand paradigm shift under gender studies.
- To become aware about gender inequalities in school.
- To explain the issues related to gender.

Existing	**Corrected**
Unit – I **1. Gender Studies: Paradigm Shift** • Meaning of gender equality, need & importance • Paradigm shift from women studies from gender studies: Some land marks from social reform 19th to 21st studies **2. Gender Issues** • Concept of gender: Issue of muscularity and familiarity • Equity and equality: Psychological and sociological perspective • Emergence of gender specific roles, cross cultural perspective	**Unit – I** **1. Gender Studies: Paradigm Shift** • Concept of gender: Issue of masculinity and femininity • Paradigm shift from women studies from gender studies: Some land marks from social reform 19th to 21st century **2. Social construction of gender** • Philosophical and sociological theories of gender • Gender identity, family, media gender role and stereo types • Social construction of gender during late childhood and adolescence
Unit – II **3. Gender Inequalities and strategies for change** • Gender Inequality in School: School curriculum, Text book, classroom processes,	**Unit – II** **3. Gender Issues** • Equity and equality: Psychological and sociological perspective • Emergence of gender specific roles, cross

and student teacher interaction • Strategies for change: policy and management in the school **4. Social construction of gender** • Philosophical and sociological theories of gender • Gender identity, family, media gender role and stereo types • Social construction of gender during late childhood and adolescence	cultural perspective • Need and Importance of Gender Equality **4. Gender Inequalities and strategies for change** • Gender Inequality in School: School curriculum, Text book, classroom processes, and student teacher interaction • Strategies for change: policy and management in the school

Practicum/Sessionals

Any one of the following

i. Identify at least two students (Boys/Girls) having gender bias attitude and develop strategies for gender sensitization.

ii. Analysis of selected ideas, trends, and problems in the study of gender across academic disciplines.

iii. Survey on Gender Equality-Status of women and girls in the family and community.

iv. Preparing sensitization material and creating awareness on Gender issues with the help of students in a village.

v. Poster making on Gender Equality and Empowerment.

vi. Observation of practice of inequality between male and female students in a rural school and report writing.

Suggested readings:

Bordia, A. (2007). *Education for gender equity*: The Lok Jumbish experience, p 313-329

Chatterji, S. A. (1993). *The Indian Women in perspective*, New Delhi: Vikas Publishing

Devendra, K. (1994). *Changing status of women in India*, New Delhi: Vikas Publishing House

Gupta, A. K. (1986). *Women and Society*, New Delhi: Sterling Publications

Ministry of Education (1959). *Report of National Committtee of Women's Education*. New Delhi: ME

Ruhela, S. (1988). *Understanding the Indian Women today*; Delhi: Indian Publishers Distributors

Thakur, H. K. (1988). *Women and Development planning* (Case study of Nauhatta Block), New Delhi: Vikas Publishing House

Course-6 & 7 Pedagogy of Teaching Subjects

Group-I: Pedagogy of Sciences

(i) PEDAGOGY OF SCIENCE

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes:

After completion of this course the students teacher will be able to:

- understand the Nature & Scope of Science.
- understand Aim and objectives of Teaching Science.
- adopt suitable approaches, methods, different resources to teach Science.
- appreciate the importance of planning for Science.
- applying e-sources in Science.
- develop a skill of conducting experiments to demonstrate Science concepts.
- develop a skill of planning lesson plan based on various approaches.
- understand the concept of continuous and comprehensive evaluation.

COURSE CONTENTS

UNIT – I

1. **Nature & Scope of Science**
   - Meaning, Nature and Scope with reference to Science & its branches.
   - History of science and contribution of Indian Scientists.
   - Need & importance Science in secondary school & its values in the present context.
   - Correlation of science with other school subjects
   - Aim & objectives of Science.
   - Bloom's Taxonomy of instructional objectives.
   - Science in the service of human welfare – Agriculture, Medicine, Industry & Conservation of Environment.

UNIT – II

2. Content & Its Pedagogical Analysis

- Content –
  - Matter in our Surroundings
  - Atom & Molecules
  - Motion
  - Force
  - Gravitation
  - Work and Energy
  - Tissues
  - Diversity in Living Organism
  - Life Process
  - Reproduction
  - Micro-organism
- **Pedagogical Analysis :**

  Following points should be followed for pedagogical analysis on topics covered in the syllabus

  a)Identification of concept, b)Listing behavioural outcomes, c)Listing activities and experiments, d)Listing evaluation techniques
- Concept, Need & Importance of Unit Planning & Lesson Planning

UNIT – III

3. Teaching Learning Resources & Procedures

- Meaning, Principles & Steps of Curriculum construction in Science
- Critical Analysis of Present Secondary School Text-Book with Reference to Haryana State
- Teaching Skills:-
  - Skill of Introducing the Lesson
  - Skill of Illustrate with the help of Examples
  - Skill of Explaining
  - Skill of Stimulus Variation
  - Skill of Black-Board Writing
- Science Laboratory – Importance, Planning, Designing, Equipping, Maintenance of Science equipment & Records
- Audio-Visual Aids: Chart, Models, Film Strip, Radio, Projectors.
- E-learning Resources – Use of Multimedia & Computers, PPT, Internet, Website, Teleconferences.
- Improvised Apparatus – Meaning, Importance & Steps
- Professional Growth of Science Teacher in Service Programme, Orientation Programme, Refresher Courses, Seminars, Symposium, Workshop, Science Fair,

  Science Exhibition, Projects.

UNIT – IV

4. APPROACHES AND EVALUATION IN TEACHING

- Science Inductive – deductive Approach, Critical Inquiry Approach, Maier's Problem Solving Approach.
- Methods of Teaching Science
  - Lecture-cum-Demonstration
  - Project Method
  - Laboratory Method
- Continuous & Comprehensive Evaluation (CCE) in Science
- Construction & Use of Achievement Test in Science
- Construction & Use of Diagnostic Test in Science, Preparation of Diagnostic Chart,
  Identification of Difficulties & Remedial Teaching.
- Meaning & Advantages of Task Analysis and Question Bank.

Praticum/Sessional

Any one of the following

i. Development of Five Demonstration Experiments on the Topics Covered in the Syllabus from Science Test-books at the Lower Secondary Level in Haryana State.
ii. Improvisation of Apparatus/Equipment
iii. Seminar Presentation on any Topics given in the Syllabus.
iv. Celebration of science week in a village school and report writing
v. Conducting asurvey on health concerns in a village

Suggested Readings

Adams, G.S. (1964). Measurement & Evaluation in Education, Psychology & Guidance, New York: Halt, Rinehart & Winston.

Aggarwal, J.C. (2005). Essential of Examination System. New Delhi: Vikas Publishing House Pvt. Ltd.

Allen, D.W. and Eve, A.W. (1968). Micro Teaching in Theory to Practices. Vol. 70, pp. 181-185.

Bloom, B.S. et al. (1956). Taxonomy of Educational Objectives: The Cognitive Domain, New York: Longum's Green.

CBSE (2009). Teacher Manual on CCE. New Delhi: CBSE.

Das, R.C. (1985). Science Teaching in Schools, New Delhi.Sterling Publication Private Ltd.,

Harrow, A.J.A. (1972). Taxonomy of Motor Domain, New York: Mckay.

Kherwadkal, Anjali (2003). Teaching of Chemistry by Modern Method, New Delhi Sarup & Sons..

Kilpatrick, W.H. (1987). The Project Method, Columbia. Teachers College Record.

Krathwohl, D.R., Bloom, B.S. and Maria, B.B. (1964). Taxonomy of Educational Objectives,

Hand-book II, Affective Domain, New York: David Mckay.

Mager, R.F. (1962). Preparing Instructional Objectives, California: Fearon.

Miller, David F. and Blaydes (1962). Methods & Materials for Teaching Biological Science, New York McGraw Hill Book Co.,

Sharma, R.C. (1995). Modern Science & Teaching, New Delhi.

Dhanpat Rai & Sons. Siddique and SIddique (1998), Teaching of Science, New Delhi. Doaba House,

Vishwanth, Pandey and Kisor Valicha (1984). Science Technology & Development, New Delhi: McMillan India Ltd.

Venkataih, S. (2001). Science Education in 21st Century, New Delhi Anmol Publishers,.

Wadhwa, Shalni (2001). Modern Methods of Teaching Physics. New Delhi:Saroop & Sons.

Group-I: Pedagogy of Sciences

(ii) PEDAGOGY OF BIOLOGICAL SCIENCE

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER
i. Paper setter will set nine questions in all, out of which students will be required to attempt five questions.
ii. Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.
iii. Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.

LEARNING OUTCOMES

After completion of this course the students teacher will be able to :

- Understand Nature & Scope of Biological Science
- Understand objectives of Teaching biological Science
- Adopt suitable approaches, methods, different resources to teach biological science.
- Appreciate the importance of planning and organizing the extension activities.
- Applying e-resources in teaching biological science.
- Develop a skill of conducting experiments to demonstrate biological concepts.
- Develop a skill of lesson planning based on various approaches.
- Understand the concept of continues and comprehensive evaluation.\

COURSE CONTENTS

UNIT – I

1. NATURE AND SCOPE OF BIOLOGICAL SCIENCE

- Meaning, Nature and Scope with reference to Biological science and its branches.
- History of Biological science and contribution of Indian Biologist.
- Need and Importance of Biological in secondary schools and its values in the present context.
- Correlation of Biological science with other school subject.
- Aim and Objectives of Teaching Biological science.
- Bloom's Taxonomy of educational objectives.
- Formulation of specific objectives in Behavioural terms.
- Biology in the service of human welfare-Agriculture, Medicine, Industry & Conservation of Environment.

UNIT – II

2. CONTENT AND ITS PEDAGOGICAL ANALYSIS

- **Content**
  - Tissues
  - Diversity in living organism
  - Diseases
  - Natural Resources
  - Improvement in Food
  - Life Process
  - Reproduction
  - Heredity
  - Control and Co-ordination
  - Micro-organism
  - Photosynthesis
- **Pedagogical Analysis :** Following points should be followed for pedagogical analysis on topics covered in the syllabus
  a) Identification of concept) Listing behavioural outcomes) Listing activities and experiments, d) Listing evaluation techniques.
- Teaching Skills
  - Skill of introducing the lesson
  - Skill of illustrate with the help of examples.
  - Skill of explaining
  - Skill of stimulus variation
  - Skill of using black board
- Concept, Need and Importance of unit planning and lesson planning.

UNIT – III

3. TEACHING LEARNING RESOURCES AND PROCESSES

- Meaning, Principles and steps of curriculum construction in Biological Sciences.
- Critical Analysis of Present secondary school text book with reference to Haryana State.
- Biological Science Laboratory. Impotence, Planning, Designing, equipping, maintenance of biological equipment and records.
- Visual Aids: - Chart, Model, Specimen.
- E-learning Resources: Use of Multimedia and Computers in Biological Science, e-learning, PPT, Internet, Website, Teleconferencing.
- Professional growth of Biological science teacher in service programme, orientation programme, refresher courses, seminar, symposium, workshop, projects, science museum, science fair and science exhibition.

UNIT – IV

4. APPROACHES AND EVALUATION IN TEACHING

- Approaches of Teaching Biological Science.
  - Inductive – deductive approach
  - Critical inquiry approach
  - Maier's Problem solving approach

- Methods of Teaching Biological Science;
  - Lecture cum demonstration method
  - Project Method
  - Laboratory method
- Continuous and Comprehensive Evaluation (CCE) in Biological Science.
- Construction and use of achievement test in Biological Science.
- Construct and Use of diagnostic Test in Biological science, preparation of diagnostic chart, identification of difficulties and remedial teaching.
- Task Analysis, meaning and advantages
- Question Bank, meaning and advantages

Praticum/Sessional

Any one of the following

i. Prepare a working model on Biological secondary school standard topics.
ii. Collect and preserve any five biological specimen and write a report
iii. Critically analyse secondary school state syllabus science text-book.
iv. Preparation of Biological science wall magazine in every month
v. A case study of any senior secondary lab and prepare report
vi. Visit a farm to study and participate in organic farming operations.
vii. Waste audit and composting to learn the important aspects of resource conservation activity.
viii. Water audit and budgeting with water harvesting to learn the important aspects of conservation activity.
ix. A survey report on garbage disposal practices in a village.

Suggested Readings:

Adams G.S., (1964). *Measurement and evaluation in education, psychology and guidance*, New York : Halt, Rinehart and Winston.

Aggarwal, J.C. (2005). *Essentials of examination system*. New Delhi : Vikas Publishing house Pvt. Ltd.

Allen, D.W, and Eve, A.W. (1968). *Microteaching in theory to practices* Vd. 70, pp. 181-185.

Ameetha P (2004). *Methods of Teaching Biological Science*. New Delhi :Neelkamal Publications,

Bloom, B.S. et. Al. (1956). *Taxonomy of Educational objectives : the cognitive domain*, New York: Lagan's Green.

CBSE (2009). *Teacher's manual on CCE.* New Delhi : CBSE.

Das, R.C. (1985). *Science teaching in schools*. New Delhi: Sterling Publication Private Ltd.

Green T.N. (1971). Teaching of Biology in tropical schools, Oxford University Press London.

Harrow, A.J.A. (1972); Taxonomy of Motor Domain, New York : McKay.

Karmer, L.M.J. (1975). Teaching of Life Science, McMillan India Ltd. New Delhi.

Kilpatrick, W.H. (1918); the project method, Columbia: Teachers College Record.

Krathwohl, D.R., Bloom B.S. and Maria B.B. (1964) Taxonomy of Educational objectives, Handbook II, Affective Domain, New York : David McKay.

Mager, R.F. (1962); Preparing Instructional objectives, California : Fearon.

Miller, David F. and Blaydes (1962); Methods and materials for teaching Biological Science, M.C. Grow Hill Book Co; New York.

Sharma, R.C. (1995). Modern Science & Teaching, Dhanpat Rai and Sons, New Delhi.

Sood J.K. (1987). Teaching of Life Science, Kholi Publisher, Chandigarh.

Vishwanth, Pandeny & Kishore, Valicha (1984). Science Technology and Development, Mc Millan Indian Ltd. New Delhi.

Group-I: Pedagogy of Sciences

(iii) PEDAGOGY OF COMPUTER SCIENCE

Time: 3 Hours **Max. Marks: 100**
(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- emphasize the need and importance of computer science as a subject.
- acquaint with the aims and objectives of teaching computer science in secondary and higher secondary schools and help them to plan learning activities according to those objectives.
- perform Pedagogical Analysis of various concepts in computer science.
- underline the need and importance of lesson planning and unit planning.
- understand the principles of curriculum construction.
- discuss the importance of computer textbooks.
- teach the proper computer laboratory planning and managing
- acquire skills relating to planning lessons and presenting them effectively.
- familiarize with the various methods that can be employed for the teaching of computer science.
- develop competencies and skill for effective evaluation in computer science.

COURSE CONTENT

Unit-I

1. **Nature and Scope**
   - Meaning, Nature and Scope of Computer Science.
   - Significance of Computer Science in school curriculum.
   - Place of Computer Science at different stages of school.
   - Aims and Objectives of Teaching Computer Science at different stages of school.
   - Blooms Taxonomy of educational objectives.
   - Formulation of specific objectives in behavioural terms.

   Unit-II
2. **Content and Pedagogical Analysis: C**oncept, need and importance of Pedagogical Analysis.

   - **Content:**

- – Computer System
- – Computer Software
- – Networking
- – MS-Windows
- – MS-Office
- – Operating System
- **Pedagogical Analysis:**
  Following point should be followed for pedagogical analysis:-

a) Identification of concept.
b) Enlisting behavioural outcomes.
c) Enlisting activities and experiments.
d) Enlisting evaluation techniques.

- **Lesson Planning:** Concept, Need and Importance of unit planning and lesson planning

Unit-III

3. Teaching Learning Resources and Processes

- Development and designing of computer science curriculum.
- Development of text-books
- Development of self instructional material
- Designing and managing Computer Laboratory.

Teaching Skills

- – Skill of Introducing the lesson
- – Skill of Probing Questions
- – Skill of illustration with examples.
- – Skill of Stimulus Variations
- – Skill of Explaining

Unit-IV

4. Approaches and Evaluation

- **Teaching Methods:**

- – Lecture-cum-Demonstration method.
- – Project method.
- – Computer Assisted Instruction method.
- – Laboratory Method.
- – Mobile learning, and Online learning

- **Evaluation**

- – Meaning and importance of evaluation
- – Types and techniques
- – Achievement Test
- – Characteristics of a good test in Computer Science.
- – Preparing, reporting and evaluating the results.
- – Comprehensive and Continuous Evaluation.

Practicum/ Sessional

Do Any one of the following:

i. Critical analysis of course content of Computer science of secondary school curriculum.
ii. Prepare an achievement test of course content of Computer science of secondary school curriculum.
iii. Internet based project: Form a group on internet and share educational information with atleast one link to audio/video material and prepare the project using ppt.
iv. Power Point Presentation on Gandhian ideas and thoughts.
v. Generating awareness regarding Digital India Initiative among rural community.

Suggested Readings

Agarwal J. C. (2006). *Essential of educational technology*, *Teaching and learning*. New Delhi: Vikas Publishing House Pvt. Ltd.

Sharma, R. A. (2008). *Technological foundation of education*. Meerut: R.Lall Books Depot.

Sharma, R. N. (2008). *Principles and Techniques of Education*. Delhi: Surjeet Publications.

Singh, Arjinder. *Teaching of Computer Education*. Jalandhar: Modern Publisher

Sinha, P.K. & Sinha, P. *Computer Fundamentals*, BPB

Singh,Y. K. (2009). *Teaching Practice*. New Delhi: APH Publishing Corporation.

Group-I: Pedagogy of Sciences

(iv) PEDAGOGY OF HOME SCIENCE

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes : After completion of this course the students teacher will be able to :

- Understand Nature & Scope of Home Science
- Understand objectives of Teaching Home Science
- Adopt suitable approaches, methods, different resources to teach biological science.
- Appreciate the importance of planning and organizing extension activities.
- Applying e-resources in teaching Home Science.
- Develop skills of lesson planning based on various approaches.
- Understand the concept of continues and comprehensive evaluation.

UNIT – I

1. **Concept, Objectives and Importance**
   - Meaning, Nature and Scope of Home Science
   - Need and Importance of Home science in secondary schools in the present context
   - Correlation of Home Science with other school subjects
   - Aims and objectives of teaching Home Science
   - Blooms Taxonomy of educational objectives
   - Formulation of specific objectives in Behavioural terms.

UNIT – II

2. **Content, Pedagogical Analysis and Teaching Skills**

- **Content**
  – Food, Nutrition and Health
  – Child Care
  – Fiber and Fabric
  – Home Management
  – Health and sanitation
- **Pedagogical Analysis :**

Following points should be followed for pedagogical analysis on topics

a) Identification of concept
b) Listing behavioural outcomes
c) Listing activities and experiments.
d) Listing evaluation techniques.

- **Teaching Skills**
  - Skill of introducing the lesson
  - Skill of illustrate with the help of examples.
  - Skill of explaining
  - Skill of stimulus variation
  - Skill of using black board
- **Concept, Need and Importance of unit planning and lesson planning**.

UNIT – III

3. TEACHING LEARNING RESOURCES AND PROCESSES

- Meaning, Principles and steps of curriculum construction in Home Sciences.
- Development and Characteristics of a good Textbooks. Critical analysis of current Home Science Text Books in secondary schools of Haryana State.
- Planning of space and equipment of Home Science Laboratory
- Classification and importance of Teaching Aids, (Visual Aids :- Chart, Model, Specimen).
- E-learning Resources: Use of Multimedia and Computers in Home Science, e-learning, PPT, Internet.
- Qualities of a good Home Science Teacher. Professional growth of Home Science Teacher

UNIT – IV

4. APPROACHES , Methods AND EVALUATION IN TEACHING

- **Methods of Teaching:**
  Lecture-cum- Demonstration; Project Method; Discussion Method; Practical and Individual Method
- **Activity Based Learning:**
  Learning by doing : Experimentation; observation ; games, quiz; puzzles; Field visits and excursions
- **Approaches of Teaching Home Science** : Inductive – deductive approach ;Maier's Problem solving approach
- Continuous and Comprehensive Evaluation (CCE) in Biological Science.
- Construction and use of achievement test and diagnostic test in Home Science.
- Task Analysis, meaning and advantages
- Question Bank, meaning and advantages

PRACTICUM/SESSIONALS:

Any one of the following:

i. A course of ten practical by the Pupil-teacher in the following:
   - Cooking
   - Stitching/Embroidery/knitting

– Home Management

ii. Preparation of online test.

iii. Preparation of objective type test, short answer type test, essay type test

iv. Organize a quiz competition in Home Science and analyze the response of students

v. Plan a field visit of Home Science students for studying and reporting the health habits and health concerns of school students of village.

vi. Prepare one remedial Teaching Programme for a Home Science student

vii. Writing of project report in extension education.

viii. Organise a handicrafts fair in a village.

SUGGESTED READING

Chandra, Shah & Joshi. *Fundamental of Teaching of Home Science*, New Delhi: Sterling Publishers Pvt. Ltd

Dass & Ray. *Teaching of Home Science*, New Delhi: Sterling Publishers Pvt. Ltd

Devdass, R. P. *Method of Teaching of Home Science*, New Delhi: NCERT.

Devdass, R. P. *Teaching of Home Science in Secondary School*. A handbook of Suggestion for Teachers, New Delhi: NCERT

Spafford, I. *Fundamental in Teaching of Home Science*, New York: John Wiley & Sons

CBSE (2009); *Teacher's manual on CCE*. New Delhi : CBSE

Group-I: Pedagogy of Sciences

(v) PEDAGOGY OF PHYSICAL SCIENCE

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER
i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.** ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.** iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes:

After completion of this course the student teacher will be able to:

- Understand the Nature & Scope of Physical Science.
- Understand Aim and objectives of Teaching Physical Science.
- Adopt suitable approaches, methods, different resources to teach Physical Science.
- Appreciate the importance of planning for Teaching Physical Science.
- Applying e-sources in Teaching Physical Science.
- Develop a skill of conducting experiments to demonstrate Physical Science concepts.
- Develop a skill of planning lesson plan based on various approaches.
- Understand the concept of continuous and comprehensive evaluation.

COURSE CONTENTS

UNIT – I

Existing	**Corrected**
1. NATURE AND SCOPE OF BIOLOGICAL SCIENCE • Meaning, Nature and Scope with reference to Physical Science & its branches. • History of Physical science and contribution of Indian Scientists in the field of Physics & Chemistry. • Need & importance Physical Science in secondary school & its values in the present context. • Correlation of Physical science with other school subjects. • Aim & objectives of Physical Science. • Bloom's Taxonomy of instructional objectives.	**1. NATURE AND SCOPE OF PHYSICAL SCIENCE** • Meaning, Nature and Scope with reference to Physical Science & its branches. • History of Physical science and contribution of Indian Scientists in the field of Physics & Chemistry. • Need & importance Physical Science in secondary school & its values in the present context. • Correlation of Physical science with other school subjects. • Aim & objectives of Physical Science. • Bloom's Taxonomy of instructional objectives.

- Physical Science in the service of human welfare – Agriculture, Medicine, Industry & Conservation of Environment.

UNIT – II

2. CONTENT AND ITS PEDAGOGICAL ANALYSIS

- Content –
  - Matter in our Surroundings
  - Atom & Molecules
  - Motion
  - Force & Law of Motion
  - Gravitation
  - Work and Energy
  - Sound
  - Acid Bases & Salt
  - Metal & Non-metal
  - Light
  - Electricity
- **Pedagogical Analysis** – Following points should be used for Pedagogical Analysis.

  Following points should be followed for pedagogical analysis on topics covered in the syllabus
- Identification of concept ,b)Listing behavioural outcomes ,c)Listing activities and experiments, d)Listing evaluation techniques
- Concept, Need & Importance of Unit Planning & Lesson Planning

UNIT – III

3. TEACHING LEARNING RESOURCES AND PROCESSES

- Meaning, Principles & Steps of Curriculum construction in Physical Science
- Critical Analysis of Present Secondary School Text-Book with Reference to Haryana State
- Teaching Skills:-
  - Skill of Introducing the Lesson
  - Skill of Illustrate with the help of Examples
  - Skill of Explaining
  - Skill of Stimulus Variation
  - Skill of Black-Board Writing
- Physical Science Laboratory – Importance, Planning, Designing, Equipping, Maintenance of Physical Science equipment & Records
- Audio-Visual Aids: Chart, Models, Film Strip, Radio, Projectors.
- E-learning Resources – Use of Multimedia & Computers, PPT, Internet, Website, Teleconferences.
- Improvised Apparatus – Meaning, Importance & Steps
- Professional Growth of Physical Science Teacher in Service Programme, Orientation Programme, Refresher Courses, Seminars, Symposium, Workshop, Science Fair, Science Exhibition, Projects.

- Physical Science in the service of human welfare – Agriculture, Medicine, Industry & Conservation of Environment.

UNIT – II

2. CONTENT AND ITS PEDAGOGICAL ANALYSIS

- Content –
  - Matter in our Surroundings
  - Atom & Molecules
  - Motion
  - Force & Law of Motion
  - Gravitation
  - Work and Energy
  - Sound
  - Acid Bases & Salt
  - Metal & Non-metal
  - Light
  - Electricity
- **Pedagogical Analysis** – Following points should be used for Pedagogical Analysis.

  Following points should be followed for pedagogical analysis on topics covered in the syllabus
- Identification of concept ,b)Listing behavioural outcomes ,c)Listing activities and experiments, d)Listing evaluation techniques
- Concept, Need & Importance of Unit Planning & Lesson Planning

UNIT – III

3. TEACHING LEARNING RESOURCES AND PROCESSES

- Meaning, Principles & Steps of Curriculum construction in Physical Science
- Critical Analysis of Present Secondary School Text-Book with Reference to Haryana State
- Teaching Skills:-
  - Skill of Introducing the Lesson
  - Skill of Illustrate with the help of Examples
  - Skill of Explaining
  - Skill of Stimulus Variation
  - Skill of Black-Board Writing
- Physical Science Laboratory – Importance, Planning, Designing, Equipping, Maintenance of Physical Science equipment & Records
- Audio-Visual Aids: Chart, Models, Film Strip, Radio, Projectors.
- E-learning Resources – Use of Multimedia & Computers, PPT, Internet, Website, Teleconferences.
- Improvised Apparatus – Meaning, Importance & Steps
- Professional Growth of Physical Science Teacher in Service Programme, Orientation Programme, Refresher Courses, Seminars, Symposium, Workshop, Science Fair, Science Exhibition, Projects.

UNIT – IV	UNIT – IV
4. APPROACHES AND EVALUATION IN TEACHING • Physical Science Inductive – deductive Approach, Critical Inquiry Approach, Maier's Problem Solving Approach. • Methods of Teaching Physical Science – Lecture-cum-Demonstration – Project Method – Laboratory Method • Continuous & Comprehensive Evaluation (CCE) in Physical Science • Construction & Use of Achievement Test in Physical Science • Construction & Use of Diagnostic Test in Physical Science, Preparation of Diagnostic Chart, Identification of Difficulties & Remedial Teaching. • Meaning & Advantages of Task Analysis and Question Bank.	**4. APPROACHES AND EVALUATION IN TEACHING** • Physical Science Inductive – deductive Approach, Critical Inquiry Approach, Maier's Problem Solving Approach. • Methods of Teaching Physical Science – Lecture-cum-Demonstration – Project Method – Laboratory Method • Continuous & Comprehensive Evaluation (CCE) in Physical Science • Construction & Use of Achievement Test in Physical Science • Construction & Use of Diagnostic Test in Physical Science, Preparation of Diagnostic Chart, Identification of Difficulties & Remedial Teaching. • Meaning & Advantages of Task Analysis and Question Bank.

Praticum/Sessional

Any one of the following

i. Development of Five Demonstration Experiments on the Topics Covered in the Syllabus from Physical Science Test-books at the Lower Secondary Level in Haryana State.
ii. Improvisation of Apparatus/Equipment
iii. Seminar Presentation on any Topics given in the Syllabus.

Suggested Readings

Adams, G.S. (1964). *Measurement & Evaluation in Education, Psychology & Guidance*, New York: Halt, Rinehart & Winston.

Aggarwal, J.C. (2005). *Essential of Examination System*. New Delhi: Vikas Publishing House Pvt. Ltd.

Allen, D.W. and Eve, A.W. (1968). *Micro Teaching in Theory to Practices*. Vol. 70, pp. 181-185.

Bloom, B.S. et al. (1956). *Taxonomy of Educational Objectives: The Cognitive Domain*. New York: Longum's Green.

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Das, R.C. (1985). *Science Teaching in Schools*, New Delhi: Sterling Publication Private Ltd.

Harrow, A.J.A. (1972). *Taxonomy of Motor Domain*, New York: Mckay.

Kherwadkal, Anjali (2003). *Teaching of Chemistry by Modern Method*, New Delhi: Sarup & Sons.

Kilpatrick, W.H. (1987). *The Project Method*, Columbia. Teachers College Record.

Krathwohl, D.R., Bloom, B.S. and Maria, B.B. (1964). *Taxonomy of Educational Objectives, Hand-book II, Affective Domain*, New York: David Mckay.

Mager, R.F. (1962). *Preparing Instructional Objectives*, California: Fearon.

Miller, David F. and Blaydes (1962). *Methods & Materials for Teaching Biological Science*, New York: McGraw Hill Book Co.

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Venkataih, S. (2001). *Science Education* in 21st Century, New Delhi:Anmol Publishers.

Wadhwa, Shalni (2001). *Modern Methods of Teaching Physics*. New Delhi: Saroop & Sons.

http://www.scienceworld.wolfram.com/physics.html.

http://www.nobel.se/physics/laureates.html.

Group-II: Pedagogy of Social-Sciences

(i) PEDAGOGY OF SOCIAL SCIENCE

Time: 3 Hours **Max. Marks: 100**
(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i) **Paper setters will set 9 questions in all, out of which students will be required to attempt 5 questions.**

ii) **Q. No. 1 will be compulsory and will carry 16 marks. There will be 4 short-answer type questions of 4 marks each to be selected from the entire syllabus.**

iii) **Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.**

Learning Outcomes

After completion of this course the student –teachers will be able to :

- understand the foundation of teaching Social Science.
- acquaint with different strategies for teaching Social Science at secondary and higher secondary level.
- to provide familiarization with Resources for teaching/learning Social science
- to develop an understanding of methods and approaches of teaching Social Science .
- to enable students to organize co-curricular activities through the Social Science Club.
- prepare achievement test in Social Science at secondary and higher secondary level.
- prepare lesson plans in Social Science for instructional purposes.
- conduct pedagogical analysis of content for teaching in the classroom.
- acquire competence in preparing tools of evaluation Social Science learning.
- acquire skills of analyzing text book in Social Science.

COURSE CONTENTS

Existing	**Corrected**
UNIT 1 1. **Nature & Scope of Teaching of Social Science** • Meaning, Nature and Scope of Social Sciences as a school subject. • Aims and Objectives of teaching Social Sciences at School level. • Values of Teaching Social Sciences • Taxonomy and behavioural Objectives in Social Sciences. • Relationship of Social Science with other subjects and within the subject . **UNIT-2**	**UNIT 1** 1. **Nature & Scope of Teaching of Social Science** • Meaning, Nature and Scope of Social Sciences as a school subject. • Aims and Objectives of teaching Social Sciences at School level. • Values of Teaching Social Sciences • Taxonomy and behavioural Objectives in Social Sciences. • Relationship of Social Science with other subjects and within the subject**.**

2. **Contents and its pedagogical analysis and Lesson planning**
   - Understanding terminology of Social Sciences: Social structure, social stratification, community, state, region, market
   - Meaning, importance and Steps of Pedagogical Analysis.
   - Pedagogical Analysis on the following topics:
     - – Constitution of India
     - – Physical features of India
     - – Indain Freedom Movement
     - – Population
     - – Democracy in the contemporary world
     - – Disaster Management
   - Lesson planning in Social Sciences: Need & Importance, Basic Elements & its Preparation

UNIT 3

3. **Teaching learning resources and process**
   - Meaning, Importance and Principles of designing a good Curriculum of Social Sciences; Critical Appraisal of the Existing Curriculum in Social Sciences, Suggestions for improvement; Approaches of organizing social sciences curriculum-logical, concentric, spiral, chronological.
   - Teaching Learning Material: Textbook & Reference Books, Documentaries, News Papers, Maps, Community, Atlas, and E-resources (Blog, World Wide Web, and Social Networking.)
   - Skills of teaching Social Studies: Skill of Explaining. Skill of Illustration with Examples, Skill of Reinforcement, Skill of Questioning and Skill of Stimulus Variation

UNIT 4

4. **Approaches and Evaluation in Teaching**
   - Classroom Processes: Discovery method, Discussion method, Source method, Survey Method, Concept Mapping and Story Telling. Concept Attainment, Inquiry Training Model.
   - Social Science Club- Meaning, Importance and Organization(Club activities, Exhibitions, Field Trips, Quiz Competitions)
   - Meaning, Importance and Types of Evaluation in Social Sciences.
   - New approaches to Assessment – Question bank, Open Book Examination, Grading & Credit System.

UNIT-2

2. **Contents and its pedagogical analysis and Lesson planning**
   - Understanding terminology of Social Sciences: Social structure, social stratification, community, state, region, market
   - Meaning, importance and Steps of Pedagogical Analysis.
   - Pedagogical Analysis on the following topics:
     - – Constitution of India
     - – Physical features of India
     - – Indian Freedom Movement
     - – Population
     - – Democracy in the contemporary world
     - – Disaster Management
   - Lesson planning in Social Sciences: Need & Importance, Basic Elements & its Preparation

UNIT 3

3. **Teaching learning resources and process**
   - Meaning, Importance and Principles of designing a good Curriculum of Social Sciences; Critical Appraisal of the Existing Curriculum in Social Sciences, Suggestions for improvement; Approaches of organizing social sciences curriculum-logical, concentric, spiral, chronological.
   - Teaching Learning Material: Textbook & Reference Books, Documentaries, News Papers, Maps, Community, Atlas, and E-resources (Blog, World Wide Web, and Social Networking.)
   - Skills of teaching Social Studies: Skill of Introducing, Skill of Illustration with Examples, Skill of Reinforcement, Skill of Questioning and Skill of Stimulus Variation

UNIT 4

4. **Approaches and Evaluation in Teaching**
   - Classroom Processes: Discovery method, Discussion method, Source method, Survey Method, and Story Telling.
   - Social Science Club- Meaning, Importance and Organization(Club activities, Exhibitions, Field Trips, Quiz Competitions)
   - Meaning, Importance and Types of Evaluation in Social Sciences.
   - New approaches to Assessment – Question bank, Open Book Examination, Grading & Credit System.
   - Construction of Achievement Test –

• Construction of Achievement Test – Concept and Steps.	Concept and Steps.

Praticum/Sessional

Existing	Corrected
Any one of the following: i. Explore how cartoons, stamps, currency, magazines, globes and so on be used in teaching of social science. ii. Make an Observation of a place of historical interest/monument nearer to your residence and prepare a report on it/ Prepare a List of Places of Cultural/Historical// Geographical/Economic/ political/scientific interest of your locality iii. Conduct a quiz competition in the class on a day of national importance/Prepare questions for a quiz programme/Prepare an action plan for social science club iv. Prepare a list 10 of books/Journals in social sciences with all bibliographic details for purchasing to the classroom library/Prepare a Text book Material for a Particular Topic. v. Draw different types of maps of World, India, and locality /Create a comparative timeline of events in India and world of Modern age/prepare a plan based on any one Model of Teaching. vi. Prepare a sample of Different Types of Test items on different objectives/ Select a concept in Social Science prepare a diagnostic test vii. Prepare a sample Content analysis /Prepare instructional objectives/Learning Activity/Learning Experience of a Topic from standard 6th or 10th	**Any one of the following:** i. Explore how cartoons, stamps, currency, magazines, globes and so on be used in teaching of social science. ii. Make an Observation and prepare a list of places of historical interest/monument nearer to your residence and prepare a report on it. iii. Conduct a quiz competition in the class on a day of national importance and prepare a report of the same. iv. Prepare an action plan for social science club. v. Prepare a list 10 of books/Journals in social sciences with all bibliographic details for purchasing to the classroom library. vi. Draw different types of maps of World, India, and locality /Create a comparative timeline of events in India and world of Modern age/prepare a plan based on any one Model of Teaching. vii. Prepare a sample of Different Types of Test items on different objectives or Select a concept in Social Science prepare a diagnostic test viii. Prepare a sample Content analysis, Prepare instructional objectives, Learning Activity, Learning Experience of a Topic from standard 6th or 10th.

Suggested Readings

Agarwal, J.C. (1993). Teaching of Social Studies- A Practical Approach, Second Revised Edition, Vikas Publishing House.

Batra, P.(ed) (2010) *Social Science Learning in Schools: Perspective and Challenges*, New Delhi, Sage

Dhamija, N. (1993). *Multimedia Approaches in Teaching Social Studies*, New Delhi: Harman Publishing House

Eklavya (1994) *Samajik Adhyayan Shikshan*: Ek Prayog, Hoshangabad: Eklavya.

George, A. and Madan, A.(2009) *Teaching Social Science in Schools*, NCERT's New Textbook, New Delhi: Sage

Gupta Rainu (2013) *Teaching of Social Science*, New Delhi, Doaba Publications.

Gupta Rainu (2012) *Samajik Vigyan Shikshan*, New Delhi :Doaba Publications.

Khan, S. U. (1998). *History Teaching-Problems: Prospective and Prospect*, New Delhi: Heera Publications

Kochhar, S.K.(1998).*Teaching of Social Studies,* New Delhi: Sterling Publishers Pvt, Ltd

New Delhi.

NCERT (2006). *Position Paper National Focus Group on Teaching of Social Sciences,* New Delhi: NCERT

NCERT Social Science Textbooks for classes VI-X, New Delhi: NCERT.

Group-II: Pedagogy of Social-Sciences

(ii) PEDAGOGY OF COMMERCE

Time: 3 Hours **Max. Marks: 100**

(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i) **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii) **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii) **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After completion of this course the student-teachers will be able to:

- understand meaning, nature and scope of commerce.
- understand aims, objectives and values of teaching commerce.
- Get familiar with the relationship of commerce with other disciplines.
- analyse the content, text-book and curriculum of commerce.
- develop the lesson plan for teaching in classroom.
- develop skills in teaching of commerce.
- acquaint with the various teaching learning resource and methods.
- develop insight into current trends of teaching commerce.
- equip themselves with practices of evaluation.
- develop a research perspective in the field of commerce.

Course content

Existing	**Corrected**
UNIT-I 1. **Concept of Commerce and Instructional Objectives** • Meaning nature and scope of Accountancy and Business studies. • Aims, Objectives and Values of teaching Commerce. • Need and Importance of Commerce in school curriculum at higher secondary level. • Blooms Taxonomy of Objectives (statement of objectives in behavioural terms).	**UNIT-I** 1. **Concept of Commerce and Instructional Objectives** • Meaning nature and scope of Accountancy and Business studies. • Aims, Objectives and Values of teaching Commerce. • Need and Importance of Commerce in school curriculum at higher secondary level. • Blooms Taxonomy of Objectives (statement of objectives in behavioural terms).

• Relationship of Commerce with other Disciplines: Economics, Law, Mathematics, Sociology, Psychology, Statistics. **UNIT-II** **2. Content Analysis and lesson planning** • Pedagogical_Analysis: Identification of concept, Listing behavioural outcomes, Listing activities and experiments, Listing evaluation techniques. Content for Pedagogical_Analysis: – Final A/Cs – Sources of Business finance. – Marketing Mix. – Social Responsibility of Business – Consumer protection – E-commerce • Development of lesson plan: Utility, steps in lesson planning, qualities of a good lesson plan **UNIT-III** **3. Teaching learning resources and Processes** • Commerce curriculum: Principles followed in development of commerce curriculum. Critical appraisal of the existing curriculum in Commerce. Suggestion for improvement • Analysis of prescribed text- book of commerce (XI &XII) • Teaching learning resources: Meaning, Importance and use of Teaching learning resources • Traditional Instructional Material: Charts , Graphs and Specimens • Mass media: Television , Newspaper , Journals • E- resources: Blog , World wide Web , Social Networking • Skills in Teaching – Skill of Introducing – Skill of Explaining – Skill of Probing Questions – Skills of Illustrating with examples – Skill of Stimulus variation **UNIT-IV** **4. Approaches and Evaluation in teaching** • Methods of teaching: – Lecture cum Discussion Method – Project Method – E-Tutoring – Role playing • Concept Attainment Model, Advanced organizer Model and Inquiry Training Model in Teaching commerce • Evaluation: Meaning, Importance , Types and Techniques. • Preparation of Blue print and construction of Achievement Test	• Relationship of Commerce with other Disciplines: Economics, Law, Mathematics, Sociology, Psychology, Statistics. **UNIT-II** **2. Content Analysis and lesson planning** • Pedagogical_Analysis: Identification of concept, Listing behavioural outcomes, Listing activities and experiments, Listing evaluation techniques. • Content for Pedagogical_Analysis: – Final A/Cs – Sources of Business finance. – Marketing Mix. – Social Responsibility of Business – Consumer protection – E-commerce • Development of lesson plan: Utility, steps in lesson planning, qualities of a good lesson plan **UNIT-III** **3. Teaching learning resources and Processes** • Commerce curriculum: Principles followed in development of commerce curriculum. Critical appraisal of the existing curriculum in Commerce. Suggestion for improvement • Analysis of prescribed text- book of commerce (XI &XII) • Teaching learning resources: Meaning, Importance and use of Teaching learning resources • Traditional Instructional Material: Charts , Graphs and Specimens • Mass media: Television , Newspaper , Journals • E- resources: Blog , World wide Web , Social Networking • Skills in Teaching – Skill of Introducing – Skill of Explaining – Skill of Probing Questions – Skills of Illustrating with examples – Skill of Stimulus variation **UNIT-IV** **4. Approaches and Evaluation in teaching** • Methods of teaching: – Lecture cum Discussion Method – Project Method – E-Tutoring – Role playing • Evaluation: Meaning, Importance , Types and Techniques. • Preparation of Blue print and construction of Achievement Test

Practicum/ Sessionals

Any two of the following:

i. Participation in discussion (class level) in any recent development in the area of commerce and prepare a report

ii. Make a report on activities performed by a company regarding its social responsibility

iii. Review at least two research articles on commerce

iv. Make a report of E-Commerce operations of a company

v. Field visit to any one (bank , factory , consumer forum).Prepare a report on functions performed

Suggested Readings

Bruce, J.M and Roger Ottewill (2001). *Effective learning & teaching in business and management.* London: Routledge

Chopra, H.K and Sharma, H. (2007). *Teaching of Commerce*, Kalyani Publishers Ludhiana

Dalal, D.C and Dalal V.C (2008). *Teaching of Commerce* (Hindi Version). Patiala: Twenty First Century Publications

Gupta Rainu (2009). *Teaching of Commerce* New Delhi, Shipra Publications

Kaur, Ravdeep (2012). *Teaching of Commerce* Gurusar Sadhar: GBD Publications

Kumar, Mahesh (2004). *Modern Teaching of Commerce*. New Delhi: Anmol Publications Pvt. Ltd.

Monga Vinty (2009). *Teaching of Commerce Patiala*: Twenty first century publications

Peter Davies, Jacek Brant (2006). *Business, Economics and enterprises*: Teaching School Subjects 11-19. London: Kogan Rage

Rao Seema (2002). *Teaching of Commerce*, New Delhi: Anmol Publicatons Pvt. Ltd.

Shankar T. (2007). *Methods of Teaching of Commerce*, New Delhi: Crecent VII

Group-II: Pedagogy of Social-Sciences

(iii) PEDAGOGY OF ECONOMICS

Time: 3 Hours **Max. Marks: 100**
(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After completion of this course the student –teachers will be able to :

- understand the foundation of teaching Economics.
- apply knowledge of Economic in understanding current socio- economic- political issues for human interests and building future economics activities in the light of past.
- conduct pedagogical analysis of content for teaching in the classroom.
- prepare lesson plans in Economics for instructional purposes
- familiarize with different strategies for teaching Economics at secondary and higher secondary level.
- acquire skills of analyzing text book in Economics.
- develop an understanding of methods and approaches of teaching Economics.
- enable students to organize co-curricular activities through the Economics Club.
- prepare achievement test in Economics at secondary and higher secondary level.
- acquire competence in preparing tools of evaluation Economics learning.

COURSE CONTENT

Existing	**Corrected**
Unit -I 1. **Nature & Scope of Teaching of Economics** • Meaning, Nature and Scope of Economics as a school subject. • Aims and Objectives of teaching Economics at School level • Values of Teaching Economics in present scenario. • Taxonomy and behavioural Objectives in Economics. • Correlation of Economics with Public Finance, Commerce, Law, Geography, Mathematics, Natural Science and	**Unit -I** 1. **Nature & Scope of Teaching of Economics** • Meaning, Nature and Scope of Economics as a school subject. • Aims and Objectives of teaching Economics at School level • Values of Teaching Economics in present scenario. • Taxonomy and behavioural Objectives in Economics. • Correlation of Economics with Public Finance, Commerce, Law, Geography, Mathematics, Natural Science and

Sociology.

Unit- II

2. **Contents and its pedagogical analysis and Lesson planning**
   - Understanding terminology of Economics: Micro Economics, Macro Economics, Market, Production, Business Economics and Budgeting.
   - Meaning, Importance and Steps of Pedagogical Analysis.Pedagogical Analysis on the following topics:
     - Poverty as Challenge facing India
     - Indian economy
     - Globalization
     - Inflation& Deflation
     - Employment
   - lesson planning in Economics: Need & Importance, Basic Elements & its Preparation

Unit-III

3. **Teaching learning resources and process**
   - Meaning, Importance and Principles of designing a good Curriculum of Economics, Critical Appraisal of the Existing Curriculum in Economics, Suggestions for improvement. Approaches of organizing the curriculum of Economics.
   - Teaching Learning Material: Textbook & Reference Books, Documentaries, Graphs, Tables, News Papers, Library and E-resources (Blog, World Wide Web, and Social Networking.)
   - Skills of teaching Economics: Skill of Explaining. Skill of Illustration with Examples, Skill of Probing Questions and Skill of Stimulus Variation

Unit-IV

4. **Approaches and Evaluation in Teaching**
   - Teaching Economics through concept mapping, Inquiry Training model, Advance Organizer model, Project method, dramatization, Survey and field visit.
   - Meaning & Importance of Co-curricular activities. Economics Club – meaning, importance and organization.
   - Meaning, Importance and Types of Evaluation in Economics.
   - Continuous and Comprehensive Evaluation: Meaning, importance & Process.
   - Construction of Achievement Test – Concept and Steps.

Sociology.

Unit- II

2. **Contents and its pedagogical analysis and Lesson planning**
   - Understanding terminology of Economics: Micro Economics, Macro Economics, Market, Production, Business Economics and Budgeting.
   - Meaning, Importance and Steps of Pedagogical Analysis.
   - Pedagogical Analysis on the following topics:
     - Poverty as Challenge facing India
     - Indian economy
     - Globalization
     - Inflation& Deflation
     - Employment
   - lesson planning in Economics: Need & Importance, Basic Elements & its Preparation

Unit-III

3. **Teaching learning resources and process**
   - Meaning, Importance and Principles of designing a good Curriculum of Economics, Critical Appraisal of the Existing Curriculum in Economics, Suggestions for improvement. Approaches of organizing the curriculum of Economics.
   - Teaching Learning Material: Textbook & Reference Books, Documentaries, Graphs, Tables, News Papers, Library and E-resources (Blog, World Wide Web, and Social Networking.)
   - Skills of teaching Economics: Skill of Explaining. Skill of Illustration with Examples, Skill of Probing Questions and Skill of Stimulus Variation

Unit-IV

4. **Approaches and Evaluation in Teaching**
   - Teaching Economics through Discussion method, Project method, problem-solving, dramatization, Survey and field visit.
   - Meaning & Importance of Co-curricular activities. Economics Club – meaning, importance and organization.
   - Meaning, Importance and Types of Evaluation in Economics.
   - Continuous and Comprehensive Evaluation: Meaning, importance & Process.
   - Construction of Achievement Test – Concept and Steps.

Praticum/Sessional

Any one of the following:

i. Explore how cartoons, advertisements, graphs, currency, pictures can be used for teaching Economics.
ii. Content Analysis and preparation of instructional material related to any unit
iii. Prepare ten (10) slides related to economics teaching content at senior secondary level.
iv. Critical appraisal of economics text books at senior secondary level.
v. Field Visits (Banks, Small-Scale Industries, Consumer Cells)

Suggested Readings:

Aggarwal J.C(2009). *Teaching Of Economics, A Practical Approach*. Agra-2: Vinod Pustak Mandir.

Bhatia & Bhatia (1994). *The Principles & Methods of Teaching*.Delhi:Doaba house.

Gupta Rainu (2003) *Teaching of Economics*.New Delhi: Jagdamba Publications.

Gupta Rainu (2004) *Arthshastra Shikshan*. New Delhi;Jagdamba Publications.

Joyce, B. & Weil. M (1979). *Models of Teaching.* New Jersey: Hall Inc.

Kanwar, B.S(1970). *Teaching of Economics.* Ludhiana : Educational Publishers.

Knoph, J.H.(1965)*Teaching of Elementary Economics.* New York: Holt Rinehart and Winston.

Mustafa M, (2005) *Teaching of Economics New Trends and Challenges.* New Delhi: Deep & Deep Publications.

Natarajan S. (1993).*Introduction to Economics of education*, New Delhi: sterling publications Private Limited.

Oliver, J.M.(1975). *The Principles of Teaching Economics*. New Delhi: Heinmann Educational Books Ltd.

Pal, H.R.(2000).*Methodologies of Teaching & Training in Higher Education*. Delhi: Directorate of Hindi Implementation, Delhi University.

Rai B.C. (1991). *Techniques of Teaching.* Luckhnow: Prakashan Kendra

Saxena, Mishra, Mahonty (2004) *Teaching of Economics.* Meerut: Surya Publication.

Tyagi, G.D.(1981). *Arthshastra Shikshan.* Agra: Vinod Pustak Mandir.

Yadav Amita (1999).*Teaching of Economics.* New Delhi:Anmol Publications Pvt. Ltd.

Group-II: Pedagogy of Social-Sciences

(iv) PEDAGOGY OF HISTORY

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After transaction of the course, student teachers will be able to:

- Understand the concept and aims of history as a school subject
- Develop skills and competence to analyse content chronologically for using different methods of teaching history.
- Prepare appropriate test and evaluation techniques to measure the knowledge of history.
- Apply knowledge of history in understanding current socio-economic-political issues for human interests and building future society in the light of past.
- Deduce the logical from the facts of history to be applied for a healthy social life.

COURSE CONTENT

UNIT – I

1. **NATURE, SCOPE, AIMS, AND OBJECTIVES OF HISTORY**
   - Meaning, Nature, Scope of history. Importance of time & space in history
   - Place of history in secondary and senior secondary level school curriculum
   - Aims, objectives and values of teaching history
   - Bloom's taxonomy to formulate objectives in behavioural terms
   - Co-relation of history with other school subjects. Relation of history with present.
   - Classification of history according to geographical boundaries, period and circumstances.

UNIT – II

2. **PEDAGOGICAL ANALYSIS OF CONTENT AND LESSON PLANNING**
   - Meaning and importance of pedagogical analysis

- Points followed for pedagogical analysis: (i) Identification of concept (ii) Listing behavioural outcomes (iii) Listing activities & Experiments (iv) Listing evaluation techniques.
- Some content for pedagogical analysis:

a) Indus valley civilization b) Ashoka The Great c) Mughal dynesty

d) First war of independence (1857 A.D.) , e) Freedom movement and modern India

- Lesson planning: Need and importance, steps involved in lesson planning, features of a good lesson planning.
- Development of self-instructional material (SIM) for secondary and senior secondary level students.

UNIT – III

3. TEACHING-LEARNING RESOURSES AND HELPING MATERIALS

- Curriculum and instructional material: Need for development and designing curriculum in history.
- Principles of curriculum construction, organization of content in history curriculum according to stages of education.
- Development of history text-book, characteristics of a good text book, need of text-book for teaching history.
- Identifying controversial points of history, analytical teaching of such points.
- Meaning, importance and use of helping material, types of helping material
- Selection of helping material: Maps, time lines, flow charts, battle plans, pictures, film-strips, models, computer & internet, radio, T.V. etc.

UNIT – IV

4. APPROACHES AND EVALUATION

- Approaches, methods and techniques of teaching history – need and importance, selection of method to teach specific content.
- Various methods of teaching history: source method, discussion method, lecture-cum-story telling method, dramatization, project method, teaching through field trips and excursions.
- Use of various techniques, tactics and maxims of teaching
- Meaning, objectives and importance of evaluation
- Evaluation techniques and devices, characteristics of a good test in history.
- Preparing, reporting and evaluating the results.

Practicum/ Sessionals

Any one of the following

i. Preparation of time line, flow chart, battle plan, map showing boundaries of any specific dynasty or king or specific period (Individual activity)
ii. Organize trip to historical place/monuments.
iii. Prepare skit/drama from history-events / life history of Mahatma Gandhi (Group-activity)

Suggested Readings:

Chaudhary, K.P. (1975). The effective teaching of History in India. New Delhi: NCERT.

Dhamija, N. (1993). Multimedia Approaches in teaching of Social studies. New Delhi: Harman Publishing House.

Khan, S.U. (1998). History teaching problems, prospectives & prospect. New Delhi: Heera.

Gunnin, D. (1978). The teaching of History. London: Goom Helm Ltd.

Group II: Pedagogy of Social Sciences

(v) PEDAGOGY OF GEOGRAPHY

Time: 3 Hours **Max. Marks: 100**
(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After completion of the course the student teacher will be able to:

- Understand the importance concepts used in Geography.
- Prepare lesson plan for different classes.
- Critically evaluate existing school syllabus and text-books.
- Prepare/handle suitable teaching aids and use them effectively in the classroom.
- Prepare diagnostic & achievement test-administer them analyse the results for providing feedback.
- Pedagogical analysis of contents in Geography.

COURSE CONTENT
Unit-I

1. NATURE AND SCOPE OF TEACHING GEOGRAPHY

- Meaning, nature & scope of Geography.
- Importance of teaching geography as school subject.
- Aims and objective of Teaching Geography at School Level.
- Bloom's taxonomy of objectives.
- Formulation of specific objectives in behavioural terms.

Unit-II

2. CONTENT AND ITS PEDAGOGICAL ANALYSIS

- Meaning, Importance and Steps of Pedagogical Analysis
- Pedagogical Analysis of the following:
  - Latitudes & longitudes
  - Rotation & Revolution
  - Agents of denudation
  - Physical Division of India

- Cash crops of India

- Points to be followed for pedagogical analysis
  - Identification of concepts
  - Listing behavioural outcomes
  - Listing activities and experiments
  - Listing evaluation techniques

Unit-III

3. DEVELOPMENT OF INSTRUCTIONAL MATERIAL

- Development and designing of curriculum
- Development of text books
- Development of self-instructional material
  - Self instructional modules
  - P.L. materials (Linear style) packages
- Development of instructional aids-Maps, atlas, Globes, Charts, Graphs, Models, Film Strips, Film Shades, Utilizaation of T.V., Video OHP, Computer
- Development of lesson plan
- Designing geography laboratory.

Unit-IV

4. APPROACHES & EVALUATION IN TEACHING

- Various methods used – Discovery Method, Discussion method, Problem Solving, Concept Mapping , Project, Laboratory, Story Telling, Concept Attainment Model, Inquiry Training Model.
- Meaning, Importance and Types of Evaluation in Geography
- New approaches to Assessment - Question bank, Open Book, Examination, Grading & Credit System.
- Construction of Achievement Test – Concept and Steps.

Practicum/Sessionals
Any Two of the following:

i. Make an Observation of a place of Geographical interest of your locality and prepare a report on it.
ii. Conduct a quiz competition on Geographical questions in class.
iii. Prepare a list of 10 books/Journals in Geography with all bibliographic details for purchasing in the library/prepare a Text Book Material for a Particular Topic.
iv. Draw different types of maps of World, India and locality.
v. Prepare a sample of different types of test items on different objectives/Select a concept in Geography prepare a diagnostic test.
vi. Prepare a sample Content analysis/ Prepare instructional objectives/Learning Activity/Learning Experience of a Topic from standard 6th to 10th.

SUGGESTED READINGS

Arora, K.l (1976). The Teaching of Geography, Jallandhar: Prakash Brothers.

David B. (1985). New Directions in Geography Education, London: Fehur Press

David, H. (1976). Geography and Geography Teacher, London: Unwin Education Books

Graves, N.G. (1982). New Source book for Geography Teaching, Longman: UNESCoHuckle, J. (1983). Geographical Education Reflection and Action, London: Oxford, University Press

Mohd, Z.U. (1984). Tadress Jugratia, Taraqqui Urdu Board New Source Book for Teaching of Geography UNESCO.

Morrey, D.C. (1972). Basic Geography, London: Hien manns Education Book Ltd.

Neelam D. (1993). Multimedia, Approaches in Teaching Social Studies, New Delhi: Human Publishing House

Verma, J.P. (1960). Bhugol Adhyhan, Agra: Vinod Pustak Mandir

Verma, O.P. (1984). Geography Teaching , New Delhi: Sterling Publication Ltd.

Walford R. (1981). Signposts for Geography Teaching, London: Longman

Group-II: Pedagogy of Social-Sciences

(vi) PEDAGOGY OF ART

Time: 3 Hours **Max. Marks: 100**

(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

iv. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**

v. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**

vi. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- understand the foundation of teaching Art
- develop an awareness of various art forms and their cultural bases.
- familiarize with different strategies for teaching Art secondary and higher secondary level.
- develop skill in use of various art tools and instruments
- develop a perspective and appreciation of art, nature, human existence relationship
- develop an understanding of methods and approaches of teaching Art

Course content

Unit-I

1. **Foundation and Context of Economics**
   - Meaning, nature, and scope of Arts
   - Aims and objectives of teaching Fine Arts
   - Importance and place of Fine Arts in Education
   - Construction of syllabus of Fine Arts at Secondary Education
   - Relationship of Fine Arts with other school subjects
   - Elements of Art (Colour, Form, Space, Texture, Light and Shade)
   - Principles of Art (Balance, Rhythm, Harmony, Unity, Proportion, Dominance)
   - Social and cultural importance of Art

Unit-II

2. **Methods of Teaching , Lesson Planning and use of teaching aids**
   – Lecture-cum-demonstration Method
   – Project Method
   – Observation Method
   – Excursion Method (field trips and tours)

- Preparation of lesson plan from 6th to 12th class
- Use of charts, flash cards and real objects
- Use of ICT

Unit-III

3. **Skill Development**
   - Skill of Art appreciation
   - Skill of observation
   - Skill of Imagination
   - Skill of Visual communication
   - Skill of handling the colours, brushes etc.
   - Skill of Art development in child at different stages

Unit-IV

4. **Professional Efficiency, Measurement and Evaluation**
   - Professional qualities of a good teacher in Art
   - Creativity in Art and Art teacher
   - Organizing Art Exhibition and decorating the classroom
   - Meaning, importance and need of measurement and evaluation
   - Types of evaluation techniques

Practicum/Sessionals

Any one of the following

i. Design
ii. Greeting Cards
iii. Composition
iv. Landscape
v. Collage
vi. Poster

Suggested Readings

Gupta, Arvind (2003). *Kabad se Jugad: Little Science*. Bhopal: Eklavya.

Khanna, S. and NBT (1992). *Joy of Making Indian Toys, Popular Science*. NewDelhi: NBT.

Prasad, Devi (1998). Art as the Basis of Education, New Delhi: NBT,.

Sahi, Jane and Sahi, R(2009).*Learning Through Art*, Eklavya,

Group II: Pedagogy of Social Sciences

(vii) PEDAGOGY OF MUSIC

Time: 3 Hours **Max. Marks: 100**

(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

vii. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**

viii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**

ix. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After completion of the course the student teacher will be able to:

- Understand the aims of teaching Music
- Understand competencies and skills for teaching of Music
- Develop understanding and awareness of the essentials of Music
- Understand the important evaluation procedures in Music
- Demonstrate Aesthetic Sense, Time Sense, Tolerance & Self-confidence

COURSE CONTENT

Unit-I

1. CONCEPT, OBJECTIVE & IMPORTANCE

- A brief history of Indian Music.
- Need and importance of Music in secondary schools in present context.
- Co-relation of Music with other school subjects.
- Aims & Objectives of teaching Music in schools.
- Knowledge of Swaras-difference of Swaras and Sruti:- division of Swaras in measures of Sruti.

Unit-II

2. ESSENTIALS OF MUSIC

- Information about Voice Culture and Carynx.
- Possibilities of Notation for Indian Music.
- Motion and Rhythm in Music.

Unit-III

3. TEACHING LEARNING RESOURCES

- Importance of various Teaching Aids in Music.
- Concept, need and importance of Lesson Planning in Music.
- Qualities of Music Teachers: Gayak, Vadak and Vadykar.

Unit-IV

4. APPROACHES AND EVALUATION IN TEACHING

- Different Method of Teaching Music.
- Meaning, importance and need of evaluation in Music.
- Types of Evaluation Techniques.
- Importance of Classical Music, Suggestions for the Popularization of Classical Music.

Practicum/Sessionals

Any Two of the following :

I. Every Candidate should be able to sing a fast Khyal or play a rezakhoni Gat with Tanas and Alaps or Jhala and Toras in each of the following Ragas: Bhupali, Bhairvi, Brindavani Sarag, Asawari, Bhimplashi, Malkauns, Kaffi.
Every candidate should be able to sing or play a slow Khal (Vilambit Bara Khyal) or Masti Khayal Gat in Asawari and Malkauns Rag.

II. The following Tals are required to be practiced in. Tha's and Dvigun Laya on Table: Teen Tal, Dadra, Juptal, Dharva, Ektal

III. Tuning of the instrument for the instrument player and tuning of the Janpura for vocal music students.

IV. Candidate shall be able to read, write music notation either of Bhatkhande or Vishnu Digamber Pulskar.

SUGGESTED READINGS

Awasthis. *Teaching of Music(Hindi)*, Extension Services, Jallandhar: Govt. Training College
Bhatnagar, S Teaching of Music
Goswami, O. Indian Music
Khande B. Short Historical Survey

Khanna, J.: Teaching of Music
Masan, P.L. Teaching of Music, (Hindi).
Patwardhan, rag Vigvan
Ranaday. Indian Music (Its Physical and Aesthetics)\
Sambamoorthy, P. Teaching of Music

Group-III: Pedagogy of Languages

(i) PEDAGOGY OF ENGLISH

Max. Marks :100

Time: 3 Hours (Theory: 80,Internal: 20)

NOTE FOR PAPER SETTER

- i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
- ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
- iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

LEARNING OUTCOMES

After transaction of the course, student teachers will be able to:

- Familiarize with the elements of English language.
- develop linguistic skills among their pupils.
- conduct pedagogical analysis of the content in English language and develop teaching skills.
- make effective use of introduction aids in teaching of English.
- evaluate the performance of the students.
- explain various teaching methods of English.

Course Content

Unit-1

1. **Nature, Scope and Concept of Language**
   - Importance of teaching English at National and International Scenario.
   - Social history of English language Teaching in India
   - Aims and objectives of teaching English
   - Pedagogical analysis of Prose, Poetry, Grammar, Composition: Objectives and Lesson Planning.

Unit-II

2. **Development of Linguistic Skills, Methods and Approaches of Teaching**
   - Strategies for developing language skills : Listening and Speaking.
   - Developing Reading Skills & reading comprehension: Intensive and Extensive Reading, silent and loud reading.
   - Developing Writing Skills : Characteristics and Techniques for improvement.
   - Teaching grammar – Deductive and Inductive Approach.

- Methods and Approaches of Teaching: Direct, Bilingual, Interactive Communicative Approach, Co-operative learning approach.

Unit-III

3. **Teaching Learning Resources & Processes**
   - Features of English Pronunciation : Stress, juncture and intonation.
   - Co-curricular activities in English classroom : Language games, quiz, debates, group discussions.
   - Importance of Instructional material and their effective use : 1. Charts, 2. Pictures, 3. Chalk board 4. Models, 5. Real Objects, 6. Use of ICT including internet.

UNIV-IV

4. **Development of Professional Efficiency & Evaluation Techniques**
   - Qualities of a good teacher of English
   - Difference between measurement and evaluation
   - Meaning and significance of Comprehensive and continuous evaluation in English.
   - Development of good test items in English (Objective- type, essay - type and short answer type)

Praticum/Sessional

Any one of the following:

i. Preparation of Diagnostic Test, Achievement Test and reading comprehension test.
ii. Preparation of Instructional Material:
   a. Preparing PPT's
   b. Preparation of Charts and Models
iii. Prepare a Remedial programme for a child having English Spelling errors.
iv. Collect Indian folkales and folklores and translate in English.
v. Organise a workshop on improving communication skills of students in a rural school.

Suggested Readings

Bansal, R.K. and Harrison,J.B. (1972) : *Spoken English for Indian*, Madras: Orient Longman Ltd.

Baruag, T.C. (1985): *The English Teacher's Handbook*, New Delhi Starling publishing Pvt.Ltd.

Brumfit,C.J. (1984): *Communicative Methodology in Language Teaching* . Cambridge: C.U.P.

Chadha, S.C. (2004). *Arts and Science of Teaching English* (2nd ed.). Meerut : Surya Publication .

Freeman D.L. (2000). *Techniques and Principles in Language Teaching* ,Oxford: CUP.

Gimson A.C. (1980). *An Introduction to the Pronunciation of English* London: Edward Arnold.

Hornby, A.S. (1968): *A Guide to Patterns and Usage in English*, Oxford: OUP

Kochar, Shasi, Rama Chandran Jyothy (2001). *Teaching of English*. New Delhi.

Lado, Robert (1971). *Language Teaching*, New Delhi: Tata McGraw Hill Publishing House Co. Ltd.

Mendonca, Lawrence, (2002). *Applied English Grammar and Composition.* New Delh: Nav Publications.
NCERT (2005) *Position Paper National Focus Group on Teaching of English*, New Delhi, NCERT.
Paliwal,A.K., (1988): *English Language Teaching*, Jaipur: Surbhi Publication

Rai, Geeta (2009). *Teaching of English,* Meerut : Vinay Rakheja
Sawhney, K.K. & Sharma, K.R. (2004). *Teaching of English,* Jammu : Educational Publishers.
Sharma, Praveen (2008). *Teaching of English Language,* Delhi : Shipra Publications.
Sharma, R.A. (2004). *Fundamentals of Teaching English,* Meerut : R.Lall Book Depot.
Wilkins, D.A. (1983), *Linguistics in English Teaching*, London : Edward Arnold
ELBS Edition.

Group-III: Pedagogy of Languages

(ii) fgUnh f'k{k.k

Maximum Marks :- 100

Time: 3 Hours **(Theory: 80, Internal-20)**

isij fuekZrk ds fy, funsZ'k

- isij fuekZrk iwjs ikB~;Øe esa ls ukS iz'uksa dk fuekZ.k djsxk ftlesa ls fo|kFkhZ dks iakp iz'u djus gksaxsA
- igyk iz'u vfuok;Z gksxk vkSj ;g lksyg vadksa dk gksxkA ;g pkj&pkj vadksa dk pkj NksVs&NksVs iz'uksa ls feydj cusxk ;g iwjs ikB~;Øe ls gksxkA
- nks nh?kZ mÙkjkRed iz'u pkjksa bdkbZ;ksa esa ls gksaxs ftlesa ls fo/kkFkhZ dks izR;sd bdkbZ esa ls ,d iz'u djuk gksxkA nh?kZ mÙkjkRed iz'u lksyg vadksa ds gksaxsA
- lHkh iz'u leku vadksa ds gksaxs

O;ogkjkRed mn~ns';%

- ekr`Hkk"kk fgUnh dh izd`fr ,oa egRo ds ckjs esa O;k[;k dj ldsaxsA
- fons'kksa esa fgUnh Hkk"kk ds egRo dks Li"V dj ldsaxsA
- ikB~;p;kZ ds mifo"k;ksa dk f'k{kk&'kkL=h; fo'ys"k.k ds :i esas O;k[;k dj ldsaxsA
- Hkk"kk ds vk/kkjHkwr dkS'kyks ds f'k{k.k dk vH;kl dj ldsaxsA
- fgUnh f'k{k.k dh fofHkUu fof/k;ksa dk oxhZdj.k dj ldsaxsA
- vf/kxe lalk/kuksa dh igpku dj ldsaxsA
- ewY;kadu izfd;k dks izfriknu dj ldsaxsA
- Cyw fizaV cukdj iz'ui= dk fuekZ.k dj ldsaxsA
- ikB~;dze ds fuekZ.k ds fl)kUrks dh lwph cuk ldsaxsA
- ikB~;iqLrd dh fo'ks"krkvksa dks ifjHkkf"kr dj ldsaxsA
- mPpkj.k ,oa v{kj foU;kl lEcU/kh =qfV;ksa dk fuokj.k dj ldsaxsA

bdkbZ&1

¼1½ **fgUnh Hkk"kk dh Hkwfedk**

- ekr` Hkk"kk fgUnh dk lEizR;;] izd`fr ,oa {ks=
- lafo/kku esa fgUnh Hkk"kk dh fLFkfr ,oa oS'ohdj.k ds lUnHkZ esa fgUnh Hkk"kk dk egRoA
- Cywe }kjk fu/kkZfjr mn~ns'; dk O;ogkfjd iz;ksx A

- fgUnh esa mPpkj.k f'k{k.k] v{kj&foU;kl%& mPpkj.k vkSj v{kj&foU;kl lEcfU/kr =qfV;ksa ds fuokj.k ,oa la'kks/ku esas Hkk"kk;h iz;ksx'kkyk dk egRoA

bdkbZ&2

¼2½ **Hkk"kkbZ dkS'ky ,oa f'k{kk 'kkL=h; fo'ys"k.k%**

¼d½ Hkk"kkbZ dkS'ky dk lkekU; Kku%

1-	Jo.k dkS'ky	3-	Hkk"k.k dkS'ky
2-	iBu dkS'ky	4-	ys[ku dkS'ky

bu dkS'kyksa dks fodflr djus esa lgk;d v/;;u lalk/kuksa dk iz;ksxA

¼[k½ fo|ky; ikB;p;kZ ij vk/kkfjr f'k{kk 'kkL=h; fo'ys"k.k%

x| vkSj i| ds fdlh nks mifo"k;ksa dk f'k{kk 'kkL=h; fo'ys"k.k ¼6 ls 10 rd ds ikB;p;kZ ls½

- f'k{kk 'kkL=h; fo'ys"k.k
  &lEizR;; dh igpku] mn~ns'; js[kkadu] iz;ksxkRed fdz;kvks dks lwphc) djuk] ewY;kadu rduhd fu/kkZj.k

bdkbZ&3

- ikB ;kstuk dk vFkZ] egRo] :ijs[kk ,oa fuekZ.k ¼dEi;wVjhd`r ,oa lwpuk rduhdh ds lg;ksx ls½
- fgUnh Hkk"kk f'k{k.k dh fof/k;kW ,oa vH;kl dk;ZA
  &x| f'k{k.k ¼fofHkUu fo/kkvksa ds :i esa½
  &i| f'k{k.k
  &O;kdj.k f'k{k.k
  &jpuk f'k{k.k ¼dgkuh] i= ,oa fucU/k ds :i esa½

bdkbZ&4

- ikB;dze fuekZ.k ,oa leh{kk
- ikB~; iqLrd dh fo'ks"krk,a ,oa ek/;fed Lrj dh fgUnh ikB~; iqLrd dh leh{kkA
- f'k{kkFkhZ mUu;u ewY;kadu ¼vk/kqfud ewY;kadu rduhd vk/kkfjr½
- iz'ui= dk fuekZ.k ¼mn~ns';okj] iz'uokj] izdj.kokj vad foHkktu ,oa Cyw fizaV dk fuekZ.k rFkk iz'ui= dk fo'ys"k.kA½

iz;ksxkRed fdz;k,W%

fuEufyf[kr esa ls fdlh ,d ij ifj;kstuk dk;Z rS;kj djsA

- fgUnh ds lkfgR;dkjksa esa ls fdlh ,d lkfgR;dkj dh fdlh ,d fo/kk dk vkykspukRed v/;;uA
- fgUnh f'k{k.k esa euksjatukRed fdz;kvksa% 'kCn vUrk{kjh] nksgk vUrk{kjh] izgsfydk dk vk;kstuA

- fgUnh f'k{kd ds fy, ok¡fNr ;ksX;rk,W ,oa O;olkf;d n{krk vkSj lEHkkfor dk;Z{ks= dk KkuA

lanHkZ xzUFk lwph%

1- mek] eaxy- ¼2008½- *fgUnh f'k{k.k*] ubZ fnYyh% vk;Z cqd fMiks
2- d';i] js.kq- ¼2001½- ^*jktHkk"kk fgUnh dk Lo:i** fo'ys"k.k] iVuk% ftKklk izdk'ku] >sye vikVZesaV
3- dqekj] ;ksxs'k- ¼2004½- *vk/kqfud fgUnh f'k{k.k** ubZ fnYyh% ,-ih- ,p- ifCyf'kax dkWjiksjs'ku
4- ik.Ms;] jke'kdy- ¼2004½- ^*uwru fgUnh f'k{k.k** vkxjk% fouksn iqLrd efUnj
5- ikjhd] eerk- ¼2006½- ^*fgUnh f'k{k.k* t;iqj % dYiuk ifCyds'kUl pkWniksy cktkj]
6- HkkfV;k] dSyk'kpunz ,oa eksrhyky prqosZnh- ¼2001½- ^*fgUnh Hkk"kk fodkl vkSj Lo:i*]* ubZ fnYyh % xzaFk vdkneh]
7- O;kl Hkxorhyky ,oa osn izdk'k- ¼2004½- *fgUnh f'k{k.k ds u;s vk;ke*% vkxjk % jk/kk izdk'ku efUnj
8- flag] fujatu dqekj- ¼2006½- ^*ek/;fed fo|ky;ksa esa fgUnh f'k{k.k** jktLFkku% fgUnh xzUFk vdkneh] fryduxj

Group-III: Pedagogy of Languages

(iii) PEDAGOGY OF PUNJABI

Time: 3 Hours **Max. Marks: 100**
(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short -answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- Explain the need and principles of Punjabi Language.
- Develop awareness about basic concepts related to teaching of Punjabi at the secondary level.
- Define linguistic skills and process of development among pupils.
- Conduct pedagogical analysis and develop teaching skills.
- Explain the concept of evaluation and methods of evaluating the performance of students.
- Demonstrate language competencies.

Course content

Unit -1

1. **Nature & Scope of Teaching of Punjabi**
   - Language & its development
     - Meaning
     - importance
     - Nature
   - Formulation of Instructional objectives in teaching of Punjabi
     - Meaning of Instructional objectives
     - Taxonomy of Instructional objectives
     - writing objectives in behavioral terms
   - Correlation
     - Inter correlation of Punjabi language with other languages(Hindi, English, Sanskrit)
     - Intra correlation of Punjabi language (Prose, Poetry, Grammar, Composition)

Unit- 2

2. **Contents and its pedagogical analysis**
   - Pedagogical Analysis- Objectives and lesson planning
     - Teaching of Prose
     - Teaching of Poetry
     - Teaching of Grammar
     - Teaching of Composition

- Development of Language skills
  - Listening
  - speaking
  - Reading
  - Writing
- Teaching skills
  - Skill of Questioning
  - Skill of Explaining
  - Skill of Technology enthusiast
  - Skill of chalk board writing

Unit-3

3. **Teaching learning resources and process**
   - Instructional Material
     - Concept
     - components
     - Importance / use
   - Use of Language laboratory and latest techniques
   - Curriculum of Punjabi Language
   - Text Books of Punjabi Language

Unit-IV

4. **Approaches and Evaluation on Teaching**
   - Remedial Teaching
     - Meaning and significance of remedial teaching
     - Common errors in Punjabi language and their removal
   - Evaluation
     - Concept of test measurement and evaluation
     - Place of Evaluation in the process of teaching learning

Practicum/Sessionals

Select anyone of the following:

i. Preparation of a Diagnostic /Achievement Test.
ii. Organize a quiz competition in Punjabi and analyze the responses of students.
iii. ICT Based presentation on any topic of your choice.
iv. Seminar presentation on any topic given in the syllabus.

Suggested Readings

Singh,G.B.(1981). *Gurumukhi Lipi Da Janam Te Vikas,* Chandigarh: Punjab University Publication Bureau

Singh, G.(1971). *Gurumukhi Lipi Bare*, Ludhinana : Lahore Book Shop

Singh, H.(1966), *Punjabi Bare*, Patiala: Punjabi University

Sekhon, S.S. & Singh, P.P.(1961). *Punjabi Boli Da Itihaas*, Punhabi Bhasha Vibhag

Group-III: Pedagogy of Languages

(iv) laLd`r f'k{k.k

le;% 3 ?k.Vs dqy

vad% 100 ckg~; vad% 80

vkUrfjd vad % 20

iz'u i= fuekZrk gsrq funsZ'k&

lEiw.kZ ikB~;Øe ls ukS iz'u fn, tka,xsA tks lHkh lksyg vadksa ds gkasxsA izFke iz'u vfuok;Z gksxk tks pkj&pkj vadksa ds pkj y?kq iz'uksa ds :i esa lEiw.kZ ikB~;Øe ls fy;k tk,xkA

mís';%

1- ek/;fed Lrj ij fo/kkfFkZ;ksa esa laLd`r&f'k{k.k mís';ksa ds ckjs esa tkx:d djukA

2- laizs"k.k dkS'ky ds egRo dh le> dks fodflr djuk

3- laLd`r f'k{k.k dh fof/k;ksa ls ifjfpr djokukA

4- laLd`r f'k{k.k ds fy, vuqns'kkRed lkexzh dks rS;kj djuk vkSj mls izHkko'kkyh <ax ls iz;ksxkRed dkS'ky fodflr djukA

5- fo|kfFkZ;ksa dks laLd`r f'k{k.k ,oa vf/kxe ds fofHkUu igyqvksa ls ifjfpr djkukA

6- laLd`r f'k{k.k esa funkukRed o mipkjkRed dkS'ky dks fodflr djukA

bdkbZ&1

- laLd`r Hkk"kk ,oa lkfgR; dk egRo o bldk vU; fo"k;ksa ls vUrZlaca/kA
- laLd`r Hkk"kk dk vU; Hkk"kkvksa ls laaca/kA
- vk/kqfud ikB~;Øe esa laLd`r dk LFkkuA
- f=Hkk"kk lw= ,oa vU; 'kkldh; izfrosnuksa dk laLd`r f'k{k.k ij izHkkoA
- laLd`r vk;ksx ds izfrosnu vkSj mlds vuqdj.k dk;Z Ikj foe'kZA
- laLd`r Hkk"kk dk fo'o Hkk"kkvksa ds lkFk lglEcU/k rFkk v/;;u dh izklafxdrkA
- laLd`r f'k{k.k ds y{;] mís'; vkSj budk foHkktuA
- pkjksa ewy Hkk"kkbZ dkS'kyksa dk laLd`r ds lanHkZ esa Kku ,oa vH;kl

bdkbZ&2

- laLd`r Hkk"kk f'k{k.k dh ijEijkxr vkSj vk/kqfud fof/k;ksa dk ifjp;
- ikB'kkyk ¼lw=½ fof/k
- Hk.Mkjdj ¼O;kdj.k vuqokn½ fof/k
- ikB~;iqLrd fof/k
- izR;{k ,oa ekSf[kd fof/k
- lajpukRed mikxe
- vfeØfer vuqns'ku
- laLd`r f'k{k.kkFkZ lwpuk rduhdh ds vk/kqfud lk/kuksa dk Kku ,oa iz;ksx dk vH;kl

bdkbZ&3

- laLd`r Hkk"kk dh fofHkUu fo/kkvksa dk f'k{k.k
- laLd`r O;kdj.k f'k{k.k mís';] egRo] izfØ;k ,oa ikB ;kstuk
- laLd`r i| f'k{k.k mís';] egRo] izfØ;k ,oa ikB ;kstuk
- laLd`r x| f'k{k.k mís';] egRo] izfØ;k ,oa ikB ;kstuk
- laLd`r jpuk f'k{k.k mís';] egRo] izfØ;k ,oa ikB ;kstuk
- laLd`r vuqokn f'k{k.k mís';] egRo] izfØ;k ,oa ikB ;kstuk
- laLd`r f'k{k.k esa vH;kl dk;Z fu;kstu rFkk la'kks/ku izfØ;k

bdkbZ&4

- laLd`r Hkk"kk dh ikB~;lgxkeh fØ;kvksa&'yksdksPpkj.k] Hkk"k.k] vfHku;hdj.k] jpuk ds vk;sktu dk f'k{k.k
- laLd`r esa ekSf[kd dk;Z esa 'kq)rk dk egRo] mPpkj.k v'kqf);ksa ds dkj.k] izdkj rFkk mipkj
- laLd`r ys[ku esa v{kj foU;kl rFkk ys[kuxr =qfV;ksa ds dkj.k] izdkj rFkk mipkj
- laLd`r ikB~;iqLrd fuekZ.k ,oa leh{kk]
- laLd`r Hkk"kk f'k{k.k ds ewY;kdau dh izkphu ,oa vokZphu fof/k;ksa dk f'k{k.k

izk;ksfxd dk;Z%&

- Nk=k/;kid laLd`r ewY;kadu gsrq ek/;fed Lrj ds ikB~;Øe esa ls oLrqfu"B y?kwÙkjkRed rFkk fucU/kkRed iz'ui=ksa dk fuekZ.k laLd`r ek/;e esa djsaxsA

- ek/;fed Lrj dh laLd`r ikB~;iqLrd dh leh{kk djsxsA
- ,d ikB~; iqLrd ds izR;sd ikB ls nl&nl 'kCnksa dk in ifjp; ikoj IokbaV ds iz;ksx }kjk rS;kj djsaxs A
- d{kk ds le o fo"ke vuqØekad okys Nk= Øe'k% xhrk ds izFke vkSj vfUre v/;k; dk 'kkL=h; fo'ys"k.k] O;k[;k vkSj la{ksihdj.k vius 'kCnksa esa djsaxsA

laUnHkZ xazFk lwph%

vkIVs] Mh-th- ,oe Mksxjs ¼1980½- *Vhfpax vkWQ laLd`r bu lSds.Mjh Ldwy]* cMkSnk% vkpk;Z cqd fMiksA

dkys] ,e-vkj- gk;j laLd`r xzkej* xouZeSUV vkWQ bf.M;k% *fjiksVZ vkWQ laLd`r deh'kuA

ik.Ms] vkj-,l- ¼2000½- *laLd`r f'k{k.k]* vkxjk% fouksn iqLrd efUnj

ik.Ms;] jke'kDy *laLd`r f'k{k.k]* vkxjk% fouksn iqLrd efUnjA

feÙky] lUrks"k *laLd`r f'k{k.k*] esjB% vkj yky cqd fMiks

feJ] izHkk'kadj laLd`r&f'k{k.k A

cksfdy ,oe~ ikjlfud *, U;w ,ijksp Vw laLd`r*] iwuk% yksd laxzg izsSlA

lQk;k] j?kqukFk *laLd`r&f'k{k.k*] p.Mhx<% gfj;k.kk lkfgR; vdkneh

flag] ,l-Mh- ,oe~ 'kekZ ¼1999½- *laLd`r f'k{k.k]* vkxjk% jk/kk izdk'ku eaMhA
'kkL=h ,oe~ 'kkL=h *laLd`r f'k{k.k*] t;iqj% jktLFkku izdk'kuA
gqQjsdj *n izksCYe vkWQ Vhfpax vkWQ laLd`r*

Group-IV: Pedagogy of Mathematics

PEDAGOGY OF MATHEMATICS

Time: 3 Hours **Max. Marks: 100**
(Theory: 80, Internal: 20)

NOTE FOR PAPER SETTER

i. **Paper setters will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q. No. 1 will be compulsory and will carry 16 marks. There will be four short-answer type questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.**
iv. **All questions will carry equal marks.**

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- understand the nature of mathematics
- develop an understanding of the correlation of mathematics with external subjects
- teach the concepts and principles of mathematics.
- select appropriate methods of teaching to teach mathematics.
- develop an understanding of innovative trends in teaching of Mathematics
- develop achievement test in mathematics;
- understand preparation and use of diagnostic test and organize remedial teaching;
- understand the application of appropriate evaluation techniques in mathematics

COURSE CONTENT

Unit-I

1. **Nature & Scope of Teaching of Mathematics**
   - Meaning, nature and scope of mathematics
   - History of Mathematics and Contribution of Indian mathematician with special reference to Bhaskaracharya, Aryabhatta and Ramanujam
   - Relationship of Mathematics with other school subjects
   - Aims and objectives of Mathematics teaching
   - Behavioural objectives: meaning and importance of behavioural objectives, writing instructional objectives for teaching of mathematics (Bloom's Taxonomy of Instructional Objectives).

Unit-II

2. **Pedagogical Analysis and Lesson Planning**
   Meaning and importance of Pedagogical Analysis
   - **Points followed for Pedagogical Analysis:** Identification of concept, listing behavioral outcome, listing activity & experiments, listing evaluation techniques
   - **Contents for Pedagogical Analysis:**

- Arithmetic (Number Systems, Fractions, Ratio and Proportion, Profit and Loss, Simple and Compound Interest)
- Algebra (Polynomials, Linear equations, Quadratic equations Arithmetic Progressions)
- Geometry (Congruent and Similar triangles, Constructions and Circles),
- Trigonometry (t-ratios, Heights and Distances)
- Statistics (Measures of Central Tendency and Graphical Representation of Data)
- Menstruation (Areas, Surface areas and volumes of solid figures)

- Skills of teaching mathematics: Skill of Introduction, Skill of Questioning, Skill of Reinforcement, Skill of Illustration with examples and Skill of Stimulus variation
- Lesson planning: Need and importance, steps involved in lesson planning, features of a good lesson plan.

Unit-III

3. Teaching Learning Resources and Processes

- Meaning, Importance and Principles of designing a good curriculum of Mathematics
- Textbooks: Meaning and importance of textbooks in mathematics, qualities of a good textbook in Mathematics
- Applications of ICT in teaching of mathematics
- Meaning and importance and preparation of audio-visual aids in teaching mathematics
- Problems in teaching and learning of mathematics
- Importance and organization of Mathematics Club
- Recreational activities of Mathematics Club
  - Quiz
  - Games
  - Puzzles
  - Mathematics exhibition

Unit-IV

4. Approaches and Evaluation in Teaching of Mathematics

- **Methods of teaching Mathematics**
  - Lecture cum demonstration method
  - Analytic-Synthetic
  - Laboratory
  - Inductive-Deductive
  - Problem Solving
  - Project Method
- **Techniques of teaching Mathematics**
  - Oral work
  - Written work
  - Drill work,
  - Brain Storming,
  - Home Assignment

- Evaluation**:** Meaning, importance and types of evaluation**.**
- Preparation of diagnostic and achievement test.

Praticum/Sessional

Any one of the following

i. Critical study of mathematics text book of secondary school.
ii. Prepare any one self-made teaching aid for teaching of Mathematics in secondary school
iii. Prepare an achievement test of mathematics
iv. Prepare a diagnostic tests of mathematics
v. Prepare slides using MS Power point on any one topic of mathematics

Suggested Readings:

Aggarwal, J. C. (2008). *Teaching of mathematics.* UP: Vikas Publishing House Pvt Ltd.

Bagyanathan, D. (2007). Teaching of mathematics. Chennai: Tamil Nadu Text Book Society.

Bhatia, K. K. (2001). Foundations of teaching learning process. Ludhiana: Tandon

CFAI. (2004). Methodology of teaching mathematics. Hyderabad: ICFAI University Press.

Ediger, M., & Bhaskara Rao, D. B. (2004). *Teaching mathematics successfully*. New Delhi: Discovery Publishing House.

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Goel, Amit. (2006). *Learn and teach mathematics*. Delhi: Authors Press.

ICFAI. (2004). *Methodology of teaching mathematics.* Hyderabad: ICFAI University Press.

James Anice (2005); *Teaching of Mathematics*, Neelkamal Publication.

Joyce., & Well., (2004). *Models of teaching.* U.K: Prentice hall of India.

Kapoor, S. K. (2006). *The teaching of vedic mathematics*. New Delhi: Lotus Press.

Kapur S. K. (2005); Learn and Teach Vedic Mathematics; Lotus Publication

Kapur, J. N. (2002). Suggested experiments in school mathematics. New delhi: Arya Book Depot.

Kulshreshtha, A. K. (2008). *Teaching of Mathematics*. Meerut: R.Lall Books Depot.

Nalikar, J. V., & Narlikar, M. (2001). *Fun and fundamentals of mathematics*. Hyderabad: Universities Press.

Ploker, Kim (2009), *Mathematics in India*: 500 BCE–1800 CE, Princeton, NJ: Princeton University Press,

Pratap, N. (2008). Teaching of Mathematics. Meerut: R.Lall Books Depot. Publications.

Reymond, B. (2000). Math-tricks, puzzles and games. New Delhi: Orient Paperbacks.

Schwartz, S. L. (2007). *Teaching young children mathematics*. London: Atlantic Publishers & Distributors (P) Ltd.

Sharan, R., & Sharma, M. (2006). Teaching of Mathematics. New delhi: A.P.H. Publishing Corporation.

Sharma, R. A. (2008). *Technological foundation of education.* Meerut: R.Lall Books Depot.

Siddizui, M. H. (2005). *Teaching of mathematics*. New Delhi: A.P.H. Publishing Corporation.

Sidhu, K. S. (2006). *The teaching of mathematics*. New Delhi: Sterling Publishers private ltd.

Singh, M. (2006). *Modern teaching of mathematics*. New Delhi: Anmol Publications Pvt.Ltd.

Tyagi, S.K. (2004); *Teaching of Arithmetic*; Commonwealth Publications

Wadhwa, S. (2008). *Modern methods of teaching mathematics*. New Delhi: Karan Papers Backs.

Course 8
KNOWLEDGE AND CURRICULUM

Max. Marks :100
Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**
ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale:

The course "Knowledge and Curriculum" addresses the theoretical foundations of school knowledge from historical, philosophical and sociological perspectives, with critical analysis of curricular aims and contexts, and the relationship between curriculum, policy and learning to shape the educational and pedagogic practice with greater awareness.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- To understand and explore the concept of education
- To develop understanding of philosophical, sociological and historical dimensions of education
- Analyze the philosophical reflections and educational thoughts of great Educational thinkers
- Understand the nature of knowledge in Education and its contribution to status of
- Education as a discipline and interdisciplinary in nature
- Realize the need and importance of equity and equality in education
- Examine the concerns and issues related to curriculum.

Course Contents

Unit-I

1. **Knowledge Basis of Education**
   - Basic concepts of Education: Teaching, Training, Learning, Skill, Beliefs and Education.
   - Contribution of Gandhi & Tagore in relation to child-centered education (activity, Discovery, Dialogue)
   - Concept, sources & types of Knowledge

Unit-II

2. **Social Basis of Education**

- Basic concepts of Society: Socialization, Equity and Equality, Modernity with reference to industrialization, democracy and individual Autonomy.
- The role of culture, economy and historical forces in shaping the aims of education.
- Individual opportunity, social justice and dignity in context of democratic education.
- A study of Secularism, Nationalism and Universalism and their interrelationship with education.

Unit-III

3. Curriculum Development

- Concept of Curriculum and Syllabus: Dimensions of Curriculum and their relationship with aims of education.
- Curriculum at different levels- National, State and School.
- Determinants of curriculum: Philosophical, Psychological, Sociological, Political, Culture and Economic.
- Basic considerations in Curriculum Development.

Unit-IV

4. Curriculum Practices

- Teachers' experiences and concerns: Laboratory work, Library and References, Field Survey, Group Discussion.
- Nature of learner and learning process and subject matter.
- Knowledge and ideology in relation to curriculum and text books.
- National curriculum framework: Concept need and process of development.

Practicum/ Sessionals

Any two of the following:

i. Socio-economic educational survey of near by village/ urban settings.
ii. Role of education in empowerment of weaker sections of society**.**
iii. To analyze and prepare a report on the present curriculum of Haryana School Education Board/ CBSE in the light of various determinates of curriculum development.
iv. Filed survey on impact of present system of education on:
   a) Socialization of child
   b) Modernization with reference to industrialization and individual autonomy.
v. To survey and prepare a project report on how far the present system of education is able to inculcate secularism, nationalism, and universalism.
vi. Blue Print of practice models of Gandhi ji /Tagore for rural reconstruction.

Suggested Readings

Butchvarov, P. (1970), *The Concept of Knowledge*, Evanston, Illinois: North Western University Press.

Chomsky, N (1986). *Knowledge of Language*, New York : Prager.

Cole Luella (1950). *A History of Education: Socrates to Montessori*, NewYork: Holt, Rinehart & Winston.

Datta, D.M. (1972). *Six ways of Knowing*. Calcultta.: Calcultta University Press,

Dewey, J.(1997.)My Pedagogic Creed', in D.J. Flinders and S.J. Thorton(eds.) The Curriculum Studies Reader, New York: Routledge.

Dewey, J (1997) *Experience and Education*, Touchstone, New York

Dewey, J (1956). *The Child and the Curriculum and School and Society*, University of Chicago Press, U.S.A. Chicago, Illinois.

Krishna M. J. (1947) *On Education*, New Delhi: Orient Longman.

Kumar K. (1996). *Learning From Conflict*, New Delhi: Orient Longman.

Lakshmi, T.K.S. & Yadav M.S.(1992). Education: Its Evolving Characteristics, in *New Frontiers in Education*, Vol. XXII, No.4, Oct-Dec.

Margaret, K.T.(1999.) *The open Classroom*, Orient Longman: New Delhi: Hirst. Paul, Knowledge and curriculum.

Peters, R.S.(1967) *The Concept of Education*, UK: Routledge.

Power, E, J., M (1962). *Currents in the History of Education*, New York. : McGraw Hill Book Co. Inc.

Prema C. (2001). *Teaching & Learning: The Culture of pedagogy*, NewDelhi: Sage Publication.

Course -9

ASSESSMENT FOR LEARNING

Max. Marks :100

Time: 3 Hours **(Theory: 80,Internal: 20)**

NOTE FOR PAPER SETTER

i. **Paper setter will set nine questions in all, out of which students will be required to attempt five questions.**

ii. **Q.No 1 will be compulsory and will carry 16 marks. There will be four short - answer type Questions of 4 marks each to be selected from the entire syllabus.**

iii. **Two long answer type question will be set from each of the four units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale:

The course "Assessment for Learning" aims to develop a critical understanding of issues in assessment and explore realistic, comprehensions and dynamic assessment processes which are culturally responsive for use in classroom.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- Understand the nature of assessment and evaluation and their role in teaching-learning process.
- Understand the importance of assessment in continuous and comprehensive manner
- Develop assessment tasks and tools to assess learner's competence and performance
- Devise marking, scoring and grading procedures,
- Devise ways of reporting on student performance
- Analyse, manage and interpret assessment data.
- Develop the habit of reflecting-on and self-critiquing to improve performance.

Course Contents

Unit I

1. **Introduction to Assessment & Evaluation**
   - Concept of Assessment & Evaluation and their inter relationships.

     Purposes and objectives of assessment for placement, providing feedbacks, grading promotion, certification, diagnostic of learning difficulties.
   - Critical review of current evaluation practices:
     a) Formative and summative evaluation
     b) Prognostic and diagnostic
     c) Norm referenced test and Criterion referenced test
     d) Quantitative and Qualitative

Unit II

2. **Assessment of Learning**

- Concept of Cognitive, Affective, Psychomotor domain of learning (Revised taxonomy of objectives (2001)
- Constructing table of specifications & writing different forms of questions – (VSA, SA, ET & objective type, situation based)
- Construction of achievement tests- steps, procedure and uses
- Construction of diagnostic test Steps, uses & limitation
- Kinds of tasks: projects, assignments, performances

Unit III

3. **Assessment Process & tools**
   - Need for CCE its importance and problems faced by teachers
   - Meaning & Construction of process-oriented tools – observation schedule; check-list; rating scale; anecdotal record;
   - Assessment of group processes – Nature of group dynamics; Socio-metric techniques; steps for formation of groups, criteria for assessing tasks; Criteria's for assessment of social skills in collaborative or cooperative learning situations.
   - Portfolio assessment – meaning, scope & uses; developing & assessing portfolio; development of Rubrics.

Unit IV

4. **Construction Interpretation and Reporting of student's performance**
   - Interpreting student's performance :
     a) Descriptive statistics (measures of central tendency & measures of variability, percentages)
     b) Graphical representation (Histogram, Frequency Curves)
     c) NPC – percentile.
     d) Grading – Meaning, types, and its uses
   - Role of feedback to stake holders (Students, Parents, Teachers) and to improve teaching – learning process; Identifying the strengths & weakness of learners.
   - Reporting student's performance – Progress reports, cumulative records, profiles and their uses, Portfolios.

Practicum/ Sessionals

Any one of the following:

i. Construction of unit test, using table of specifications and administering it to target group and
interpreting the result.
ii. Construction of any one of the process oriented tools and administering it to group of students & interpreting it.
iii. Analysis of question papers (teacher made)
iv. Writing self appraisal/ create portfolio.
v. Planning and organizing student's portfolio.
vi. Writing a report on the evaluation and learner practice of school education.
vii. Examine and reflect upon the problems and issues involved in assessment practice of school evaluation.
viii. Activities and Assessment criteria for Work education and Experiential learning, Community service.

Suggested Readings

Bransford, J., Brown, A.L., & Cocking, R.R. (Eds.). (2000). How people learn: Brain, mind, experience, and school. Washington, DC: National Academy Press.
Burke, K. (2005). How to assess authentic learning (4th Ed.). Thousand Oaks, CA: Corwin.
Burke, K., Fogarty, R., & Belgrad, S (2002). The portfolio connection: Student work linked to standards (2nd Ed.) Thousand Oaks, CA: Corwin.
Carr, J.F., & Harris, D.E. (2001). Succeeding with standards: Linking curriculum, assessment, and action planning. Alexandria, VA: Association for Supervision and Curriculum Development.
Danielson, C. (2002). Enhancing student achievement: A framework for school improvement. Alexandria, VA: Association for Supervision and Curriculum Development.
Gentile, J.R. & Lalley, J.P. (2003). Standards and mastery learning: Aligning teaching and assessment so all children can learn. Thousand Oaks, CA: Corwin.
Guskey, T.R., & Bailey, J.M. (2001). Developing grading and reporting systems for student learning. Thousand Oaks, CA. Corwin.
Linn, Robert and Norman E Gronland (2000); Measurement and Assessment in teaching, 8th edition, by Prentice Hall, Inc, Pearson Education, Printed in USA.
Natrajan V.and Kulshreshta SP(1983). Assessing non-Scholastic Aspects-Learners Behaviour, New Delhi: Association of Indian Universities.
NCERT(1985). Curriculum and Evaluation, New Delhi:NCERT
Newman, F.M. (1996). Authentic achievement: Restructuring schools for intellectual quality. San Francisco, CA: Jossey-Bass.
Nitko, A.J. (2001). Educational assessment of students (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
Norris N.(1990) Understanding Educational Evaluation, Kogan Page Ltd.
Rao, Manjula (1998): Training material on continuous and comprehensive evaluation (monograph) Mysore: Regional Institute of Education (NCERT).
Rao, Manjula (2004): Evaluation in schools – a training package (monograph), Mysore: Regional Institute of Education (NCERT).
Singh H.S.(1974) Modern Educational Testing. New Delhi: Sterling Publication.
Ved Prakash, et.al. (2000): Grading in schools, NCERT, Published at the publication Division by the secretary, NCERT, New Delhi: Sri Aurobindo Marg.

Course 10

CREATING AN INCLUSIVE SCHOOL

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER
i. **Paper setter will set five questions in all, out of which students will be required to attempt three questions.**
ii. **Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.**
iii. **Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.**

Rationale

The course "Creating an inclusive school" aims to develop an understanding of the cultures, Policies and Practices that need to be addressed in order to create an inclusive school.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- To define the concept of Disability, Inclusion, Psychosocial construct of disability and identity.
- The course aims to develop an understanding of the Cultures, Policies and Practices that need to be addressed in order to create an inclusive school.
- To analyze the policy and Programme initiatives in the area of inclusion and barrier to learning and participation while formulating a policy of good practice and review.
- To understand how barriers of learning arise from various discriminatory practices, curriculum, teaching approaches, school organization, and various other social and cultural factors.
- To study the role of children, Parents, Community, Teachers, Administrators and Policy Makers in terms of inclusion.
- To explore and understand the possibility of change through inclusive education

Course Contents

Unit I

1. **Inclusive education:**
   - Meaning, nature, need and philosophy of inclusive education.
     a) Models of inclusion,
     b) Barriers to learning and participation.
     c) Implementation and strategies for inclusion in society and school.
   - Constitutional provisions-Govt. policies and practices:
     a) National Policy of Persons with Disabilities Act 2006,
     b) Sarva Shiksha Abhiyan in terms of Inclusive Education.
   - Psycho-social and educational characteristics, functional limitations, role of family and community participation with reference to-Loco motor Impairment,

Hearing Impairment, Visual Impairment, Learning Impairment and Mental retardation

Unit-II

2. **Inclusive practices in classrooms**
    - School readiness and support services for inclusive education.
    - Teacher competencies, role of class teachers and resource teachers in inclusive education.
    - Guidance and counseling in inclusive education.
    - Teaching learning strategies in inclusive education: co- operative learning, peer tutoring, social learning, multisensory learning.
    - Individual Educational Programme (IEP) and use of emerging technologies.

Practicum/ Sessionals

Any one of the following:

i. Preparation of status report on school education of children with diverse needs.
ii. Evaluation of text books from the perspective of differently abled children.
iii. Field visit to school/institutions promoting inclusive practices and discussion with teachers and observation and analysis of teaching learning practices.
iv. Analysis of policy document (national, international) related to diversity.
v. Planning and conducting multi level teaching in the local school.
vi. Critical review of policy and practice and panel discussion by a group of students.
vii. Make a list of existing resources in the local area and discuss their use and limitations based on survey of five inclusive schools.
viii. Study of forms of inequities in the society, education, health, civic participation, social justice and gender.
ix. Case study of a Child with Disability in a village

Suggested Readings

Alur Mithu and Michael Bach, (2009), *The Journey For Inclusive Education In The Indian Sub-Continent.* UK: Routledge

Dettmer, p., Dyck,N.and Thurston, L.P.(1999). Consultation collaboration and teamwork for students with special needs, Needham Heyats, M.a Allyn &Bacon

Epstein, C. (1984) *Special Children in Regular Classrooms.* Virginia: Reston Publishing Company, Inc

Frostig, M, and, P. Maslow (1973) *Learning Problems in the Classroom: Prevention and Remediation*. New York: Grune & Stratton.

Jorgensea, C.M.ed(1998). R restructuring High Schools for all Students: Taking inclusion to the next level, Baltimore: Paul H. brookes.

Hallahan, D & Kauffman, J.M. (1991). Exceptional Children: Introduction to special Education, Englewood, NJ: Prentice Hall.

COURSE 11 (Optional)

(i) ENVIRONMENT EDUCATION

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER
i. Paper setter will set five questions in all, out of which students will be required to attempt three questions.
ii. Q.No 1 will be compulsory and will carry 8 marks. There will be two short -answer type Questions of 4 marks each to be selected from the entire syllabus.
iii. Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- acquaint the concept , need ,scope and objectives of Environmental Education.
- sensitize the global environmental problem.
- explain teaching-learning strategies & evaluation techniques in Environmental Education.
- understand the curriculum development of environmental education.
- understand the role of Media & internet in environmental Issues.
- sensitize toward Environmental disasters**.**

Course Content

Unit-I

1. **Concept of Environmental Education:**
   - Meaning, need and scope of environmental education.
   - Evolution and development of environmental education.
   - Stock Holm conference, Thelisi conference and Earth Summit.
   - Objective of environmental education.
2. **Environmental problems and policies**:
   - Acid rain, Ozone depletion, effect of urbanization, industrialization and deforestation.
   - Global warming and Kyoto Conference.
   - Pollution and its types.
   - Policies related with environmental problems.
   - Sustainable development
   - Environmental legislation in India.
   - Concept of healthy environment
   - Eco club: Meaning, Characteristics & Importance.

Unit-II

3. **Curriculum development and environmental education**:
   - Teaching learning strategies and evaluation techniques in environmental education.

- Planning of environmental education in school, colleges and universities.
- Role of electronic media, mass media and computers in environmental education.
- Curriculum development: India explainer, formal and non-formal approach.

4. **Managing environmental disasters:**
   - Meaning, types, causes and effects of different disasters.
   - Managing environmental disaster at community and individual level
   - Rescue from disaster: Principles governing rescue, rescue process
   - Relief for disaster: preparatory phase of relief ,planning immediate relief, execution of relief.

Practicum/Sessionals

Any one of the following:

i. Prepare a scrap file along with suggestion of pupil-teacher related to environmental articles and news.
ii. Project report on local environmental problem.
iii. Conducting discussion (class level)on disaster management and prepare a report on it.
iv. Participating and promoting Vanamahotsav with school community participation a feast for creating awareness of trees and planting of saplings.
v. On field learning: Raising a nursery/ Kitchen garden.
vi. Organise activities of an eco club in a rural school

Suggested Readings:

Ali Khan,S.&Sterling,(1998). *Sustainable development education*: Teacher education specification, London, Education for sustainable development Panel.
Allaby,M.(1996).*Basics of Environmental Science*. New York: Routledge.
Aptekar.Lewis (1914). *Environmental Disasters in Global perspective*. New York :G.K.Hall; Toronto: Maxwell macmillan.
Burton , Ian , Robert W.Kares and Gilbert F.white(.1993). *The environmental as Hazard*. New York: the Guildford press.
Dani, H.M.(1996). *Environmental Education* .Chandigarh: Punjab University Publication Bureau.
Huckle,J. & Sterling, S.(eds)(1996). *Education for sustainability*, London: Earthscan.
Kaur,T.N.(1999), *Environmental Concerns & Strategies*, New Delhi: Ashish Publication House.
Laeeq Futehally (1994) *Our Environment*. India: National Book Trust
Lambert, P.R.(2000). *Education for sustainable development : a new role for subject association, education in science* ,208.pp.8-9
Pankaj Shrivastava & D.P. Singh (2002). *Environment Education*, Anmol publication Pvt. Ltd.
Pelling, Mark (ed.)(2003).*Natural Disasters & development in a globalizing world* . London: New York; Routledge.
Trivedi, P.R.(2000). *Encyclopedia of environmental Pollution Planning & Conservation*; New Delhi: A.P.H.Co.
Verma V.A. (1972). *Textbook of Plant Ecology*, Delhi: Euolcary Publication.
Warburton D.(ed.)(1998). *Community & Sustainable Development*, London, Earthscan.
Yogendra N.Srivastava (2012). *Environmental Pollution* . New Delhi: PPH Publishing Corporation.

Course-11 (optional)
(ii) PEACE EDUCATION

Max. Marks :50

Time: 1.30 Hours **(Theory: 40, Internal: 10)**

NOTE FOR PAPER SETTER
iv. Paper setter will set five questions in all, out of which students will be required to attempt three questions.
v. Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.
vi. Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- to understand the concept of peace education.
- to acquire the knowledge about peaceful mind makes peaceful world.
- to understand the philosophical thoughts for peace.
- understand the nature of conflicts and their resolution.
- to develop the ability to use various methods and techniques for teaching peace education.
- adopt peace education in the curriculum.
- imbibe the knowledge, attitude and skills needed to achieve and sustain a global culture of peace.
- understand the dynamics of transformation of violence into peace.

Course Contents

Unit -1

1. **Introduction of Peace Education**
   - Meaning, Concept and need of Peace Education.
   - As a universal value
   - Aims and Objectives of Peace Education.
   - Role of Social Agencies: Family, Religion, Mass Media, Community, School, NGO's, Government Agencies in promoting peace education.
   - Current Status of Peace Education at Global Scenario.

Unit-2

2. **Peace In The Indian Context**
   - Role of Religion in propagation of Peace. Mother-Theresa, Vivekananda, Gandhian Philosophy in promoting Peace Education. Role of Great personalities in promoting Peace.
   - Challenges to Peace- Stress, Conflict, Crimes, Terrorism, Violence and Modernization.
   - Strategies and Methods of teaching Peace Education- Meditation, Yoga, Dramatization ,
     Debate and etc.

- Democracy and Peace, Secularism and Peace, Culture and Peace.

Practicum/Sessionals

Any one of the following:

i. Prepare a Role Play of Great Personalities who worked/ contributed towards Peace.
ii. Organize an activity in schools to promote Peace.
iii. Write a report on Gandhi and Peace.
iv. Write about the contribution of any two Noble prize winners for Peace.
v. Prepare an album of Indian Philosophers and write their thoughts on peace.

References

Adams.D (Ed) (1997). *UNESCO and a culture of Peace: Promoting a Global Movement*.

Paris UNESCO.

Taj.H. (2005). *National Concerns and Education*, Neelkamal Publications.pvt.Ltd

Taj.H (2005). *Current challenges in Education*, Neelkamal Publications.pvt.Ltd

Bhargava.M. & Taj.H (2006). *Glimpses of Higher Education*. Agra-2: Rakhi Prakashan,

http://www.un.org/cyberschoolbus/peace/content.html.

Course-11(optional)

(iii) HEALTH, PHYSICAL AND YOGA EDUCATION

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER
i. Paper setter will set five questions in all, out of which students will be required to attempt three questions.
ii. Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.
iii. Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.

Learning Outcomes:-

After the transaction of the course, student teachers will be able to:

- explain the concept of Health, Physical and Yoga Education along with their roles for a healthy Individual.
- under stands the basis of Diet and Nutrition.
- acquaint themselves with ways and means to protect pollution and Global Warming.
- understand correct posture
- understand and apply various ways and means for the safety and security of the child.

Course Contents

Unit-I

1. **Health ,Yoga and Physical Education**:
    - Concept of Health and factors affecting Health
    - Concept and types of Yoga.
    - Physical Education and its objectives.
    - Role of School and society in developing a healthy individual through the programmes of Health, Yoga and Physical Education.
2. **Food and Nutrition:**
    - Diet, Food, nutrition
    - Balanced diet, its functions and components.
    - Types of food according to Yogis and Yogic Diet
    - Malnutrition –causes and prevention

Unit-II

3. **Safety and Security**
    - Communicable diseases- modes, Prevention and control.
    - First Aid in case of Wounds, Hammerages, Fracture, Dislocations, Sprain, Strain and Bites
    - Health Hazards
    - Pollution: Types, causes and prevention
    - Water conservation, management and recycling
    - Global warming
    - Personal and Environmental Hygiene
4. **posture and Physical Fitness:**
    - Postural deformities and their Management through Yogic and other exercises

- Physical Fitness –Elements, importance.

Practicum/Sessionals

Any one of the following:

1. A) Prepare a Medical report of a school student.
   B) Report of common first aid emergencies in school.
2. Performing & Reporting any five advance yoga asana.
3. Prepare a report on health awareness programme in school community.
4. Survey report on health status of students in a rural school
5. celebration of Yoga day/Yoga week.
6. Awareness programme to promote hygiene,sanitation in a nearby village.

References:

Anderson, C.R. *Your guide to health*.

Bucher, C.A. (1964) *Foundations of Physical Education, New York: Mosby and company*.

Catharine Ross Benjamin Caralleso, Robert, J. Cousino (2009). *Modern Nutrition in health and diseases.*

Holmes, A.C. *Health in developing countries*.

Kang Gurpreet singh & Deol NishanSingh.(2013). *An Introduction to Health and Physical Education*,21st century publications,India.

Piper, B. (1999). *Diet and Nutrition: A guide for students and practitioners*.

COURSE 11 (Optional)

(iv) GUIDANCE AND COUNSELLING

Max. Marks :50

Time: 1.30 Hours **(Theory: 40,Internal: 10)**

NOTE FOR PAPER SETTER
i. Paper setter will set five questions in all, out of which students will be required to attempt three questions.
ii. Q.No 1 will be compulsory and will carry 8 marks. There will be two short - answer type Questions of 4 marks each to be selected from the entire syllabus.
iii. Two long answer type question will be set from each of the two units, out of which the student will be required to attempt one question from each unit. Long- answer type questions will carry 16 marks each.

Rationale

The course on "Guidance and Counselling" is designed to introduce the student teacher to the study of concept of Guidance and Counselling, assessing an individual with testing and non testing techniques of guidance and organization of guidance services in the schools.

Learning Outcomes

After transaction of the course, student teachers will be able to:

- explain the concepts of guidance and counseling.
- describe educational, vocational and personal guidance.
- understand the need of assessing an individual.
- familiarize with testing and non-testing devices of guidance.
- get aware of the organization of guidance services in the schools.

Course Content

UNIT-I

1. INTRODUCTION TO GUIDANCE

- Meaning, Nature and Scope
- Principles of Guidance
- Types of Guidance : Educational, Vocational and Personal Guidance (Meaning, Need and Importance, Objectives)

2. COUNSELING

- Concept of Counselling, Need & Importance of Counselling
- Types of Counselling : Directive, Non-Directive and Eclectic
- Meaning and Characteristics
- Process of Counselling

UNIT-II

3. STUDYING AN INDIVIDUAL

- Need and importance of Studying an individual
- Testing and Non-testing devices for the study of an individual
- Testing : Interest Inventories and aptitude tests
- Non-Testing : Interview, Questionnaire Cumulative record card, Anecdotal record, Rating scale

4. GUIDANCE SERVICES AND THEIR ORGANIZATION IN THE SCHOOLS:

- Types of Guidance services
- Role of School personnel in organizing guidance services
- Role of Teacher as a counselor.

Practicum/Sessionals

Any one of the following

i. Make a study of a guidance centre. Prepare a report.
ii. Prepare a cumulative record card of a student studying at secondary level.
iii. Prepare a report on the guidance services organized by school personnel.
iv. Learning and participating in the world of work : Study of local occupations, technologies & skills and work force.
v. Prepare a report on the guidance & counselling needs of Students with Disabilities in a rural school.

Suggested Readings:

Bhatia K.K (2002). *Principles of Guidance and counseling*, Ludhiana : Kalyani Publishers.
Gibren, R.h and Mitchell, M.H (2003). *Introduction to counseling and guidance*, New Delhi: Pearson Educaiton.
Pandey, K.P (2000). *Educational and Vocational Guidance in India*, Varanasi: Vishwa VidyalayaPrakashan.
Robinson (2005). *Principles and Procedures in Students counseling*, New York : Harper & Row.
Sharma, R.A (2008). *Fundamental of Guidance and counseling*, Meerut: R LalI Book Depot.
Sidhu, H.S (2005). *Guidance and Counselling*, Patiala : Twenty First Century.
Strong, R. (2005). *Counselling Techniques in colleges and secondary school.* New York: Harper.

Course EPC-1

Reading and Reflecting on Text.

Max. Marks :50

Time: 3 Hours **(External: 40,Internal: 10)**

Learning Outcomes

After the transaction of the course, student-teacher will be able to:

- Read and respond to a variety of texts in different ways: personal, creative & critical
- Get involved in the readings interactively-individually and in small groups and enhance capacities as active readers and writers.
- Comprehend and think reflectively on spoken or written texts.
- Read critically and analyze course readings and pedagogical experiences.

COURSE CONTENT

Existing	Corrected
Unit 1 • **General Orientation** • Communication- concept and type of communication, overcoming barriers of communication. • Identifying and describe some differences in dhonemic system of language spoken by learners (in first and second language). a. Engaging with narrative and descriptive accounts. The selected text could include stories or chapter from fiction, dramatic incidence, vivid descriptive accounts, or even well produced trip stories. **Suggested Activities:** i. Exposure (native speaker) to give students by using ICT followed by discussion. ii. Narrating/describing a related account from one's life experience (in front of a smaller group) by student -teacher. iii. Re-telling the account – in one's own words/from different points of view (talking turns in a smaller group). iv. Discussion of chapter character and situation sharing interpretation and points of view (in a small group) v. Writing based on text, e. g. summary of scene, extrapolation of a story, converting a situation into a dialogue, etc. (individual text). **Unit II** • Engaging with popular subject- based expository writing (educational and writing) Spelling and punctuation. • The selected text could include articles, Essays and biographical writing with themes that are drawn from the subject area of the students, teachers (various sciences, Mathematics, social sciences, language.) **Suggested Activities:** i. Attending the writing style, subject specific, vocabulary and perspective or	**Unit 1** **1. Text and Reading** Types of Texts: General: Literary or non-literary; Narrative, expository, technical & persuasive. Education: Descriptive, conceptual, historical, policy documents, narrative texts, expository texts, ethnographies. **2. Text and Reflection** • Text structure, language, genre, context, socio-cultural diversity. • Reflection in Reading: Pre-reading, Post-reading. • Previews the text and make predictions, makes connections to personal experience or other texts, asks clarifying questions, identify difficult sentences or passages, restates in own words, reacts to the text by using language laboratory. **Unit 2** **3. Communicative Reader- Interactive reading (Individual and groups)** Concept and relevance of communicative reader. **4. Expressive Reflections** a) Concept of reflective writing b) Critical appreciation of the text: Note taking, critically reviewing the text. **Suggested Activities:** i. Ways of reading: pre-reading and post reading ii. Read a book, a journal Article, or a chapter and write personal responses and summarize. iii. Prepare presentations on literary TEXT – Autobiography / ethnographic text. iv. Beyond the textbook: reading comprehension and question –answers. v. Preparing a Vocabulary Book (50

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<td>Unit III</td>
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reference frame in which different topic are presented- (group discussion).
ii. Writing a review or a summary of the text, with comments and opinion.
• Engaging with journalistic writing
• Student teacher will select newspaper/magazine articles on topics of contemporary issues.
• Analyze the structure use of articles by identifying sub-heading, keywords, sequencing of ideas, use of concrete details and statistical representation.
• Articles on topics of interest for write collage magazine/wall.

• Engaging with subject – related reference books.
• Sequence of Activities
i. Students teacher (in small group) will make a choice of a specific topic in their subject area which they could research from a set of available references books.
ii. Search relevant references books from library/internet source and extract relevant information.
iii. Makes notes on these ideas in some schematic from (flow diagram/mind map)
iv. Plan a presentation with display and oral comments.
v. Make presentation to whole group.
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words), with Meanings and Usage.
vi. Writing a book review and critically analyze the Content and Language of the text.
vii. Make a list of reading books of diverse texts and classify them under headings.
viii. Conduct interactive group reading session (small groups).
ix. Narrating/describing a related account from one's life experience (in front of a smaller group).
x. Discussion of characters and situations – sharing interpretations and points of view (in a smaller group).
xi. Read a book and identify the text structure, language, genre, context, socio-cultural diversity.
xii. Reading to extract overall meaning, information, subject knowledge (guided reading in pairs and simple note making).
xiii. Explain the gist of the text/topic to others (in the larger subject group)
xiv. Discussion of the theme, sharing responses and points of view (small group discussion).
xv. Conduct debates/discussions, role-playing, dialogues on educational policies and documents on them by using language laboratory.
xvi. Study and reflect on Biography of Gandhi ji..
xvii. Studying and reporting health concerns/ drainage system of school/ village.
xviii. Writing expenditure account for an activity/function and house hold family budget plan.
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EPC-2
Drama and Art in Education

Max. Marks :50

Time: 3 Hours **(External: 40,Internal: 10)**

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- develop aesthetic sensibilities in students to learn the use of art in teaching- learning.
- shape student consciousness through introspection and imagined collective experiences

1. **Drawing and Painting**
    - Representational Drawing and painting from nature – plants, foliage, flowers, birds and animals etc. (medium – pencil, pen & ink, crayon, water-colour- any two medium)
    - Perspective Drawing.
    - Still-life study (medium – pencil, pen & ink, crayon, water colour, oil-colour, acrylic colour – any two medium).
    - Composition Painting – (Crayon, Water-colour, Oil-colour – any two medium).
    - Arrangement printing with leaf, finger, cork, stamps, cardboard, jute and bandage texture– any two medium.
    - Monotype surface-printing, Thread-print, Stencil-print, spray-print, Simple block making and print – Potato-cut-print, vegetable print with lady finger, Simple block making and print – Potato-cut-print, vegetable print with lady finger, – any two medium.
2. **Creative Art /Drama**
    - Creative pictorial or geometrical design – Water colour / Pastel colour.
    - Surface design – Floor decoration (Alpana, Rangoli), Wall decoration.
    - Poster-Design (Monochrome / multi-colour).
    - Simple lettering for communication, calligraphy.
    - developing narratives in visuals, composition of an imagined situation
    - telling a story through comic strips, creating a collage using images, bits cut-out from old magazines, news paper etc.
    - Collecting and arranging rare photographs, photo print on various theme.
    - Understanding the Drama as a medium of instructions and its role in effective teaching. It should be based on the lesson from particular subjects of teaching: One Act Play, Skit, Mono Acting, Voice Play, Storey Board etc. should be implemented as one of the effective teaching aid.
    - The prospective teacher will prepare minimum TWO lessons through drama. The contents will be from or based on the lesson to teach in the class.
    - Reflective report on curriculum of Art, Craft, Drama, Music and Theatre in schools.
    - Tailoring, Stitching , Knitting and folk arts- Preparing samples.

Course EPC 3

Critical Understanding of ICT

Max. Marks :50

Time: 3 Hours **(External: 40,Internal: 10)**

Learning Outcomes

After the transaction of the course, student teachers will be able to:

- acquire knowledge of computers, its accessories and software.
- acquire the skills of operating a computer in multifarious activities and integrate technology into classroom teaching learning strategies.
- demonstrate the use of MS Windows
- develop skill in using MS-Word, Power points and Spread sheets.
- acquire skill in accessing world wide web and Internet and global accessing of information.
- Interact with ICT and its integration in education.
- select and use effectively ICT tools and relevant software applications for specific purpose in teaching learning process.

COURSE CONTENTS

1. **ORIENTATION TO ICT**

- **ICT:** Meaning, Importance and Tools of ICT
- **Computer Fundamentals:** Basic anatomy, types and applications, Input-Output devices, Storage devices.
- **MS-Windows**: Basic components of Windows, Control Panel, Program Manager, File Manager, Accessories, Paint Brush, notepad.
- **MS Word:** Concept of word processing, Entering Text, Selecting and Inserting text, editing text, Making paragraph, Getting help, moving and copying, searching and replacing, formatting character and paragraph, handling multiple documents, Manipulation of tables and foot notes, table of contents and index, sorting, formatting sections and documents.
- **MS Excel:** Basics of Spreadsheet, creating and saving a worksheet, Manipulation of cells, Columns and Rows, editing and formatting a worksheet, embedding charts, use of simple statistical functions, sort and filter.
- **MS Power point:** Basics of power point, creating a presentation, the slide manager, preparation of different types of slides, slide design, transition and animation and presentation of slides, printing the slides and handouts.
- **Multimedia:** Components of Multimedia, Textual Information, Animation, Digital Audio, Digital Video, MS-Publisher, Photo Draw.

2. **DIGITAL SHARING AND EXCHANGE OF INFORMATION**

- **Internet:** the world-wide web, websites and web browsers, Internet connectivity, browsing software, URL addresses, Search engines, Exploring websites and downloading materials from websites, E- mail – Sending, receiving and storing mail, handle attachments, Chatting, social networks, participate in discussion forum and blogging.

3. **ICT TOOLS AND ITS INTEGRATION IN EDUCATION**

  - Over-head Projector

- LCD Projector
- T.V.
- Camera
- Visualizer
- Interactive Boards
- CD/DVD Player

Hands On Training:

i. Administrative use – Letter correspondence and E-Mail
ii. Construction of a Portfolio and Question paper of teaching subjects
iii. Creating learning materials – handouts
iv. Data processing, storing and retrieving simple financial transactions of the school such as school budget and accounting.
v. Tabulation of Bio data of staff and students of the school in which the student teacher is attached for practice teaching.
vi. Students progress record – Tabulation and graphical representation of results of an academic test.
vii. Multimedia presentation on a topic relevant to the Optional Subjects
viii. Prepare transparencies on a topic relevant to the Optional Subjects.
ix. Organizing science and technology based activities/services for the community and/or the locality.

A softcopy of above activities should be presented at the time of external examination.

Suggested Readings

1. Copestake, S. (2004). Excel 2002. New Delhi: Drem Tech Press.
2. Hahn, H. (1998). The internet- complete reference. New Delhi: Tata McGrow Hill Publication.
3. Intel Education & NCTE. (2007). Hand book for teacher educators. Bangalore: NCTE.
4. Leon, A. M. (2001). Computer for every one. New Delhi: Vikas Publishing house.
5. Petzold, C. (1998). Programming windows. USA: Microsoft Press.
6. Sundararajan, K. (1998). Internet. Chennai: Kannadhasan Publications.
7. Stone, E. (1996). How to use Microsoft Access. California: Emergyville.
8. Simon, C. (1995). The way microsoft windows 95 works. USA: Microsoft Press.
9. Srinivasan, T. M. (2002). Use of Computers and Multimedia in education. Jaipur: Aavisakar Publication.

EPC-4

Understanding the self

Max. Marks :50

Time: 3 Hours **(External: 40,Internal: 10)**

Existing	Approved & Included
NIL	**Objectives** • To enable the student teacher to discover oneself. • To orient the student teacher the significance of knowing oneself. • To understand the process of identity formation. • To examine the effects of stereotyping and prejudice. • To equip student teachers with skills for empathetic listening and self expression. • To evolve as a progressive and flexible teacher. **Course Content** **General Orientation** • Concept of self and self identity • Exploring oneself: Self identity; Potential of self; fear; aspiration • Factors affecting self identity: Social, Cultural, Gender, Religion & Language. • Role of teacher as a facilitator in self exploration of pupil teacher. **Suggested Activities:-** (i) Self expression through varied forms: Poetry, Aesthetic Representation (painting, Poster Making, sketch & Cartoon making) (ii) Critically evaluate oneself as a 'Prospective teacher' (Self Appraisal Report) (iii) Write a self reflective accounts of significant experiences concerning gender, stereotypes and prejudices. (iv) Role play and Paired activity for empathetic listening. (v) Critically reflects on one's teaching-learning practices.

	(vi) Yoga sessions (vii) Conducting workshop on following issues: a) Self Awareness b) Self Identity c) Sharing life turning incidents d) Meditation workshop e) Gender biasness f) Stereotyping and prejudice g) Marginalization h) Role of media in dealing with above issues. (viii) Case study of Happiness, Pleasure and Non-violence in school/ classrooms. **Suggested Readings:** Brooksfield, S.d.(1995). Becoming a critically refelective teacher. San Francisco. CA:Johm Wiley & Sons. Duval. T.S., & Silvia, P.J(2001). Self awareness and causal attribution: A dual systems theory. Boston: Kluwer Academic. Phillips, A.g., & Silvia. P .J. (2002). Self-awareness, self evaluation and creativity. Personality and social psychology Bulletin, 30. 1009-1017. Gurol.A (2010). Determing the relective thinking skills of pre-service teachers in learning and teaching process. Firat University. Turkey.

School Internship Programme (SIP)
&
Engagement with the Field (EWF)

<table>
<tr><th>Existing</th><th>Proposed</th></tr>
<tr><td>
Schedule for School Internship Programme
First Year
Duration: Four (04) Weeks
f) Observation of school functioning in terms of Teaching- Learning process and related tasks.
g) Observation of classroom teaching undertaken by school teacher and assisting the teacher in Teaching- Learning process.
h) Developing teacher sensibilities and skills under the mentorship of school Head/ school teacher/ faculty
i) Development of Learning Material
j) Understanding the Diverse needs of the learners
k) Report of School Based activities undertaken during the period : CEC; School Record; Time Table

Second Year
Duration: Four (16) Weeks
• Observation of various School Activities/ functioning of the particular school allotted to the pupil Teacher – (one week)
• Supervised Delivery of lessons in the school : 180 (90 in each pedagogy paper)
• Peer Observation : 1 daily
• Criticism lesson: 4 (2 in each pedagogy subject)
• Organization of co-curricular activities
• Maintenance of school record
• Community Based activities
l) Note : lessons to supervised by school Head/ school teacher/ faculty
</td><td>
Course-13
School Internship Programme (SIP)
&
Engagement with the Field (EWF)
Duration
B.Ed. - Ist Year: SIP- 1 Week
EWF- 3 Weeks
B.Ed.- IInd Year: SIP- 14 Weeks
EWF- 2 Weeks

‘Student-Teachers’ Tasks:

A) Engagement with the Field (EWF)

This includes sustain engagement with Self, Child, Community and School at different levels through establishing close connection between curricular areas. This would include task and assignments running through all curricular areas i.e. Perspectives in education, Curriculum & Pedagogical studies and EPC. Evaluation of these tasks and Assignments will be considered with respective Course I to XII (part of Internal Assessment).

B) School Intership Programme (SIP)
During SIP a ‘student-teacher’ shall observe & undertake various activities aimed at understanding the ‘Internship School’ and the ‘Community’ around.

B.Ed. – Ist Year

Observation of school functioning in terms of :
i) Teaching- Learning process and related tasks & Classroom teaching undertaken by school-teacher.
ii) Developing teacher sensibilities and skills under the mentorship of school Head/ school teacher/ faculty.
iii) Understanding need & process of CCE (Comprehensive & Continious Evaluation), Maintenance of various records, Development of learning material.
iv) Documentation of the above activities in the form of a brief comprehensive report.

B.Ed. – IInd Year

1. Observe and record 10 lessons of regular classroom teaching of teachers for each pedagogic subject This write up will be preceded by general information of PT and with particular focus on
i. Teaching method
ii. Use of teaching aids
iii. Pupil teacher interaction in the class
iv. Class room management
</td></tr>
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	v. Homework (checking and feedback) 2. Critically analyse syllabus and textbook of respective pedagogic subject for one class. This write up will be preceded by general information of PT with particular focus on i. Physical Aspect ii. Nature of Content iii. Organisation of Content iv. Presentation of Content v. Style vi. Illustration vii. Exercise & Project viii. Bibliography 3. Observe and record 10 lessons of regular classroom teaching of Peers for each pedagogic subject. This write up will be preceded by general information of PT with particular focus on: *i. Teaching method* *ii. Use of teaching aids* *iii. Pupil teacher interaction in the class* *iv. Class room management* *v. Homework (checking and feedback)* 4. Prepare a brief report of the internship school. *i. General Information of PT* *ii. Physical infrastructure* *iii. Pupil Teacher Ratio (PTR)* *iv. Curriculum Transactions* *v. Pupil Teacher Interaction(curricular as well as co-curricular)* 5. Plan and write five lesson each of both the pedagogic subjects as follows: *i. General information* *ii. Instructional Aids* *iii. Writing Objectives in Behavioral terms* *iv. Assumed Previous Knowledge* *v. Previous Knowledge Testing Questions* *vi. Announcement of the topic* *vii. Presentation* *viii. Recapitulation* *ix. Home-Assignment* 6.Teach 2-4 period per day in respective pedagogic subject 7. Teach classes as and when directed by the mentor teacher /head of the lab school. 8. Prepare and use teaching aids like model/chart/ flash card etc for making the teaching effective and interesting. At least 2 teaching aids in each subject shall be evaluated for the purpose of internal assessment. 9. Prepare a question paper of full syllabus of any one chart for any one subject along with its blue print: 10. Preparation of a diagnostic tests and organisation of remedial teaching 11. Undertake action research project on at least one

	problem area of schooling. 12. Identify, plan and execute any one activity closely related to the local environment. 13. Maintain a reflective diary to record day to day happenings and reflections thereon. *While selecting the units of the syllabus, the student-teachers shall follow the annual instructional plan drawn by the host school.*

List of Contributors

Development of Draft Syllabi - B.Ed -2 year course as per NCTE curriculum frame work 2014

K.U.K

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28	Mrs. Rita Saini, Assistant Professor (on contract), University College of Edu., KUK.
29	Mrs. Reena Yadav, Assistant Prof.(on contract), University College of Edu., KUK.
30	Dr. Mamta Chawla, Assistant Prof. (on contract), University College of Edu., KUK.
31	Ms. Puja Saini, Assistant Prof. (on contract), University College of Edu., KUK.

List of Participants

Consultative Meeting regarding development of Draft Syllabi of B.Ed -2 year course as per NCTE curriculum frame work 2014)held on 22.04.2015 at University College of Education, K.U.K

Sr. No.	Name
1	Dr. Taruna.C.Dhall, Principal (Off)- Associate Prof., University COE, KUK.
2	Dr. B.S.Yadav, Associate Prof.University College of Edu., KUK.
3	Dr. Amisha Singh, Associate Prof. University College of Edu., KUK.
4	Dr. Pinki Malik, Assistant Professor, University College of Edu., KUK.
5	Dr. Rajwinder Kaur, Assistant Professor, University College of Edu., KUK.
6	Dr. Rohini, Assistant Professor, Member, University College of Edu., KUK.
7	Mrs. Kanwal Preet Kaur, Assistant Professor, University College of Edu., KUK.
8	Mr. Digvijay Singh, Assistant Professor, University College of Edu., KUK.
9	Mrs. Rita Saini, Assistant Professor, University College of Edu., KUK.
10	Mrs. Reena Yadav, Assistant Professor, University College of Edu., KUK.
11	Dr. Mamta Chawla, Assistant Professor, University College of Edu., KUK.
12	Ms. Puja Saini, Assistant Professor, University College of Edu., KUK.
13	Dr. Renu Gupta, Principal, Hindu College of Education., Sonipat
14	Dr. Ramesh Sandhu, Associate Prof., C.R.College of Education, Hissar.
15	Dr. Purnima, Assistant Professor , C.R.College of Education, Hissar.
16	Prof. V.K.Gupta, . Principal (Rtd), UCEK, KUK.
17	Dr. Saroj Sobti, Assistant Professor,Dr.G.D.D.A.V. College of Education for Women, Karnal.
18	Dr. Kamlesh Sandhu, Principal, RKSD. College of Education, Kaithal.
19	Dr. Mrinalini Somnath, Principal, Ch.I.S.M. COE, Pundri.
20	Dr. Anju Walia, Member, Principal, SNS College of Education, Yamuna Nagar
21	Dr. Shashi Manchanda, Principal, G.V.M.College of Education, Sonipat
22	Dr. G. Ponmeni, , Assistant Professor, DDE, K.U.K.
23	Dr. Chander Prabha, Associate Professor, C.R.College of Education, Hissar.
24	Dr. Ajit Singh, Associate Professor, C.R.College of Education, Hissar.
25	Dr. Narender Kaushik, Associate prof. , SLDAV, College of Education, Ambala City
26	Dr. Raj Kumar, Asstt. Prof., Deptt. of Education, CDLU, Sirsa.
27	Dr. Vinod Kumar, Asstt. Prof., Deptt. of Education, CDLU, Sirsa.
28	Dr. Ram Niwas, Dy. Dean, Dept. Of education, G.K. University. Talwandi Sabo, Bathinda (Pb)
29	Dr. Rita Grover, Associate Prof. (Rtd), U.C.E.K

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester III (w.e.f Session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	0	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	ES-205	Principles of Programming Languages	3:0:0	3	3	75	25	0	100	3
2	PC-CS-201	Data Structure and Algorithms	3:0:0	3	3	75	25	0	100	3
3	ES-207	Digital Electronics	3:0:0	3	3	75	25	0	100	3
4	PC-CS-203	Object Oriented Programming	3:0:0	3	3	75	25	0	100	3
5	BS-205	Mathematics-III	3:0:0	3	3	75	25	0	100	3
6	HM-902	Business Intelligence and Entrepreneurship	3:0:0	3	3	75	25	0	100	3
7	PC-CS-205L	Data Structure and Algorithms Lab	0:0:4	4	2	0	40	60	100	3
8	ES-209L	Digital Electronics Lab	0:0:4	4	2	0	40	60	100	3
9	PC-CS-205 L	Object Oriented Programming Lab	0:0:4	4	2	0	40	60	100	3
		Total		**30**	**24**	**450**	**270**	**180**	**900**	
10	SIM-201*	Seminar on Summer Internship	2:0:0	2		0	50	0	50	

***Note: SIM-201* is a mandatory credit-less course in which the students will be evaluated for the Summer Internship (training) undergone after 2nd semester and students will be required to get passing marks to qualify.**

ES-205	Principles of Programming Languages						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of programming languages for design and implement the software intensive systems.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of programming language, the general problems and methods related to syntax and semantics.						
CO 2	To introduce the structured data objects, subprograms and programmer defined data types.						
CO 3	To outline the sequence control and data control.						
CO 4	To introduce the concepts of storage management using programming languages.						

Unit-I: Introduction, Syntax and Semantics

Introduction: A brief history, Characteristics of a good programming language, Programming language translators-compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.
Syntax and Semantics: Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

Unit-II: Structured data objects, Subprograms and Programmer Defined Data Types

Structured data objects: Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.
Subprograms and Programmer Defined Data Types: Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

Unit–III: Sequence Control and Data Control

Sequence Control: Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing
Data Control: Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

Unit-IV: Storage Management and Programming Languages

Storage Management: Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.
Programming Languages: Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

Suggested Books:

- Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.
- Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill, 2009.
- Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.
- C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS201	Data Structure and Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of Data structure , basic data types ,searching and sorting based on array data types.						
CO 2	To introduce the structured data types like Stacks and Queue and its basic operations's implementation.						
CO 3	To introduce dynamic implementation of linked list.						
CO 4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

Unit-1

Introduction to Data Structures, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

Arrays, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices,
Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble, Radix Algorithm

Unit-2

Stacks: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

Queues: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and Its Implementation, Priority Queues and Its Implementation, Applications of queues.

Unit-3

Linked Lists: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List.

Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List. Dynamic Implementation of Stacks and Queues.

Unit-4

Trees: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals. Representation of Infix, Post-Fix and Prefix Expressions using Trees.

Introduction to Binary Search Trees: B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

Graphs: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Minimum-Spanning Trees, Warshal Algorithm, Graph Traversals Algorithms: Breadth First and Depth First.

Suggested Books:

- Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.
- Data Structures and Algorithms by PAI, TMH.
- Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
- Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
- Data Structures and Program Design in C by Robert Kruse, PHI,
- Shukla, Data Structures using C++, Wiley India
- Introduction to Computers Science -An Algorithms Approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
- Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

ES-207	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.						
Course Outcomes (CO)							
CO1	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions						
CO2	To introduce the methods for simplifying Boolean expressions						
CO3	To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits						
CO4	To introduce the concept of memories and programmable logic devices.						

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations,Logical Operators, Logic Gates-AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map and Quine McCluskey Tabular method.introduction of TTL and CMOS Logic and their characteristics, Tristate gates.

UNIT II COMBINATIONAL CIRCUITS

Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Look-Ahead Carry Adders. BCD adder, BCD subtractor, Parity Checker/Generator, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder ,BCD to Seven segment Display Decoder/Driver, LCD Display, and Comparators.

UNIT III SEQUENTIAL CIRCUITS

Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Edge triggering, Level Triggering; Flip Flop conversions; Master-Salve JK.

Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers, Shift Register Counters. Introduction to counters, Types of Counters-Asynchronous and synchronous counters, Up/Down Synchronous Counters, Modulo-n Counter , State table, excitation table concepts, Design of asynchronous and synchronous counters, Ring Counter, Applications of counters.

UNIT IV CONVERTER and MEMORY DEVICES

Digital to Analog Converter, Weighed Register: R-2R Ladder Network: Analog to Digital Conversion, Successive Approximation Type, Dual Slope Type.

Classification of memories - ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM: - RAM organization - Write operation, Read operation, Memory cycle, Timing wave forms, memory expansion, Static RAM Cell, MOSFET RAM cell structure, Dynamic RAM cell structure, Programmable Logic Devices - Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of PLA, PAL using ROM.

Suggested Books:

- Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.M.
- Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
- ALI, Digital Switching Systems, , TMH
- A.K. Maini, Digital Electronics, Wiley India
- John F. Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
- John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
- S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
- William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
- Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
- Donald D. Givone, Digital Principles and Design, TMH, 2003.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS203	**Object Oriented Programming**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

Unit–1

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Controlling Access Function, Constant, Class Member, Structure and Class

Unit-2

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,
Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

Unit-3

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

Unit-4

Text Streams and binary stream, Sequential and Random Access File, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.
Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

Suggested Books:

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BS-205	Mathematics-III						
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessional**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To familiarize the prospective engineers with techniques in sequence and series, multivariable calculus, and ordinary differential equations.						
Course Outcomes (CO)							
CO1	To develop the tool of sequence, series and Fourier series for learning advanced Engineering Mathematics.						
CO2	To introduce effective mathematical tools for the solutions of differential equations that model physical processes.						
CO3	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.						
CO4	To familiarize the student with calculus of vector functions that is essential in most branches of engineering.						

UNIT-I

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, D'Alembert's Ratio test, Logarithmic test, Cauchy root test, Raabe's test).
Fourier series: Introduction, Fourier-Euler Formula, Dirichlet's conditions, Change of intervals, Fourier series for even and odd functions, Half range sine and cosine series.

UNIT-II

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
Differential equations of higher orders:
Second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy and Legendre's linear differential equations.

UNIT-III

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar) Applications: areas and volumes; Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT-IV

Vector Calculus: Introduction, Scalar and Vector point functions, Gradient, divergence and Curl and their properties, Directional derivative. Line integrals, surface integrals, volume integrals, Theorems of Green, Gauss and Stokes (without proof).

Suggested Books:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons, 2006.
- W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
- S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
- E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
- E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
- G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
- Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-I, reprint 2015, Wiley India Publication.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

HM-902	Business Intelligence and Entrepreneurship						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3**
Purpose	To make the students conversant with the basics concepts in management thereby leading to nurturing their managerial skills.						
Course Outcomes (CO)							
CO1	Students will be able understand who the entrepreneurs are and what competences needed to become an Entrepreneur.						
CO2	Students will be able understand insights into the management, opportunity search, identification of a Product; market feasibility studies; project finalization etc. required for small business enterprises.						
CO3	Students can be able to write a report and do oral presentation on the topics such as product identification, business idea, export marketing etc.						
CO4	Students will be able to know the different financial and other assistance available for the small industrial units.						

Unit –I

Entrepreneurship : Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, Entrepreneurial challenges.

Unit -II

Opportunity / Identification and Product Selection: Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, Marketing Plan : Conducting of Marketing Research, Industry Analysis, Competitor analysis, market segmentation and positioning, building a marketing plan, marketing mix, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM.

Unit –III

Small Enterprises and Enterprise Launching Formalities : Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

Unit –IV

Role of Support Institutions and Management of Small Business : DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India.

Special Issues for Entrepreneurs: Legal issues – Forming business entity, requirements for formation of a Private/Public Limited Company, Entrepreneurship and Intellectual Property Rights: IPR and their importance. (Patent, Copy Right, Trademarks) , Case Studies-At least one in whole course.

Note:

• Case studies of Entrepreneurs – successful, failed, turnaround ventures should be discussed in the class.
• Exercises / activities should be conducted on 'generating business ideas' and identifying problems and opportunities.
• Interactive sessions with Entrepreneurs, authorities of financial institutions, Government officials should be organized

Suggested Readings:

- "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
- "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
- "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- Enterpreneurship Development- S.Chand and Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS205L	**Data Structure and Algorithms Lab**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce dynamic implementation of linked list.						
CO4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
10 Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement insertion, deletion and traversing in B tree

NOTE:
At least seven experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining eight.

ES-209L	Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	To learn the basic methods for the design of digital circuits and systems.						
Course Outcomes (CO)							
CO1	To Familiarization with Digital Trainer Kit and associated equipment.						
CO2	To Study and design of TTL gates						
CO3	To learn the formal procedures for the analysis and design of combinational circuits.						
CO4	To learn the formal procedures for the analysis and design of sequential circuits						

LIST OF EXPERIMENTS:

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To verify the operation of Bi-directional shift register.
8. To design and verify the operation of 3-bit asynchronous counter.
9. To design and verify the operation of asynchronous Up/down counter using J-K FFs.
10. To design and verify the operation of asynchronous Decade counter.
11. Study of TTL logic family characteristics.
12. Study of Encoder and Decoder.
13. Study of BCD to 7 segment Decoder.

NOTE:
At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS205 L	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

Q1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

Q2. A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

Enter coordinates for P1: 3 4
Enter coordinates for P2: 5 7
Coordinates of P1 + P2 are : 8, 11

Q3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3
Answer = 3.333333
Do another (Y/ N)? Y
Enter first number, operator, second number 12 + 100
Answer = 112
Do another (Y/ N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212
- My number is (212) 767-8900
- Your number is (415) 555-1212

Q5. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

Q6. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.

• Overload << operator to enable output through cout.

Write a main ( ) to test all the functions in the class.

Q7. Consider the following class definition

```
class father {
protected : int age;
public;
father (int x) {age = x;}
virtual void iam ( )
{ cout < < "I AM THE FATHER, my age is : "<< age<< end1:}
};
```

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

Q8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient
b) Date of admission
c) Disease
d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q10. Make a class **Employee** with a name and salary. Make a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Make a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

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Q13. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach ( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft ( ) function and display each item. Notice the order in which the items are displayed: Using getLeft ( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight ( ) were used.

Q14. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.

b) Display the balance.
c) Compute and deposit interest.
d) Permit withdrawal and update the balance.
e) Check for the minimum balance, impose penalty, necessary and update the balance.
f) Do not use any constructors. Use member functions to initialize the class members.

Q15. Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data( ) to initialize baseclass data members and another member function display_area( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:

Area of rectangle = x * y

Area of triangle = ½ * x * y

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

Bachelor of Technology (Computer Science and Engineering)
Credit Based Scheme of Studies/Examination
Semester IV (w.e.f Session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-202	Discrete Mathematics	3:0:0	3	3	75	25	0	100	3
2	PC-CS-204	Internet Technology and Management	3:0:0	3	3	75	25	0	100	3
3	PC-CS-206	Operating Systems	3:0:0	3	3	75	25	0	100	3
4	PC-CS-208	Design and Analysis of Algorithms	3:0:0	3	3	75	25	0	100	3
5	HM-901	Organizational Behaviour	3:0:0	3	3	75	25	0	100	3
6	PC-CS-210L	Internet Technology and Management Lab	0:0:4	4	2	0	40	60	100	3
7	PC-CS-212L	Operating Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-214L	Design and Analysis of Algorithms Lab	0:0:4	4	2	0	40	60	100	3
		Total		**27**	**21**	**375**	**245**	**180**	**800**	

9	MC-901 *	Environmental Sciences	3:0:0	3	0	75	25	0	100	3

***MC-901 is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.**

PC-CS202	Discrete Mathematics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3**
Purpose	To provide the conceptual knowledge of Discrete structure.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Set Theory and Logics.						
CO2	To study and understand the Relations, diagraphs and lattices.						
CO3	To study the Functions and Combinatorics.						
CO4	To study the Algebraic Structures.						

Unit 1 Set Theory and Logic

Fundamentals - Sets and subsets, Venn Diagrams, Operations on sets, Laws of Set Theory, Power Sets and Products, Partition of sets, The Principle of Inclusion- Exclusion.

Logic : Propositions and Logical operations, Truth tables, Equivalence, Implications, Laws of Logic, Normal forms, Predicates and quantifiers, Mathematical Induction.

Unit 2: Relations, diagraphs and lattices

Product sets and partitions, relations and diagraphs, paths in relations and diagraphs, properties of relations, equivalence and partially ordered relations, computer representation of relations and diagraphs, manipulation of relations, Transitive closure and Warshall's algorithm, Posets and Hasse Diagrams, Lattice.

Unit 3 Functions and Combinatorics

Definitions and types of functions: injective, subjective and bijective, Composition, identity and inverse, Review of Permutation and combination-Mathematical Induction, Pigeon hole principle, Principle of inclusion and exclusion, Generating function-Recurrence relations.

Unit 4: Algebraic Structures

Algebraic structures with one binary operation - semi groups, monoids and groups, Product and quotient of algebraic structures, Isomorphism, homomorphism, automorphism, Cyclic groups, Normal sub group, codes and group codes, Ring homomorphism and Isomorphism**.**

Suggested Books:

- Elements of Discrete Mathematics C.L Liu, 1985, Reprinted 2000, McGraw Hill
- Discrete Mathematics - Revised (SIE) (Schaum's Outline Series), LIPSCHUTZ , TMH
- Discrete mathematical structures by B Kolman RC Busby, S Ross PHI Pvt. Ltd.
- Discrete Mathematical Structures with Applications to Computer Science , by Tremblay J.P, and Manohar R., McGraw Hill Book Company, 1975, International Edition, 1987.
- Discrete and Combinatorial mathematics ", Ralph P., Grimaldi, Addison-Wesley Publishing Company, Reprinted in 1985.
- Discrete Mathematics and its Applications ", Kenneth H.Rosen, McGraw Hill Book Company, 1999. Sections: 7.1 to 7.5.
- Discrete Mathematics for computer scientists and Mathematicians, Joe L. Mott, Abraham

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS204	Internet Technology and Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3**
Purpose	To provide the conceptual knowledge of Internet and methodologies used in web and secure internet communication and networking.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Internetworking techniques with their characteristics.						
CO2	To study and understand the requirements for world-wide-web formats and techniques.						
CO3	To study the E-mail functioning and basics of HTML, XML and DHTML languages.						
CO4	To study the functioning of Servers and Privacy and Security related mechanisms.						

UNIT-1 : THE INTERNET

Introduction to networks and internet, history, Internet, Intranet and Extranet, Working of Internet, Internet Congestion, internet culture, business culture on internet. Collaborative computing and the internet. Modes of Connecting to Internet, Internet Service Providers(ISPs), Internet address, standard address, domain name, DNS, IP.v6.Modems, Speed and time continuum, communications software; internet tools.

UNIT-II : WORLD WIDW WEB

Introduction, Miscellaneous Web Browser details, searching the www: Directories search engines and meta search engines, search fundamentals, search strategies, working of the search engines, Telnet and FTP, HTTP, Gophar Commands, TCP/IP. Introduction to Browser, Coast-to-coast surfing, hypertext markup language, Web page installation, Web page setup, Basics of HTML and formatting and hyperlink creation.Using FrontPage Express, Plug-ins.

UNIT-III : INTERNET PLATEFORM AND MAILING SYSTEMS

Introduction, advantages and disadvantages, User Ids, Pass words, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, MIME types, Newsgroups, mailing lists, chat rooms, secure-mails, SMTP, PICO, Pine, Library cards catalog, online ref. works.
Languages: Basic and advanced HTML, Basics of scripting languages **–** XML, DHTML, Java Script.

UNIT-IV : SERVERS

Introduction to Web Servers: PWS, IIS, Apache; Microsoft Personal Web Server. Accessing and using these servers.
Privacy and security topics: Introduction, Software Complexity, Attacks, security and privacy levels, security policy, accessibility and risk analysis, Encryption schemes, Secure Web document, Digital Signatures, Firewalls, Intrusion detection systems

Suggested Books:

- Internet and World Wide Programming, Deitel,Deitel and Nieto, 2012, Pearson Education
- Fundamentals of the Internet and the World Wide Web, Raymond Greenlaw and Ellen Hepp, TMH- 2012
- Inline/Online: Fundamentals of The Internet And The World Wide Web, GREENLAW, TMH
- Complete idiots guide to java script,. Aron Weiss, QUE, 2013
- Network firewalls, Kironjeet syan -New Rider Pub.2014
- Networking Essentials – Firewall Media.Latest-2015
- www.secinf.com
- www.hackers.com
- Alfred Glkossbrenner-Internet 101 Computing MGH, 2013

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS-206	OPERATING SYSTEMS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3**
Purpose	To familiarize the students with the basics of Operating Systems.						
Course Outcomes (CO)							
CO1	To understand the structure and functions of Operating system.						
CO2	To learn about processes, threads and scheduling algorithms.						
CO3	To understand the principle of concurrency.						
CO4	To understand the concept of deadlocks.						
CO5	To learn various memory management schemes.						
CO6	To study I/O management and file systems.						
CO7	To study the concept of protection and security.						

UNIT 1

Introduction: Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

UNIT II

CPU scheduling: scheduling criteria, preemptive and non-preemptive scheduling, scheduling algorithms, algorithm evaluation, multi-processor scheduling.

Threads: overview, benefits of threads, user and kernel threads.

Process Management: Concept of processes, process states, process control, co-operating processes, inter-process communication.

Process Synchronization: background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

UNIT III

Deadlocks: Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Memory Management: background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation.

Virtual Memory: background, demand paging, concept of page replacement, page replacement algorithms , allocation of frames, thrashing.

UNIT IV

File Systems: file concept, file organization and access methods, allocation methods, directory structure, free-space management

I/O Management: I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation)

Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk Performance parameters

Protection and Security:

Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.

Case studies: UNIX file system, Windows file system

Suggested Books:

- Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley
- Operating systems: a concept based approach", Dhananjay M. Dhamdhere, McGraw Hill .
- Operating Systems : Internals and Design Principles, William Stallings, Pearson
- Operating Systems Design and Implementation" ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull
- Taub and Schilling, Principles of Communication Systems, TMH.
- Mithal G K, Radio Engineering, Khanna Pub.
- Sirnon Haykin, Communication Systems, John Wiley

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS208	**Design and Analysis of Algorithms**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data Structures and their analysis.						
CO2	To study the concept of Dynamic Programming and various advanced Data Structures.						
CO3	To introduce various Graph algorithms and concepts of Computational complexities.						
CO4	To study various Flow and Sorting Networks						

Unit 1: Introduction

Review:- Elementary Data Structures, Algorithms and its complexity(Time and Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation:- Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

Unit 2: Advanced Design and analysis Techniques

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,
Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Advanced data Structures:- Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

Unit 3: Graph Algorithms

Review of graph algorithms:-Traversal Methods(Depth first and Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Computational Complexity:-Basic Concepts, Polynomial Vs Non-Polynomial Complexity, NP- hard and NP-complete classes.

Unit 4: Network and Sorting Algorithms

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, The zero- One principle, Bitonic sorting network, Merging networks

Suggested Books :

- Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
- Das Gupta :Algorithms, TMH.
- Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications
- Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
- R.B.Patel: Expert Data Structures with C, Khanna Publications , Delhi, India, 2^{nd} Edition 2004, ISBN 81-87325-07-0.
- R.B.Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi , India, 2^{nd} Edition 2004,ISBN 87522-03-8

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

HM-901	Organizational Behavior						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3**
Purpose	To make the students conversant with the basics concepts of organizational culture and behavior for nurturing their managerial skills.						
Course Outcomes (CO)							
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior.						
CO2	Understand the concept and importance of personality ,emotions and its importance in decision making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

Unit 1

Introduction to Organizational Behavior*:* Concept and importance of Organizational Behavior, Role of Managers in OB, Foundations or Approaches to Organizational Behavior, Challenges and Opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept of Abilities and Learning , Learning and Learning Cycle, Components of Learning, concept of values and attitude, types of attitude, attitude and workforce diversity.

Unit 2

Introduction to Personality and Emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence

Perception and individual decision making*:* Meaning of perception, factors influencing perception, Rational decision making process, concept of bounded rationality. Leadership- Trait approaches, Behavioral approaches, Situational approaches, and emerging approaches to leadership.

Unit-3

Motivation: concept and theories of Motivation, theories of motivation-Maslow, Two Factor theory, Theory X and Y,ERG Theory, McClelland's Theory of needs, goal setting theory, Application of theories in Organizational Scenario, linkage between MBO and goal setting theory, employee recognition and involvement program.

Foundations of Group Behavior and conflict management :Defining and classifying of Groups, stages of group development, Informal and Formal Groups – Group Dynamics, Managing Conflict and Negotiation , a contemporary perspective of intergroup conflict, causes of group conflicts, Managing intergroup conflict through Resolution.

Unit-4:

Introduction to Organizational Communication: Meaning and Importance of Communication process, importance of Organizational Communication, Effective Communication, Organizational Stress: Definition and Meaning , Sources and Types of Stress, Impact of Stress on Organizations, Stress Management Techniques.

Introduction to Organization Culture- Meaning and Nature of Organization Culture, Types of Culture, Managing Cultural Diversity, Managing Change and Innovation – Change at work, Resistance to change, A model for managing organizational change.

Suggested Books

- Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGraw-Hill Education, 2017.
- Hitt, Michael A., C. Chet Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.
- Robbins, Stephen P., and Timothy Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017.
- Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
- Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.
- UdaiPareek, Understanding OrganisationalBehaviour, Oxford Higher Education.
- Mc Shane and Von Glinov, OrganisationalBehaviour, Tata Mc Graw Hill.
- Aswathappa, K., OrganisationalBehaviour– Text and Problem, Himalaya Publication

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PC-CS210L	Internet Technology and Management Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3 Hour**
Purpose	Learn the internet and design different web pages using HTML .						
Course Outcomes (CO)							
CO1	Understanding different PC software and their applications.						
CO2	To be able to learn HTML.						
CO3	To be able to write Web pages using HTML.						
CO4	To be able to install modems and understand the e-mail systems.						

PC Software: Application of basics of MS Word 2000, MS Excel 2000, MS Power Point 2000, MS Access 2000, HTML

1. To prepare the Your Bio Data using MS Word
2. To prepare the list of marks obtained by students in different subjects and show with the help of chart/graph the average, min and max marks in each subject.
3. Prepare a presentation explaining the facilities/infrastructure available in your college/institute.
4. Design Web pages containing information of the Deptt.

HTML Lists:

1. Create a new document that takes the format of a business letter. Combine <P> and <BR> tags to properly separate the different parts of the documents. Such as the address, greeting, content and signature. What works best for each?
2. Create a document that uses multiple <BR> and <P> tags, and put returns between <PRE> tags to add blank lines to your document see if your browser senders them differently.
3. Create a document using the <PRE>tags to work as an invoice or bill of sale, complete with aligned dollar values and a total. Remember not to use the Tab key, and avoid using emphasis tags like <B> or <EM> within your list.
4. Create a seven-item ordered list using Roman numerals. After the fifth item, increase the next list value by 5.
5. Beginning with an ordered list, create a list that nests both an unordered list and a definition list.
6. Use the ALIGN attribute of an <IMG> tags to align another image to the top of the first image.. play with this feature, aligning images to TOP, MIDDLE and BOTTOM.
7. Create a 'table of contents' style page (using regular and section links) that loads a different document for each chapter or section of the document.

Internet:

1. Instilling internet and external modems, NIC and assign IP address.
2. Study of E-mail system.
3. Create your own mail-id in yahoo and indiatimes.com.
4. Add names (mail-id's) in your address book, compose and search an element.

NOTE:

At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS212L	Operating Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Sessional**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	To familiarize the students with the basics of Operating Systems.						
Course Outcomes (CO)							
CO1	To understand the CPU scheduling.						
CO2	To learn about memory management.						
CO3	To understand system calls.						
CO4	To understand the concept of file operations.						
CO5	To learn various classical problems.						

1. Simulation of the CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
2. Program for paging techniques of memory management.
3. Program for page replacement algorithms
4. Simulation of Bankers Deadlock Avoidance and Prevention algorithms.
5. Program for Implementation of System Calls.
6. Program for File Permissions
7. Program for File Operations.
8. Program for File Copy and Move.
9. Program for Dining Philosophers Problem.
10. Program For Producer – Consumer Problem concept.
11. Program for disk scheduling algorithms.

NOTE:
At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

PC-CS214L	**Design and Analysis of algorithms Lab**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2.0**	**40**	**60**	**100**	**3**
Purpose	The student should be made to Learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and Understand the limitations of Algorithm power.						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for various computing problems.						
CO2	The student should be able to Analyze the time and space complexity of algorithms.						
CO3	The student should be able to Critically analyze the different algorithm design techniques for a given problem.						
CO4	The student should be able to Modify existing algorithms to improve efficiency.						

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the lIst to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a. Obtain the Topological ordering of vertices in a given digraph.
   b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kristal's algorithm.
7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set S = {sl,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.
13. Use divides and conquers method to recursively implement Binary Search

NOTE:
At least ten experiments are to be performed from above list and the concerned institution as per the scope of the syllabus may set remaining five.

MC-901	Environmental Sciences						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes (CO)							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT 1

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.

(b) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

(f) Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Sturcture and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation: Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition: Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment. From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and

Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressan drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

Suggested Books

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Bachelor of Technology (Electronics Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination

LIST OF OPEN ELECTIVES (B.TECH. ECE)		
SEM	**CODE**	**SUBJECT**
V	ECO-1	Computer Networks
	ECO-2	Mechatronics
	ECO-3	Electronic Measurement and Instruments
	ECO-4	Renewable Energy Resources
	MOOC 1	
VI	ECO-5	Data Structures
	ECO-6	Multimedia Communication
	ECO-7	Consumer Electronics
	ECO-8	Transducers and Their Applications
	MOOC 2	
VII	ECO-9	Bio-informatics
	ECO-10	Electromechanical Energy Conversion
	ECO-11	Operating Systems
	ECO-12	Robotics
	MOOC 3	
VIII	ECO-13	Machine Learning
	ECO-14	Soft Computing
	ECO-15	Neural Networks and Fuzzy Logic
	ECO-16	Software Defined Radio
	ECO-17	Statistics and Operational Research
	ECO-18	Biomedical Signal Processing
	ECO-19	Internet of Things
	ECO-20	Wireless Sensor Networks
	MOOC 4	
	MOOC 5	

LIST OF PROGRAM ELECTIVES (B.TECH. ECE)		
SEM	**CODE**	**SUBJECT**
V	ECP-1	Probability Theory & Stochastic Processes
	ECP-2	Speech and Audio Processing
	ECP-3	Introduction to MEMS
	ECP-4	Power Electronics
	ECP-5	VLSI
VI	ECP-6	Antennas and Propagation
	ECP-7	CMOS Design
	ECP-8	Bio-Medical Electronics
	ECP-9	Scientific Computing
VII	ECP-10	Fiber Optic Communications
	ECP-11	Nano electronics
	ECP-12	Microwave Theory and Techniques
	ECP-13	Adaptive Signal Processing
VIII	ECP-14	Wireless Sensor Networks
	ECP-15	Satellite Communication
	ECP-16	High Speed Electronics
	ECP-17	Wavelets
	ECP-18	Embedded systems
	ECP-19	Mixed Signal Design
	ECP-20	Error correcting codes
	ECP-21	Digital Image & Video Processing
	ECP-22	Mobile Communication and Networks

Bachelor of Technology (Electronics & Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination
Semester III (w.e.f. session 2019-2020)

Sr. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	BS-201	Optics &Waves	3:0:0	3	3	75	25	0	100	3
2	EC-201	Electronic Devices	3:0:0	3	3	75	25	0	100	3
3	EC-203L	Electronic Devices Lab	0:0:2	2	1	-	40	60	100	3
4	EC-205	Digital Electronics	3:0:0	3	3	75	25	0	100	3
5	EC-207L	Digital Electronics Lab	0:0:2	2	1	-	40	60	100	3
6	EC-209	Signals & Systems	3:0:0	3	3	75	25	0	100	3
7	EC-211L	Signals & Systems Lab	0:0:2	2	1	-	40	60	100	3
8	EC-213	Network Theory	3:0:0	3	3	75	25	0	100	3
9	ES-201	Essentials of Information Technology	3:0:0	3	3	75	25	0	100	3
10	*EC-215	Industrial Training-I	2:0:0	2	-	-	100	-	100	3
11	**MC-901	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
		Total		**26**	**21**	**450**	**270**	**180**	**900**	

*EC-215is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.
**MC-901 is a mandatory credit-less course in which the students will be required to get passing grade.

Bachelor of Technology (Electronics & Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination
Semester IV (w.e.f. session 2019-2020)

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	BS-204	Higher Engineering Mathematics	3:0:0	3	3	75	25	0	100	3
2	HM-903	Soft Skills & Interpersonal Communication	3:0:0	3	3	75	25	0	100	3
3	EC- 202	Digital Communication	3:0:0	3	3	75	25	0	100	3
4	EC-204L	Communication Lab	0:0:2	2	1	-	40	60	100	3
5	EC-206	Analog Circuits	3:0:0	3	3	75	25	0	100	3
6	EC-208L	Analog Circuits Lab	0:0:2	2	1	-	40	60	100	3
7	EC-210	Microprocessors & Microcontrollers	3:0:0	3	3	75	25	0	100	3
8	EC-212L	Microprocessors & Microcontrollers Lab	0:0:2	2	1	0	40	60	100	3
9	ES-202	Basics of Analog Communication	3:0:0	3	3	75	25	0	100	3
10	*MC-902	Constitution of India	3:0:0	3	-	75	25	0	100	3
		Total		**27**	**21**	**450**	**270**	**180**	**900**	

*MC-902 is a mandatory credit-less course in which the students will be required to get passing grade.

Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester

Syllabus

B.Tech ECE IIIrd Semester

Credit Based

(2019-20)

BS - 201	Optics and Waves						
L	T	P	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3h
Purpose	To introduce the fundamentals of wave and optics for the applications in Engineering field.						
Course Outcomes							
CO 1	Familiarize with basic phenomenon used in propagation of waves.						
CO 2	Introduce the fundamentals of interference, diffraction, polarization and their applications.						
CO 3	To make the students aware to the importance of Laser in technology.						

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent 's half shade polarimeter, Biquartz polarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein's Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping schemes, Main components of Laser, Gas lasers (He-Ne, CO_2), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd*., *India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd., India.*
3. A. Ghatak, Optics, *McGraw Hill Education (India) Pvt. Ltd., India*.
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

EC-201	Electronic Devices						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**

Course Outcomes (CO)	
CO1	**To understand the concept of carrier transport phenomena in semiconductors and diodes such as p-n junction diode and tunnel diode.**
CO2	**To understand the detailed operation of BJT and calculation of its parameters using transistor models.**
CO3	**To understand the operation, characteristics & parameters of FET and MOSFET.**
CO4	**To understand the concept of different types of regulated power supplies and Op-Amp based voltage regulators**

UNIT-I

Charge Carriers Transport : Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Continuity equation, PN Junction: Basic Structure, small signal equivalent circuit of p-n diode, derivation of barrier potential and diode current equation, Simple diode circuits: clipping, clamping and rectifiers, Zener diode and its application as voltage regulator.

UNIT-II

Bipolar Junction Transistor: Basic principle of operation, Current gains : derivation of α,β,Υ and their relationship. Various modes of operation of BJT, Base Width Modulation, Transistor hybrid model, h-parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters, calculation of input impedance, output impedance and voltage gain.

UNIT-III

Field Effect Devices: JFET : basic Operation and characteristics, drain and transfer characteristics, pinch off voltage, parameters of JFET: Transconductance (g_m), ac drain resistance (r_d), amplification factor(μ) ,Small Signal Model & Frequency Limitations. MOSFET: basic operation, depletion and enhancement type, pinch-off voltage, Shockley equation and Small Signal Model of MOSFET, MOS capacitor.

UNIT-IV

Regulated Power Supplies: Voltage Regulation, block diagram of DC regulated power supply, Zener diode voltage regulators: transistor series voltage regulator, Transistor shunt voltage regulator, Controlled Transistor Voltage Regulator, Op-Amp Series and shunt voltage regulator.

Text Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
4. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-203L	Electronic Devices Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To teach the students how to experimentally plot the VI characteristics of various diodes such as p-n diode, zener diode etc. find the threshold voltage and zener breakdown voltage from the VI curve.**						
CO2	**To teach the students how to experimentally find the values of various parameters of Transistor such as voltage gain, current gain etc.**						
CO3	**To teach the students how to plot the input and output characteristics of FET and MOSFET by experimental method.**						
CO4	**To experimentally teach the students the concept of different configurations of regulated power supplies using Zener diodes and Op-Amp.**						

List of experiments:

1. To study the VI characteristics of p-n diode in forward and reverse bias and find the threshold voltage from the VI curve.
2. To study the operation of Zener diode as a voltage regulator.
3. To study the operation of half-wave and full wave rectifiers and calculate their ripple factor values.
4. To study the operation of series and parallel Clippers using P-N junction diodes.
5. To study the operation of clampers using P-N junction diodes.
6. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
7. To experimentally plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
8. To study the transfer and drain characteristics of JFET and calculate its various parameters.
9. To study the transfer and drain characteristics of MOSFET and calculate its various parameters.
10. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.
11. To study the Zener diode as a transistor series voltage regulator.
12. To study the Zener diode as a transistor shunt voltage regulator.

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-205	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Students will be able to understand the basic logic gates and will be able to apply minimization techniques for reducing a function upto six variables.**						
CO2	**Students will be able to design combinational circuits and applications related to them.**						
CO3	**Students will be able to write the truth table, excitation table, characteristic equations of various flip flops and to design the sequential circuits using Flip flops.**						
CO4	**Students will be able to familiarize with varied memory types and various A/D, D/A Converters and their characteristics.**						

UNIT-I

Fundamentals of Digital Systems and Techniques: Digital signals, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, number systems: binary, signed binary, octal, hexadecimal number, binary arithmetic,one's and two's complements arithmetic, Codes:BCD codes, Excess-3, Gray codes, Error detecting and correcting codes: parity check codes and Hamming code

Minimization Techniques: Basic postulates and fundamental theorems of Boolean algebra: Standard representation of logic functions: SOP and POS forms, Simplification of switching functions using K-map and Quine-McCluskey tabular methods,Don't care conditions, Digital logic families: TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

UNIT-II

Combinational DigitalCircuits:Design procedure: Half adder, Full Adder, Half subtractor, Full subtractor , Parallel binary adder, parallel binary Subtractor, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ De-multiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator.

UNIT-III

Sequential circuits: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K, T and D types flip flops, applications of flip flops: shift registers, serial to parallel converter, parallel to serial converter, Synchronous and Asynchronous mod counter,FSM, sequence generator and detector.

UNIT-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter, specifications for D/A converters, analog to digital converters: quantization and encoding, parallel comparator A/Dconverter, successive approximation A/D converter, specifications for A/D converters

Semiconductor Memories and Programmable Logic Devices: Characteristics of memories, read only memory (ROM), read and write memory (RAM), Programmable logic array, Programmable array logic, Introduction to Field Programmable Gate Array (FPGA)

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.
3. Taub Schilling, Digital Integrated Electronics, TMH

Reference Books:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. A.K. Maini, Digital Electronics, Wiley India
3. R P Jain, Modern digital electronics, TMH

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-207L	Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Students will be able to verify truth tables of basic logic gates and design various gates using universal gates.**						
CO2	**Students will be able to design various combinational circuits and verify their operation.**						
CO3	**Students will be able to design different sequential circuits by using flip flops and verify their operation.**						
CO4	**Students will be to study and design various encoders and decoders.**						

List of experiments:

1. Familiarization with Digital Trainer Kit and associated equipment.

2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

3. Design and realize a given function using K-Maps and verify its performance.

4. To verify the operation of Multiplexer and De-multiplexer.

5. To verify the operation of Comparator.

6. To verify the truth table of S-R, J-K, T, D Flip-flops.

7. To verify the operation of Bi-directional shift register.

8. To design and verify the operation of 3-bit asynchronous counter.

9. To design and verify the operation of asynchronous Up/down counter.

10. To design and verify the operation of asynchronous Decade counter.

11. Study of Encoder and Decoder.

12. Study of BCD to 7 segment Decoder

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

ECE-209	Signals and Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO) **At the end of this course, students will demonstrate the ability to**							
CO1	**Analyze different types of signals.**						
CO2	**Represent continuous and discrete systems in time and frequency domain using different transforms.**						
CO3	**Understand sampling theorem and its implications.**						

UNIT-I

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and a periodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation

Introduction to Systems: Linear and non-linear systems, time invariant and time varying systems, lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

UNIT-II

Random Variables: Introduction to Random Variables, pdf, cdf, moments, distributions, correlation functions.

Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations, Concept of impulse response.

UNIT-III

Discretization of Analog Signals: Introduction to sampling, sampling theorem and its proof, effect of undersampling, reconstruction of a signal from sampled signal.

Fourier Series : Continuous time Fourier series (CTFS), Properties of CTFS, Convergence of Fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS **,** Fourier series and LTI system, Filtering.

UNIT-IV

Fourier Transform: Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations, Discrete time fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by Linear constant coefficient difference equations.

Laplace Transform: Introduction to Laplace transform, Region of convergence for laplace transform, Inverse laplace transform, Properties oflaplace transform, Analysis and characterization of LTI systems using laplace transform, System function algebra and block diagram representations,Unilateral laplace transform.

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009

Reference Books:

1. Simon Haykins – “Signal & Systems”, Wiley Eastern
2. Tarun Kumar Rawat , Signals and Systems , Oxford University Press.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.

5. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Note: Question paper template will be provided to the paper setter.

ECE-211L	**Signals & Systems Lab**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To understand the basic concepts of software.**						
CO2	**To explore properties of various types of signals and systems.**						
CO3	**To explore different properties of signals and systems.**						
CO4	**To understand the concept of sampling in time and frequency domain.**						

List of experiments:

1. Introduction of the MATLAB/SciLab/Octave software.
2. To demonstrate some simple signal.
3. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time- shifting).
4. To visualize the complex exponential signal and real sinusoids.
5. To identify a given system as linear or non-linear.
6. To explore the time variance and time invariance property of a given system.
7. To explore causality and non-causality property of a system.
8. To determine Fourier transform of a signal.
9. To determine Laplace transform of a signal.
10. To demonstrate the time domain sampling of bandlimited signals (Nyquist theorem).
11. To demonstrate the sampling in frequency domain (Discrete Fourier Transform).
12. To demonstrate the convolution and correlation of two continuous-time signals.
13. To demonstrate the convolution and correlation of two discrete-time signals.

Reference Books:

1. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

2. Signals and Systems using Scilab, www.scilab.in.

3.Signals and Systems using Octave, www.octave.org

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-213	Network Theory						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To understand the concept of network topologies and the network analysis in the time domain for solving simple and complex circuits.**						
CO2	**Describe the circuit element models, network analysis using Laplace transform and time domain behavior from the pole-zero plots.**						
CO3	**Describe the characteristics & parameters of two port networks.**						
CO4	**To understand the concept of filters and synthesis of one port networks.**						

UNIT I

INTRODUCTION: - Principles of network topology, graph matrices, Network Analysis (Time-Domain): Singularity Functions, Source-Free RC, RL, Series RLC, Parallel RLC circuits, Initial & Final Conditions, Impulse & Step Response of RC, RL, Series RLC, Parallel RLC circuits.

UNIT 2

NETWORK ANALYSIS (using Laplace Transform): - Circuit Element Models, Transient Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

NETWORK FUNCTIONS: - Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions.

UNIT 3

CHARACTERISTICS AND PARAMETERS OF TWO PORT NETWORKS: - Relationship of two-port variables, short-circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks.

UNIT 4

TYPES OF FILTERS AND THEIR CHARACTERISTICS: - Filter fundamentals, constant-k and m-derived low-pass and high-pass filters.

NETWORK SYNTHESIS: - Causality & Stability, Hurwitz Polynomials, Positive real functions, Synthesis of one port networks with two kind of elements.

TEXT BOOKS:

1. Fundamentals of Electric Circuits: Charles K. Alexander, Matthew N. O. Sadiku, McGraw Hill Education
2. Network Analysis: M.E. Van Valkenburg, PHI

REFERENCE BOOKS:

1. Network Analysis & Synthesis: F. F. Kuo, John Wiley.
2. Circuits & Networks: Sukhija & Nagsarkar, Oxford Higher Education.
3. Basic Circuit Theory: DasoerKuh, McGraw Hill Education.
4. Circuit Analysis: G.K. Mithal, Khanna Publication.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

ES-201	Essentials of Information Technology						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Develop basic computational thinking. Learn how to reason with variables, state transitions, conditionals, and iteration**						
CO2	**Understand the notion of data types, and higher order data structures such as lists, tuples, and dictionaries.**						
CO3	**Develop a basic understanding of computer systems -architecture, OS, mobile and cloud computing.**						
CO4	**Learn basic SQL programming**						

UNIT-I

Python Programming: Familiarization with the basics of Python programming, process of writing a program, running it, and print statements; simple data-types: integer, float, string. The notion of a variable, and methods to manipulate it, Knowledge of data types and operators: accepting input from the console, assignment statement, expressions, operators and their precedence. Conditional statements: if, if-else, if-elsif-else; Notion of iterative computation and control flow: for, while, flowcharts, decision trees and pseudo code

UNIT-II

Idea of debugging: errors and exceptions; debugging: pdb, break points. Sequence datatype: Lists, tuples and dictionary, Introduce the notion of accessing elements in a collection using numbers and names. Sorting algorithm: bubble and insertion sort; count the number of operations while sorting. Strings: Strings in Python : compare, concat, substring. **Data visualization using Pyplot:** line chart, pie chart, and bar chart.

UNIT-III

Computer Systems and Organisation: description of a computer system and mobile system, CPU, memory, hard disk, I/O, battery, power. Types of software:Types of Software – System Software, Utility Software and Application Software, how an operating system runs a program, operating system as a resource manager. **Cloud Computing**: Concept of cloud computers, cloud storage (public/private),and brief introduction to parallel computing.

UNIT-IV

Relational databases: idea of a database and the need for it, relations, keys, primary key, foreign key; use SQL commands to create a table, foreign keys; insert/delete an entry, delete a table. SQL commands: select, project, and join; indexes. Basics of NoSQL databases: Mongo DB

Text Books:

1. Python Programming: A modular approach by Sheetal Taneja and Naveen Kumar Pearson

Reference Books:

1. Python Programming - Using Problem Solving Approach by Reema Thareja Oxford Publication.

2. Database Management System a Practical Approach by Rajiv Chopra by S. Chand

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MC-901	**ENVIRONMENTAL SCIENCES**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To learn the multidisciplinary nature, scope and importance of Environmental sciences.**						
Course Outcomes							
CO1	**The students will be able to learn the importance of natural resources.**						
CO2	**To learn the theoretical and practical aspects of eco system.**						
CO3	**Will be able to learn the basic concepts of conservation of biodiversity.**						
CO4	**The students will be able to understand the basic concept of sustainable development.**						

NIT 1

The multidisciplinary nature of environmental studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
(b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food Resources- World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Sturcture and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological Succession. Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem-

a. Forest Ecosystem
b. Grassland Ecosystem
c. Desert Ecosystem

d. Aquatic Ecosystems(ponds, streams, lakes, rivers, oceans, esturaries

Field Work. Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India.Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment. From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns. Case Studies. Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland Reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness. Human population and the Environment. Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health. Human rights. Value Education. HIV/AIDS, Women and Child Welfare. Role of Information Technology in Environment and Human Health. Case Studies. Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressan drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science- Botkin and Keller. 2012. Wiley , India

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Syllabus

B.Tech ECE IVth Semester

(Credit Based)

(2019-20)

BS-204	HIGHER ENGINEERING MATHEMATICS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 h
Purpose	The objective of this course is to familiarize the prospective Engineers with Laplace Transform, partial differential equations which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:						
Course Outcomes							
CO 1	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.						
CO 2	To introduce the Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.						
CO 3	To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.						
CO 4	To familiar with essential tool of Numerical differentiation and Integration needed in approximate solutions for the ordinary differential equations.						

UNIT-1

Laplace Transform

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

UNIT-2

Partial Differential Equations

Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

UNIT-3

Numerical Methods-1

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-4

Numerical Methods-2

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993. AICTE Model Curriculum in Mathematics.
2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
10. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
11. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.

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HM- 903	Soft Skills & Interpersonal Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Develop basic understanding of Communication**						
CO2	**Understand the process of communication and speaking**						
CO3	**Develop the Personality concepts and its implementation**						
CO4	**Develop the basic of Group Discussion and interviews**						

UNIT-I

Communication**:** Introduction Verbal, Non-Verbal, kinesics, proxemics, chronemics, Types of communication, extrapersonal communication, intrapersonal communication, intrapersonal communication, mass communication,Creativity in communication, Role of communication, flow of Communication and its need, Persuasive communication and negotiation;Time management in Persuasive communication, Importance of Persuasive Communication

UNIT-II

Barriers in the way of communication, noise, intrapersonal barriers, interpersonal barriers,organizational barriers, Extrapersonal barriers, Basics of communication:importance of communication,process of communication, objectives and characteristics of communication,Communication skills: Accent, Intonation, Phonetics, Speaking skills, Confidence, clarity, Fluency,Quality,pronunciation

UNIT-III

Personality Development; what is personality? Role of personality,Heredity, Environment, situation, Basics of personality, Soft skills; Needs and training, Activity in soft skills, Organizational skill;introduction and its need ,basics principles for Organization skills,Stress management;Introduction, Stress at home and office, Stress prevention, analyze the model of stress.

UNIT-IV

Group discussion, form of Group discussion, strategy for Group discussion, discussing problems and solution, Oral presentation, introduction, planning, Occasion, Purpose, Modes of delivery, Resume making;Purpose of Resume, Resume design and structure, contents in Resume, types of resume, Job interview, introduction, objective of Interview, types of interview, stages of interview,Face to face interview and campus interview

Text Books:

1.Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication

Reference Books:

1.Personality Development and soft skills by Barun K. Mitra, Oxford Publication

2.Communication Skills For Engineers by C.Muralikrishna and Sunita Mishra, Pearson Pub.

Note: Separate paper **template** will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-202	Digital Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To learn digitization of analog signal by pulse modulation system and analyze their system performance**						
CO2	**To analyze different baseband transmission schemes and their performance.**						
CO3	**To learn and understand different digital modulation schemes and compute the bit error performance**						
CO4	**To analyze different modulation tradeoffs and different equalization techniques.**						

UNIT-I

Pulse modulation.Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing.Quantization noise in delta modulation, The O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation, varients of DM.

UNIT-II

Base Band Pulse Transmission: Matched filter and its properties, average probability of symbol error in binary enclosed PCM receiver, Intersymbol interference, Nyquist criterion for distortionless base band binary transmission, ideal Nyquist channel raised cosine spectrum, correlative level coding Duo binary signalling, tapped delay line equalization, adaptive equalization, LMS algorithm, Eye pattern.

UNIT-III

Elements of Detection Theory, Optimum detection of signals in noise,Coherent communication with waveforms- Probability of Error evaluations.

Pass band Digital Modulation schemes- ASK, Phase Shift Keying, Frequency Shift Keying,Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Signal space diagram and spectra of the above systems, effect of intersymbol interference, bit symbol error probabilities, synchronization.

UNIT-IV

Digital Modulation tradeoffs.Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver).Equalization Techniques.Synchronization and Carrier Recovery for Digital modulation.

Text Books:

1.Haykin S., "Communications Systems", John Wiley and Sons, 2001.

2.Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

Reference Books:

1.Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

2.Lathi B.P., " Modern Digital and Analog Communication", 4th edition, Oxford university Press, 2010

EC-204L	COMMUNICATION LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**2 Hrs.**
Course Outcomes (CO) **Upon completion of the course, students will be able to**							
CO1	**Generate and analyze Analog Modulated and demodulated Signals.**						
CO2	**Test & observe the outputs of different types of analog detectors.**						
CO3	**Generate and analyze digital Modulated and demodulated Signals.**						
CO4	**Test & observe the outputs of different types of digital detectors.**						

List of experiments:

1: To study and Perform Amplitude Modulation & Demodulation.
2: To study and Perform Frequency Modulation and Demodulation.
3: To study and Perform Pulse Amplitude Modulation and Demodulation.
4: To study and Perform Pulse Width Modulation and Demodulation.
5: To study and Perform Pulse Position Modulation and Demodulation.
6: To study and Perform Pulse Code Modulation and Demodulation.
7: To study and Perform Time Division Multiplexing (TDM) system.
8: To study and Perform Amplitude Shift Keying (ASK) Modulation and De- Modulation.
9: To study and Perform Frequency Shift Keying (FSK) Modulation and De-Modulation.
10: To study and Perform Phase Shift Keying (PSK) Modulation and De-Modulation.
11: To study and Perform Quadrature Phase Shift Keying (QPSK) Modulation and De-Modulation.
12: To study and perform Adaptive Delta Modulation and demodulation.
13. To study Base Band Transmission and calculate bit error rate.

Note: At least ten (10) experiments from the above list are mandatory to perform for the students.

Reference Books:

1. Taub & Schilling, Principles of Communication Systems, McGraw Hill Publications, (1998) 2nd ed.
2. Simon Haykin, Communication Systems, John Wiley Publication, 3rd ed.
3. Sklar, Digital Communications, Prentice Hall-PTR, (2001) 2nd ed.
4. Lathi B. P., Modern Analog and Digital Communication, , Oxford University Press, (1998) 3rd

EC-206	Analog Circuits						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To make the students understand the analysis of various BJT and FET amplifiers using small signal models.**						
CO2	**To teach the students the concept of describe the frequency response of multistage amplifiers and the detailed concept of feedback topologies.**						
CO3	**To make the students learn various oscillator circuits using both Op-Amp and BJT.**						
CO4	**To teach the students the various application circuits of Op-Amp and designing for a given specification.**						

UNIT-I

Amplifier Models: Amplifier types: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier, comparison based on input impedance and output impedance. Small signal analysis of BJT amplifiers: CE, CB and CC amplifiers using r_e model, small signal analysis of the CS JFET amplifiers, estimation of voltage gain, input resistance, output resistance etc, design procedure for particular specifications of amplifiers.

UNIT-II

Transistor Frequency Response: Class A, class B, class C amplifiers: calculation of maximum efficiency. Frequency response of the amplifiers: low frequency, mid-frequency and high frequency region. Effect of cascading of amplifiers on the frequency response, cut-off frequencies, Bandwidth and voltage gain. Miller effect, Feedback in amplifiers: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth, input impedance, output impedance.

UNIT-III

Oscillators: Barkhausen criterion for oscillators, types of Oscillators: RC phase shift oscillator, Wien bridge oscillator, LC oscillators : Hartley oscillator, Collpit oscillator, derivation of frequency of oscillation for BJT and Op-amp configurations, 555 timer: operation as astable and monostable multivibrator.

UNIT-IV

Op-Amp Applications: Simple op-amp circuits: adder, subtractor, Schmitt trigger, Differential amplifier: calculation of differential gain, common mode gain, CMRR, OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages.

Text Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
4. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

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EC-208L	Analog Circuits Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	**To design and calculate the gain , frequency response etc. of the various configuration of transistor amplifier.**						
CO2	**To make students Design various RC oscillators using Op-Amp 741 for a given frequency of oscillation.**						
CO3	**To make students Design various RC oscillators using BJT for a given frequency of oscillation.**						
CO4	**To teach the students the design of various Op-Amp circuits such as adder, subtractor etc.**						

List of experiments:

1. To design a simple common emitter (CE) amplifier circuit using BJT and find its gain and frequency response. To design a differential amplifier using BJT and calculate its gain and frequency response.
2. To design a BJT emitter follower and determine is gain, input and output impedances.
3. To design and test the performance of Phase shift Oscillator using Op-Amp 741.
4. To design and test the performance of Wien bridge oscillator using Op-Amp 741.
5. To design and test the performance of BJT - RC Phase shift Oscillator for f0 ≤ 10 KHz.
6. To design and test the performance of BJT – Hartley Oscillators for RF range f0 ≥100KHz.
7. To design and test the performance of BJT – Colpitt Oscillators for RF range f0 ≥100KHz.
8. To design an astable multivibrator using 555 timer.
9. To design a monostable multivibrator using 555 timer.
10. To design Schmitt trigger using Op-amp and verify its operational characteristics.
11. To design an adder circuit using Op-Amp to add three dc voltages.
12. To design a subtractor using Op-Amp to subtract DC voltages v1 and v2.

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.
3. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-210	MICROPROCESSORS AND MICROCONTROLLER						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Acquired knowledge about the architecture of Microprocessors and Microcontrollers.**						
CO2	**Acquired knowledge about instruction set and programming concept of Microprocessors and Microcontrollers in assembly and C language.**						
CO3	**To understand peripheral interfacing with Microprocessors and Microcontrollers.**						
CO4	**To design the systems /models based on Microprocessors and Microcontrollers**						

UNIT-I

Evolution of Microprocessor, Introduction to 8-bit Microprocessor 8085 architecture, Pin Details 8085 Microprocessor, 8086 Architecture description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU, 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode.

UNIT-II

8051 Architecture, On-chip memory organization – general purpose registers, SFR registers, Internal RAM and ROM, Oscillator and Clock circuits. Pin Diagram of 8051, I/O Pins, Port, Connecting external memory, Counters and Timers, Purpose of TCON & TMOD registers, Serial data transmission/reception and transmission modes, Purpose of SCON & PCON registers, Different Types of Interrupts, Purpose of Time Delays, 8051 addressing modes.

UNIT-III

8086 Instruction format, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions. 8051 Data transfer instructions, arithmetic and logical instructions, Jump and Call instructions, I/O port, Timer and Counter programming, Serial port and Interrupt programming, Assembly language programs.

UNIT-IV

Memory devices, Address decoding techniques, Interfacing SRAMS; ROMS/PROMS, 8086 Interrupt mechanism; interrupt types and interrupt vector table. Intel's 8255 - description and interfacing with 8086, ADCs and DACs, - types operation and interfacing with 8086.

Interfacing of Matrix Keyboards, ADC, DAC, Temperature Sensor, Stepper Motor with 8051.

Text Books:

1. D.V. Hall, Microprocessors and Interfacing, McGraw Hill 2nd ed.
2. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.

3. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay," The 8051 Microcontroller and Embedded systems using assembly and C" -2nd Ed, Pearson Education.
4. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI,2005.
5. Barry B. Brey, "The Intel Microprocessor8086/8088, 80186", Pearson Education, Eighth Edition, 2009.
6. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.

Reference Books:

1. Mke Predko, "Programming and Customizing the 8051 Microcontroller", TMH.
2. Manish K Patel,"Microcontroller based embedded system", McGraw Hill Education.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

EC-212L	MICROPROCESSORS AND MICROCONTROLLER LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	-	2	1	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	**To familiarization with 8085, 8086 Microprocessors and 8051 Microcontrollers.**						
CO2	**Ability to write an assembly language program for 8086 Microprocessors as well as C language program for 8051 Microcontroller.**						
CO3	**Ability to interfacing the various Peripheral to 8086 Microprocessors and 8051 Microcontrollers.**						
CO4	**Ability to design the systems based on 8051 Microcontrollers.**						

List of experiments to be performed using 8086 and 8051 Microcontrollers

For 8086 Microprocessor write an Assembly Language Program to

1 Add / Sub two 16 bit numbers.
2 Multiply two 16 bit unsigned/ signed numbers.
3 Divide two unsigned/ signed numbers (32/16 , 16/8, 16/16, 8/8)
4 Find smallest/ largest number from array of n numbers.
5 Arrange numbers in array in ascending/ descending order.
6 Convert Hex to Decimal, Decimal to Hex.
7 Compare two strings using string instructions / without using string instructions.
8 Display string in reverse order, string length, Concatenation of two strings.
9 To find 1's and 2's complement of a number.
10 To find the Fibonacci Series.
11 To find Log of a given number using look up table.
12 To find Factorial of a number.
13 To write an ALP using 8051 Microcontrollers to perform addition, subtraction, multiplication and division of two eight bit numbers.
14 To write an ALP using 8051 Microcontrollers to perform logical operation i.e., AND, OR, XOR and Complement of two eight bit numbers.
15 To write an ALP using 8051 Microcontrollers to perform multi byte addition and subtraction of unsigned number.
16 To write an embedded C program using 8051 Microcontrollers for interfacing LCD to display message "LCD Display" on LCD screen.
17 To write an embedded C program using 8051 Microcontrollers for interfacing keypad to port P0 .Whenever a key is pressed; it should be displayed on LCD.
18 To write an embedded C program using 8051 Microcontrollers for interfacing a switch and a buzzer to two different pins of a Port such that the buzzer should sound as long as the switch is pressed.
19 To write an embedded C program using 8051 Microcontrollers for interfacing stepper motor to rotate clockwise and anticlockwise directions.
20 To write an embedded C program using 8051 Microcontrollers for interfacing relay and buzzer.

Reference Books:

1. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.
2. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay," The 8051 Microcontroller and Embedded systems using assembly and C" -2nd Ed, Pearson Education.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

ES -202	BASICS OF ANALOG COMMUNICATION						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**

Course Outcomes (CO)	
Upon completion of the course, students will be able to	
CO1	**Describe different types of noise and predict its effect on various analog communication systems.**
CO2	**Understand and analyze various Amplitude modulation and demodulation methods.**
CO3	**Understand and analyze Angle modulation and demodulation methods.**
CO4	**Understand the concepts of Transmitters and Receivers and their circuits.**

Unit-I

Communication system and Noise: Constituents of communication system, Modulation, Bandwidth requirement, Noise, Classification of noise, Resistor noise, Multiple resistor noise sources, Noise Temperature, Noise bandwidth, Noise figure, its calculation and measurement, Bandpass noise representation, Noise calculation in Communication Systems: Noise in Amplitude Modulated System, Noise in angle modulated systems.

Analog Modulation Techniques: Theory of amplitude modulation, AM power calculations, AM modulation with a complex wave, Concepts of angle modulation, Theory of frequency modulation, Mathematical analysis of FM, Spectra of FM signals, Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, Comparison of AM, FM & PM.

Unit-II

AM Transmission: Generation of Amplitude Modulation, Low level and high level modulation, Basic principle of AM generation, Square law modulation, Vander bijl modulation, Suppressed carrier AM generation (Balanced Modulator) ring Modulator.

AM Reception: Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver, RF Amplifier, Image Frequency Rejection, Cascade RF Amplifier, Frequency Conversion and Mixers, Tracking & and Alignment, IF Amplifier, AM detectors, Distortion in diode detectors, AM receiver characteristics.

Unit-III

FM Transmission: FM allocation standards, Generation of FM by direct method, Varactor diode Modulator, Indirect generation of FM, The Armstrong method RC phase shift method, Frequency stabilized reactance FM transmitter, FM stereo transmitter, Noise triangle.

FM Reception: Direct methods of Frequency demodulation, Frequency discrimination (Balanced slope detector), Foster seelay of phase discriminator, Ratio detector, Indirect method of FM demodulation, FM detector using PLL, Pre-emphasis / de-emphasis, FM receiver, FM stereo receiver.

Unit-IV

SSB Transmission: Introduction, Advantages of SSB Transmission, Generation of SSB, The Filter method The Phase Shift Method, The Third Method, Pilot Carrier SSB, Vestigial Side-band Modulation (VSB), VSB-SC, Application of AM and FM in TV transmission.

SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Pilot Carrier SSB Receiver, Modern Communication Receiver.

Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM): Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), PWM and PPM Demodulator,

Text Books

1. Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.
2. Lathi.B.P.,Modern Digital and Analog Communications Systems 3rd ed.

Reference Books:

1.Taub, H., Principles of Communication Systems, McGraw-Hill (2008) 3rd ed.
2. Haykin, S., Communication Systems, John Willey (2009) 4th ed.
3. Proakis, J. G. and Salehi, M., Fundamentals of Communication Systems, Dorling Kindersley (2008) 2nd ed.
4. Mithal G K, Radio Engineering, Khanna Pub.
5. Singh & Sapre—Communication Systems: 2/e, TMH

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

MC-902	Constitution of India					
Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

UNIT-I

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

UNIT - II

3. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
4. Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT - III

5. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
6. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT-IV

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.

8. Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof.Narender Kumar (2008) 8th edition. Allahabad Law Agency.

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

Bachelor of Technology (Biotechnology)
Credit-Based
SCHEME OF STUDIES/EXAMINATIONS
Semester – III (w.e.f. the session 2019-20)

S. No.	Course No.	Course Title	Teaching Schedule				Credits	Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours/Week		Major Test	Minor Test	Practical	Total	
1	BTE-201	Cell Biology & Genetics	3	0	0	3	3.0	75	25	0	100	3
2	BTE-203	Microbiology	3	0	0	3	3.0	75	25	0	100	3
3	BTE-205	Biochemistry	3	0	0	3	3.0	75	25	0	100	3
4	BTE-207	Principles of Biostatistics	3	0	0	3	3.0	75	25	0	100	3
5	HM-901	Organizational Behavior	3	0	0	3	3.0	75	25	0	100	3
6	BTE-209L	Cell Biology & Genetics Lab	0	0	3	3	1.5	0	40	60	100	3
7	BTE-211L	Microbiology Lab	0	0	3	3	1.5	0	40	60	100	3
8	BTE-213L	Biochemistry Lab	0	0	3	3	1.5	0	40	60	100	3
		Total	**15**	**0**	**9**	**24**	**19.5**	**375**	**245**	**180**	**800**	
9	BTE-215	Industrial Training-I	2	0	0	2	-	-	100	-	100	-
10	*MC-902	Constitution of India	3	0	0	3		75	25	0	100	3

Note: BTE-215 is a mandatory credit less course in which the students to be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

***MC-902** is a mandatory credit less course in which the student will be required to get passing marks in the major test

Bachelor of Technology (Biotechnology)
Credit-Based
SCHEME OF STUDIES/EXAMINATIONS
Semester – IV (w.e.f. the session 2019-20)

S. No.	Course No.	Course Title	Teaching Schedule				Credits	Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours /Week		Major Test	Minor Test	Practical	Total	
1	BTE-202	Molecular Biology	3	0	0	3	3.0	75	25	0	100	3
2	BTE-204	Bio-analytical Techniques	3	0	0	3	3.0	75	25	0	100	3
3	BTE-206	Immunology	3	0	0	3	3.0	75	25	0	100	3
4	BTE-208	Industrial Biotechnology	3	0	0	3	3.0	75	25	0	100	3
5	BS-202	Basics of Thermodynamics and Organic Chemistry	3	0	0	3	3.0	75	25	0	100	3
6	BTE-212L	Molecular Biology Lab	0	0	3	3	1.5	0	40	60	100	3
7	BTE-214L	Bio-analytical Techniques Lab	0	0	3	3	1.5	0	40	60	100	3
8	BTE-216L	Industrial Microbiology Lab	0	0	3	3	1.5	0	40	60	100	3
9	BTE-218L	Immunology Lab	0	0	3	3	1.5	0	40	60	100	3
		Total	**15**	**0**	**12**	**27**	**21**	**375**	**285**	**240**	**900**	
10	MC-901*	Environmental Sciences*	3	0	0	3		75	25	0	100	3

***MC-901** is a mandatory credit less course in which the student will be required to get passing marks in the major test.
Note: All the students have to undergo 4-6 weeks industrial training after IV semester and to be evaluated in V semester.

BTE-201	**Cell Biology and Genetics (B.Tech. Biotechnology) Semester-III**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3hrs**
Purpose	To familiarize the students with the basic of cell biology and genetics.						
Course outcome							
CO1	Student to learn the fluidity and structural organization of bio membrane and cytoskeleton						
CO2	To learn the fundamentals of inheritance via both qualitative and quantitative patterns.						
CO3	Able to understand the basic concept of evolution and genetic basis of variations.						
CO4	Student will learn about the genome mapping by different techniques ranging from bacteria to human beings.						

UNIT-1

Bio membrane-Physical and chemical properties, Structural organization, Cell signaling (Different Pathways), cell recognition and membrane transport, Membrane receptor for macromolecules and regulation of receptor expression and function. Receptors for neurotransmitters

Structural organization and functions -Microtubule, Microfilament and Inter-mediatery filaments.

UNIT-II

Mendelism – History of Mendel, Monohybrid, Di- hybrid and Tri-hybrid cross, Gene interaction, Concept of dominance - incomplete ,complete and co-dominance(Blood group system in human beings),Multiple alleles(Skin color in rabbit),Concept of lethality and pedigree analysis. Sex linked, sex influenced and sex limited inheritance.

Quantitative inheritance-History, Yule experiment, Nelsson-Ehle experiment, skin color in human beings, Basis of genetic variation. Numerical problems on quantitative inheritance.

UNIT-III

Population Genetics- Concept of Random Mating and controlled mating and Inbreeding. Hardy Weinberg Law-Allele frequency, Genotype frequency, Causes of variations (Mutation, Migration, Random genetic drift, and Natural selection).

Mutation-Classification, application, detection, site directed mutagenesis and DNA repair Mechanism-(Mismatch repair, Photo-reactivation, tolerance, retrieval system.

UNIT-IV

Genome mapping-Difference between cytological, physical and molecular mapping. Recombination, Linkage, Gene mapping based on Two point cross in Neurospora and Three point test cross in wheat. History and development of human genome project.

Muscle contraction-Types of muscles, Structural proteins of muscles , regulation and energetic of muscle contraction.

Nerve Transmission- structure and function of neurons. Action and resting potential, Mechanism of nerve transmission, Neuromuscular junction.

Text /ReferenceBooks

1. Cell Biology: Organelle structure and function, Sadava, D.E.(2004) Panima Pub., New Delhi.
2. Fundamentals of Genetics, Singh, B.D., Kalyani Publishers, New Delhi.
3. Basic Genetics. (2000) Miglani, G.S., Narosa Publishing House, New Delhi.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-203	Microbiology (B.Tech. Biotechnology) Semester- III						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3.0**	**75**	**25**	**100**	**3hrs**
Purpose	To familiarize the students with the basic of Microbiology						
Course outcome							
CO1	To learn the history and classification of microbiology						
CO2	To learn microbial nutrition and various microbiological techniques						
CO3	Able to understand microbial growth and genetics						
CO4	Student will learn about various microbial diseases and drugs						

UNIT - I

1. **History and scope of Microbiology**: Development of Microbiology, various branches of microbiology and applications of microbiology.
2. Classification of Microorganisms: Microbial Taxonomy- criteria used including molecular approaches. Microbial phylogeny and current classification of bacteria.

UNIT - II

3. **Microbial Diversity**: Morphology and cell structure of major groups of microorganisms e.g. bacteria. fungi, algae, protozoa and viruses.
4. **Cultivation and microbial nutrition of Microorganism**: Methods of isolation, purification and preservation. Pure culture technique and sterilization methods. Requirement for C, N, S and growth factors. Nutritional categories of microorganisms.

UNIT - III

5. **Microbial Growth and Metabolism**: Growth curve (normal and biphasic) and generation time. Measurement of growth. Synchronous, batch and continuous cultures. Microbial fermentation and its types.
6. **Microbial Genetics**: Bacterial plasmids. Bacterial recombination: transformation, transduction and conjugation. Formation of endospores and mechanism of sporulation.

UNIT - IV

7. **Environmental Microbiology**: Normal and contaminating microflora of water, soil and air. Methods to study water and air pollution.
8. **Medical Microbiology**: Antibacterial, Antiviral, Antifungal and Antiprotozoan drugs, Major water, air and soil borne microbial diseases.

Text Book:

1. Microbiology 5th Edition. Prescott, L.M.; Harley, J.P. and Klein, D.A.(2003) McGraw Hill, USA.
2. Microbiology. Pelczar Jr., M.J.; Chan, E.C.S. and Krieg, N.R. (1993) Tata McGraw Hill, New Delhi.

References Books:

3. Modern Food Microbiology. Jay, J.M. (1996) CBS Publishers and Distributors, New Delhi.
4. Food Microbiology 2nd ed, Adam, M. R. and Moss (2003) Panima Pub, New Delhi.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-205	Biochemistry (B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To introduce the students with basics of Biochemistry						
Course Outcomes							
CO1	The students will be able to learn the structure and functions of carbohydrates and proteins						
CO2	The students will be able to learn structure and functions of lipid and nucleic acids along with basic concepts of enzymes.						
CO3	The students will be able to write major pathways of carbohydrates and lipid metabolism						
CO4	To make the students learn synthesis and degradation of pyrimidine nucleotides						

UNIT-I

1. **Amino acids & Proteins –**Structure and properties of amino acids. Peptide bonds.

   Proteins classification based on their biological roles. Forces stabilizing protein structure and shape. Different levels of structural organization of proteins. Ramachandran plot, alpha helix, beta plated sheets, domain motif and fold.

2. **Carbohydrates-Structure and functions:** Structures and properties of glucose and fructose, distinguishing features of different disaccharides. Ring structure and mutarotation. Structure and brief introduction of starch, glycogen and cellulose.

UNIT – II

3. **Lipids-Structure and functions:** Classification of lipids based on their biological roles and their general functions. Membrane lipids and brief discussion on fatty acids.
4. **Nucleic Acids-Structure and functions:** Structure and properties of purine and pyrimidine bases.A brief introduction of ATP, GTP, CTP AND UTP.

5. **Enzymes:** Classification of Enzymes according to enzyme commission report. Activation energy and rate of reaction. Rate constant, reaction order. A brief introduction of mechanism of enzyme catalysis. Enzyme inhibition and concept of allostery. Michaelis-Menten equation.

UNIT-III

6 **Carbohydrate Metabolism:** Glycolysis and TCA cycle. Pentose phosphate pathway and its significance. Gluconeogenesis pathway. Biosynthesis of lactose, sucrose and starch. Glycogenolysis, glycogenesis and control of glycogen metabolism.

7.Lipid Metabolism: Beta -oxidation of saturated fatty acids, Degradation of triacylglycerols by lipases. Biosynthesis of saturated fatty acids. Biosynthesis of triacylglycerols, phospholipids.

UNIT -IV

8 Amino Acid Metabolism: General reactions of amino acids metabolism- transamination, oxidative andnon-oxidative deamination and decarboxylation. Urea cycle and its regulations.

9. Nucleic Acid Metabolism: Catabolism,*de novo*-biosynthesis and salvage pathway.

10. **Mitochondrial oxidative phosphorylation:** Mitochondrial electron transport chain. Hypotheses ofmitochondrial oxidative phosphorylation.

Text

1. Biochemistry, concepts and connections, 1st edition, by Dean R. Appling, Spencer J. Anthony-Cahill and Christopher K. Matthews (2015). Pearson Education, Inc.

2. Biochemistry, 4th edition, by L. Stryer (1995). W.H. Freeman & Co. NY

3. Lehninger: Principles of Biochemistry, 3rd edition, by David L. Nelson and M.M. Cox (2000) Maxmillan/ Worth publishers

References Books:

1. Biochemistry, 4th edition, by G. Zubay (1998). Wm.C. Brown Publishers.

2. Biochemistry, 2nd edition, by Laurence A. Moran, K.G. Scrimgeour, H. R. Horton, R.S. Ochs and J. David Rawn (1994), Neil Patterson Publishers Prentice Hall.

3. Biochemistry, 2nd edition, by R.H. Garrett and C.M. Grisham (1999) . Saunders college Publishing, NY. Sons, NY.

4. Fundamentals of Biochemistry by Donald Voet and Judith G Voet (1999) , John Wiley & Sons, NY

5. Harper's Biochemistry, 25th edition, by R.K. Murray, P.A. Hayes, D.K. Granner, P.A. Mayes and V.W. Rodwell (2000). Prentice Hall International.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-207	Principles of Biostatistics (B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3
Purpose	**To Introduce statistical concept for biological data interpretation**						
Course Outcomes							
CO1	**To develop basic understanding about statistics**						
CO2	**To develop basic knowledge of probability and different tests.**						
CO3	**To derive numerical approach between data correlation and their variations.**						
CO4	**To understand the numbers and errors**						

UNIT-1

Introduction: Basic concept of statistics, Difference between statistics and mathematics, Samples and variables, Frequency distribution curve and basic quantitative method: Mean median, mode, standard deviation and variance.

UNIT-II

Probability distribution: Basic concept of probability, binomial distribution, Poisson distribution and normal distribution.

Hypothesis testing: Students T-test, estimation of null hypothesis, confidence limit of variance and chi-square test.

UNIT-III

Analysis of Variance:F-test, Two way ANOVA and Three way ANOVA

Correlation and Regression: Analysis of correlation and their different types, analysis of covariance and multiple regressions.

UNIT-IV

Approximation and error: Introduction, Accuracy of numbers: approximate number, significant number, rounding off. Different types of error.

Role of computer in solving biostatical problem: Genetic Algorithm, Application of statistical methods in biotechnology.

Text Books:

1. Statistical Methods. S.P.Gupta. Sultan chand and sons, New delhi

Reference Books:

1.Introduction to Biostatistics. Glover T. and Mitchell K. (2002). MacGraw Hill, New York.

2. Fundamentals of Biostatistics. Rosner Bernard. (1999), Duxbury Press.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

HM-901	OrganizationaL Behavior(B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3
Purpose	To make the students conversant with the basics concepts of organizational culture and behavior for nurturing their managerial skills						
COURSE OUTCOMES							
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior						
CO2	Understand the concept and importance of personality ,emotions and its importance in decision making and effective leadership						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication						

UNIT -I

Introduction to Organizational Behavior*:* Concept and importance of Organizational Behavior, Role of Managers in OB, Foundations or Approaches to Organizational Behavior, Challenges and Opportunities for OB

Foundation of individual behavior: Biographical characteristics, concept of Abilities and Learning , Learning and Learning Cycle, Components of Learning, concept of values and attitude, types of attitude, attitude and workforce diversity

UNIT-II

Introduction to Personality and Emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence

Perception and individual decision making*:* Meaning of perception, factors influencing perception, Rational decision making process, concept of bounded rationality. Leadership- Trait approaches, Behavioral approaches, Situational approaches, and emerging approaches to leadership.

UNIT-III

Motivation: concept and theories of Motivation, theories of motivation-Maslow, Two Factor theory, Theory X and Y,ERG Theory, McClelland's Theory of needs, goal setting theory, Application of theories in Organizational Scenario, linkage between MBO and goal setting theory, employee recognition and involvement program

Foundations of Group Behavior and conflict management:Defining and classifying of Groups, stages of group development, Informal and Formal Groups - Group Dynamics, Managing Conflict and Negotiation , a contemporary perspective of intergroup conflict, causes of group conflicts, Managing intergroup conflict through Resolution.

UNIT-IV

Introduction to Organizational Communication: Meaning and Importance of Communication process, importance of Organizational Communication, Effective Communication, Organizational Stress: Definition and Meaning Sources and Types of Stress, Impact of Stress on Organizations, Stress Management Techniques

Introduction to Organization Culture- Meaning and Nature of Organization Culture, Types of Culture, Managing Cultural Diversity, Managing Change and Innovation - Change at work, Resistance to change, A model for managing organizational change.

Text Books

Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. *Organizational Behavior: Improving Performance and Commitment in the Workplace*. 5th ed. New York: McGraw-Hill Education, 2017.

Hitt, Michael A., C. Chet Miller, and Adrienne Colella. *Organizational Behavior*. 4th ed. Hoboken, NJ: John Wiley, 2015.

Robbins, Stephen P., and Timothy Judge. *Organizational Behavior*. 17th ed. Harlow, UK: Pearson Education, 2017.

Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

Reference Books

Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.

Udai Pareek, Understanding Organisational Behaviour, Oxford Higher Education.

Mc Shane & Von Glinov, Organisational Behaviour, Tata Mc Graw Hill.

Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-209L	Cell Bio and Genetics Lab (B.Tech. Biotechnology) Semester –III						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn working of instruments and their principles to study basic concepts.						
Course Outcomes							
CO1	Students will be able to learn basic instruments need to study all types of cellular structures.						
CO2	Preparation of permanent slides to study histology of different organ systems..						
CO3	Students will come to know about the procedure of division of cells in both somatic and gametic cells.						
CO4	Students will learn Techniques of DNA extraction and its application in fingerprinting.						

LABORATORY EXPERIMENTS

1. Study of different types of microscopes.
2. Microscopy: Structure of Prokaryotic and eukaryotic cell.
3. Microtomy. Histology of various organ systems (Nervous, digestion, reproductive, respiratory and circulatory system).
4. Cell division in onion root tip.
5. Cell division in insect gonads/flower bud.
6. Isolation of Chloroplasts/ Mitochondria from Plants.
7. Fluorescence labeling of cellular organelles.
8. Isolation of DNA and study of its denaturation spectrophotometrically & viscometrically.

Reference books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw-Hill, Book Company, UK.

BTE-211 L	MICROBIOLOGY LAB (B.Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**To learn the practical aspects of Microbiology**						
Course Outcomes							
CO1	**Students will be able to know about the instruments and their working principles.**						
CO2	**Learning of Culture Media Preparation for Microbial Growth.**						
CO3	**Students will learn Pure Culture Techniques for isolation and preservation of microbes.**						
CO4	**Students will learn about staining methods for identification of microbes and effect of different factors on growth of microbes.**						

LABORATORY EXPERIMENTS

1. Rule and Regulations of working in the laboratory.
2. To know about the instruments and equipments used in the laboratory
3. Preparation of culture media for culturing microbes.
5. Collection of samples from different sources and serial dilution method.
6. Culture techniques- Pour plate and spread plate.
7. Isolation of pure colonies by streaking method.
8. Gram Staining method to differentiate between gram positive and gram negative bacteria.
8. To analyze the waste water samples for presence of microbes.
9. Measurements of growth and study of effect of various factors on growth of microorganisms-temperature, pH, salt concentration,
10.Milk Microbiology- Testing the quality of milk.

Text and References Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology. 4th Edition. Aneja, K.R. (2003)New Age International Publishers, New Delhi.
2. Microbiology- a laboratory manual. 4th edition. Cappuccino J. and Sheeman N. (2000) Addison Wesley, California.
3. Environmental Microbiology – A Laboratory Manual Pepper. I.L.; Gerba, C.P. and Brendecke, J.W.(1995) Academic Press, New York.

BTE-213L	BIOCHEMISTRY LAB (B.Tech. Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the practical aspects of Biochemistry						
Course Outcomes							
CO1	Students will be able to learn qualitative and quantitative estimation of biomolecules						
CO2	Students will be able to learn procedure to perform enzyme assay of any common enzyme.						
CO3	Students will learn effect of environmental factors on enzyme activity						
CO4	Students will be able to calculate Km and Vmax of any common enzyme						

LABORATORY EXPERIMENTS

1. Qualitative tests for amino acids, proteins, Lipids and carbohydrates.
2. Quantitative estimation of proteins by Lowry method.
3. Determination of reducing sugar by Nelson-Somogyi's method
4. Assay of any commonly occurring enzyme.
5. Effect of pH, temperature, enzyme concentration and protein denaturation on an enzyme activity.
6. Determination of Km and Vmax of any commonly occurring enzyme.

Text/ Reference Books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw-Hill, Book Company, UK.

MC-902	Constitution of India (B.Tech. Biotechnology) Semester- III					
Lecture	Tutorial	Practical	Major Test	Minor Test	Total	Time
3	-	-	75	25	100	3 Hrs.
Purpose	To know the basic features of Constitution of India					
Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.					
CO2	To know about fundamental duties and federal structure of Constitution of India.					
CO3	To know about emergency provisions in Constitution of India.					
CO4	To know about fundamental rights under constitution of India.					

UNIT-I

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

UNIT - II

3. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
4. Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT - III

5. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
6. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT-IV

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.
8. Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof. Narender Kumar (2008) 8th edition. Allahabad Law Agency.

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-202	Molecular Biology (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To familiarize the students with basic concepts of molecular biology.						
Course Outcomes							
CO1	The students will be able to learn the Basic structure of DNA RNA.						
CO2	To learn the process of DNA replication and regulation.						
CO3	The students will be able to understand the process of Transcription of DNA in Prokaryotes and Eukaryotes.						
CO4	The students will be able to explain the process of Translation.						

UNIT- I

1.Genes : DNA/RNA as the genetic material. Double helical structure of DNA.Types of DNA.Super coiling and periodicity of DNA.Linking number of DNA.Nature of multiple alleles, Cis- acting sites and Trans–acting molecules.Euchromatin and heterochromatin.Nucleosomes.Organelle DNA- Mitochondrial and chloroplast DNA.
2. From Genes to Genomes : exons and introns, repetitive and non –repetitive DNA, C-value paradox.
3. DNA Replication : Origin of DNA replication. Bacterial and eukaryotic replicons.DNA polymerases.Mechanism and regulation of DNA replication in prokaryotes and eukaryotes.

UNIT - II

4. Transcription: Various RNA species and their properties- tRNA as an adapter and turnover of mRNA.

a) **Transcription in Prokaryotes:** RNA polymerases. Mechanism of transcription- initiation, elongation and termination.Role of sigma factor in transcription.

b) **Transcription in Eukaryotes:** RNA Polymerases. Downstream and upstream promoters. Techniques to define promoters- foot printing experiment. Mechanism of transcription.Interaction of upstream factors with basal apparatus.Role of enhancers.Post-transcriptional modifications of various RNA species.Transcription in mitochondria and chloroplast.

c) **The Operon:** Positive and negative control of transcription, repressor-inducer complex, catabolite repression and attenuation.

d) **Regulation of Transcription:** DNA binding domains- zinc finger motif, helix loop helix, leucine zippers and homeodomains. Demethylation and gene regulation.

UNIT -III

5. Genetic Code: Evidence for triplet code. Properties of genetic code, Wobble hypothesis.Mitochondrial genetic code. Suppressor tRNAs.

6. Protein Synthesis : Structure of prokaryotic and eukaryotic ribosomes and their role in protein synthesis. Mechanism of initiation, elongation and termination of protein synthesis.Regulation of translation in prokaryotes and eukaryotes. Post translational modifications of proteins.

7. Protein folding : Role of molecular chaperones.

UNIT -IV

8. Nuclear Splicing : Lariat formation, Sn RNAs, cis-splicing and trans-splicing reactions. Catalytic RNA- Ribozymes- Ribonuclease P, small RNAs, group I &II introns.

Text/Reference Books :

1. Genes XI Lewin, Benjamin(2013)OUP, Oxford.
2. Genomes,2nded, Brown, T. A.(2002) John Wiley and sons ,Oxford
3. Molecular biology of cell 4thed Alberts, Bruce; Watson,J D(2002) Garland Science Publishing, New York.
4. Molecular cell biology 4thedLodish, Harvey and. Baltimore,D(2000) W.H. Freeman and Co., New York
5. Cell and Molecular Biology 8thed, Robertis, EDP De &Robertis, EMF De(2002) lippincott Williams & Wilkins international student edition, Philadelphia.
6. Essentials of Molecular Biology 4thed, Malacinski, G. M. (2003) Jones &Bartlet Publishers, Boston
7. Cell and Molecular Biology: concepts and experiments 3rded Karp, Gerald(2002) John Wiley and sons, New York.
8. The Cell-a molecular approach, 3rded Cooper, G M&Hausman, R E(2004) ASM Press, Washington D C

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-204	Bioanalytical Techniques (B.Tech. Biotechnology) Semester- IV						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To acclimatize students about different bioanalytical techniques.						
Course Outcomes							
CO1	The students will be able to understand the principle of microscopy.						
CO2	The students will be able to understand the principle and applications chromatography techniques.						
CO3	The students will be able to learn underlying principle and applications of spectroscopy.						
CO4	The students will be able to learn process of detection and measurement of radioactivity.						

UNIT- I

1. **Principles of Microscopy:** Light, electron (scanning and transmission), fluorescence microscopy, marker enzymes.
2. **Centrifugation: Basic concepts and** applications, differential centrifugation, high speed and ultracentrifugation techniques.

UNIT- II

3. **Electrophoresis**: basic principle and applications of Paper and gel electrophoresis, isoelectric focussing, two-dimensional electrophoresis.

4 **Principles of Chromatography**: Ion-exchange, gel filtration, affinity, gas chromatography, High Pressure Liquid Chromatography (HPLC), FPLC and Hydrophobic Interaction Chromatography.

UNIT- III

5. **Principle and applications of Spectroscopy:** UV/visible, IR, NMR, ESR, fluorescence, Raman.
6. **Mass spectroscopy**: LC-MS, X-ray diffraction (molecular crystals), CD.

UNIT- IV

7. **Radioisotope Techniques**: Nature of radioactivity, properties of α, β and γ-rays, detection and measurement of radioactivity, use of radioisotopes in research, autoradiography, radio-immunoassay.

Text/ References Books:

1. Physical Biochemistry, 2nd edition, by D Friefelder (1983). W.H. Freeman & Co., U.S.A.
2. 4. Analytical Chemistry for technicians: John Kenkel (1994), Lewis Publishers. Boca Raton.
3. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
4. Biophysical Chemistry: Principles and Techniques, 2nd edition by A. Upadhyay, K. Upadhyay and N. Nath. (1998). Himalaya Publishing House, Delhi.
5. Physical Biochemistry, 2nd edition, by K. E. VanHolde (1985), Prentice Hall Inc, New Jersey.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-206 IMMUNOLOGY (B.Tech Biotechnology) semester-IV							
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To learn the role of various components of immune system and their response against various diseases**						
Course Outcomes							
CO1	**The students will be able to learn the basic concepts of cells and organs related to immune system.**						
CO2	**Able to learn the formation, maturation and functions of B cells and T cells.**						
CO3	**To learn the concepts of various Immunological techniques and understanding various effector responses of body against an infection.**						
CO4	**To learn the immunological reasons behind various diseases.**						

UNIT – I

1. **Introduction to immune system**: Innate and acquired immunity, cells and organs of immune System- B-Lymphocytes and T-Lymphocytes, primary and secondary lymphoid organs, humoral and cell mediated immune response.

2. Immune System: Antigens. Immunoglobulins- structure and function, antigenic Determinants (isotype, allotype, idiotype).

UNIT –II

3. Generation of B-Cell and T-Cell Responses: Major histocompatibility complex. Antigen Processing and presentation.

4. Cell mediated immunity: T-cell receptor, T-cell maturation, activation and differentiation.

UNIT –III

5 Immunological techniques: Immunoprecipitin reactions, agglutination reactions, ELISA, RIA, Immunofluorescence.

6. Immune effector responses: Cytokines. Complement system.

UNIT – IV

7. Immune System in Health and Disease: Hypersensitive reactions. Auto immunity and immune response to infectious diseases. Immune response to transplants. Vaccines.

Text Book:

1. Kuby's Immunology, 5th ed. Goldsby, R A. Kindt, T.J, Osborne, B.A.(2003) W. H. Freeman and company, New York

Reference Books

1. Essential Immunology, 10th ed Roitt, Ivon; Delves, Peter (2001) Blackwell Scientific Publications Oxford.
2. Fundamentals of Immunology: Paul W.E. (Eds.) Raven Press, New York.
3. Immunology by Presscot.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BTE-208	INDUSTRIAL BIOTECHNOLOGY (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Purpose	To learn the various aspects of Industrial Biotechnology						
Course Outcomes							
CO1	To learn basic concepts of Fermentation Bioechnology						
CO2	To learn the theoretical aspects of Process Technology for the production of various products						
CO3	To learn the concepts of biopesticides, biofuels and biofertilizers.						
CO4	To understand the concept of integrated strain improvement program.						

UNIT-I

1. Industrial Biotechnologyy: Introduction, objectives and scope**.**
2. Fermentation Technology:. Biochemistry of fermentation. Ttaditional and modern biotechnology-A brief survey of organisms, processes and products. Basic concepts of upstream and downstream processing in fermentation technology

UNIT - II

3. Production of Primary metabolites and alcoholic beverages Organic acids, dextran, amino acids (Glutamic acid, L-Lysine) and alcohols and alcoholic beverages (wine and beer.
4. Production of Industrial Enzymes- Amylase, protease, lipase, xylanase, lignocellulase**.** production of acrylamide, adipic acid and 1,2-Propanediol.

UNIT-III

5. Production of Biopesticides and Biofertilizers: Characteristics of biopesticides. Important biopesticides- Bt-toxin, Kasugamycin, Beauverin, Devine and Collego. Beneficial Soil Microorganisms. Biofertilizers.

6. Production of Biofuels: Basic concepts and important types of biofuels. Fuel from biomass, production and economics of biofuels, biogas, biorefineries, Microbial Enhanced Oil Recovery (MEOR).

7. Production of other industrial bioproducts- Single Cell Protein & Mushroom Culture, Biopreservatives Nisin), Cheese, Biopolymers (Xanthan gum, PHB). Biosynthetic Technology. Bioflavours and biopigments: microbial production of flavours and fragrances. Microbial pigments in textile and food industries.

UNIT-IV

8. Strain Improvement Strategies- Improvement of industrially important microorganisms, selection of mutants, use of rDNA technology. Integrated Strain Improvement Program (Precision Engineering Technology)

9. **Microbial Production of Pharmaceuticals**. Antibiotics (penicillin, streptomycin and tetracycline), Enzyme Inhibitors. Production of Vitamin E, K, B_2 and B_{12}, Genetic engineering of microorganisms for production of non-ribosomoal peptides (NRPS) and polyketides (PKS), antiacancer drugs.

Text

1. A Textbook of Basic and Applied Microbiology. Aneja, K. R., Jain, P. and Aneja, R. (2008). New Age International Publishers, New Delhi

Reference Books:

1. Industrial Microbiology.Casida Jr., L.E. (1968) New Age International (P)Ltd. New Delhi.

2. Prescott & Dunn's Industrial Microbiology. Ed. E.G. Reed (1987).CBS Publishers, New Delhi.

3. Biotechnology: A Textbook of Industrial Microbiology 2nd Edition. Crueger, W. and Crueger, A. (2000) Panima Publishing Corporation, New Delhi.

4. Enzymes: Biochemistry, Biotechnology, Clinical chemistry. Palmer, T. (2000) Horwood publishing Colphon.

5. Process engineering in biotechnology. Jackson, A.T. (1991) Prentice Hall.

6. Manual of Industrial Microbiology and Biotechnology 2nd Edition. Ed. Arnold L. Demain and Julian E. Davies (1999) ASM Press Washington D.C.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

BS-202	**Basics of Thermodynamic and Organic Chemistry (B.Tech. Biotechnology Semester IV)**						
Lecture	**Tutorial**	**Practi cal**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs**
Purpose	**To familiarize the students with basic concepts of thermodynamic and organic chemistry.**						
Course Outcomes							
CO1	**The students will be able to know the basic concepts of naming of organic compounds and general organic reactions.**						
CO2	**Able to know about spatial arrangement of molecules and their bonding.**						
CO3	**Able to know about basic concepts of thermodynamics.**						
CO4	**Able to know about concept of free energy in biomolecules and binding used in biochemical reactions.**						

UNIT-I

IUPAC Nomenclature: Systematic IUPAC nomenclature of alkenes, alkynes, cycloalkanes, aromatics, bicyclic and polyfunctional organic compounds. Bond line notation.Types of Organic Reactions: Substitution, Addition, Elimination reactions. Wanger-Meerwin rearrangement reaction. Hyperconjugation : concept and consequences, mole concepts.

UNIT-II

Bonding: Hydrogen bonding- Nature, type, stability and its importance in organic compounds. Tautomerism-Concept, Ring-chain tautomerism, Ring-chain isomerism, properties and reactions of keto-enol tautomers.

Stereo Chemistry: Classification of stereomers, diastereomers, separation of enantiomers, absolute configuration (R & S), projection formulae, stereochemistry of compounds containing two asymmetric C- atoms, stereochemistry of biphenyls. Geometrical isomerism-concept, E & Z nomenclature and aldol condensation

UNIT –III

Thermodynamic parameters –internal energy, enthalpy; their relationship and their significance. First law of thermodynamics. Kirchoff's Equation. Heat capacity at constant pressure and volume and their relationship.

Concepts of Entropy, Second law of thermodynamics. Entropy changes for reversible and irreversible processes. Entropy of mixing.

Third Law of Thermodynamics. Numerical problems on Laws of Thermodynamics.

UNIT-IV

Basic concept of Equilibrium and steady state conditions, Free energy and its relation with equilibrium constant, Chemical potential, Gibbs-Duhem equation and their application, Standard biochemical state and standard free energy changes. Thermodynamic basis of Biochemical reactions, solvent extraction for purification of compounds. Binding – Non-cooperative binding, Co-operative binding and its biological significance

Text/Reference Books:

1. Organic Chemistry V1:6th ed. Finar,I L(2003) Pearson Education, Delhi

2. Organic Chemistry V2:5th ed. Finar,I L(2003) Pearson Education, Delhi.

3. Organic Chemistry 6th ed. Morrison,R & Boyd,T.(2003) Pearson Education, Delhi.

4. Organic Chemistry. Paula Yurkanis Bruice; Pearson Education, Delhi.

5. Principle of Organic Synthesis. Richard Norman and James M Coxon.

6. Organic Chemistry:Reactions & Reagents,37th ed. Aggarwal (2003) Goel Publishing House,Meerut.

7. Organic Analytical Chemistry. Jagmohan (2003) Narosa pub. New Delhi.

Kinetics and Thermodynamics in Biochemistry : Bray & White.

8. Biophysical chemistry Vol. I : Edsall and Wyman

9. Non Equilibrium Thermodynamics in Biophysics : Katchalasky and Curran; Harvard University Press.

10. Principles of Physical Biochemistry : Kensel. E.Van Holde, W. Curtis Johnson, P. Shing Ho (2005) 2 nd edition, Prentice Hall

11. Physical basis of biochemistry: Foundations of molecular biophysics, Bergethan, P.R.(2000) Springer.

BTE-212L		Molecular Biology Lab (B.Tech. Biotechnology Semester IV)					
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	3	1.5	60	40	100	3 Hrs.
Purpose		To familiarize the students with basic concepts of molecu.					
	Course Outcomes						
CO1		Students will be able to learn Isolation of DNA from Prokaryotic and Eukaryotic Cells					
CO2		Learning of Gel Electrophoresis for separation of DNA, RNA and Proteins					
CO3		Students will learn the technique of PCR Amplification of Nucleic Acids					
CO4		Students will learn Restriction Mapping of Plasmid DNA					

LABORATORY EXPERIMENTS

1. Isolation of genomic DNA from eukaryotic cells.

2. Isolation of RNA from eukaryotic cells.

3. Isolation of proteins from eukaryotic cells.

4. Isolation of genomic DNA from prokaryotic cells.

5. Isolation of plasmid DNA from Prokaryotic cells.

6. Restriction mapping of plasmid DNA:This experiment involves single and double digestion of the plasmid with restriction enzymes.

7. Gel electrophoretic separation of DNA and molecular wt. determination.

8. Gel electrophoretic separation of RNA.

9. Gel electrophoretic separation of proteins.

10. Transblot analysis of DNA.

11. Gel Extraction of DNA.

12. PCR amplification of DNA: Visualization by gel electrophoresis.

Reference Book:

Molecular Cloning – A laboratory manual: 3rd Edition Vol. 1-3. Sambrook J and Russell D.W. (2001). Cold Spring Harbor laboratory Press, New York.

BTE-214L	Bioanalytical Techniques Lab (B.Tech. Biotechnology) Semester- IV						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time
-	-	3	1.5	60	40	100	3 Hrs
Purpose	To learn the Bioanalytical Techniques used in the field of Biotechnology						
Course Outcomes							
CO1	Students will learn about working of spectrophotometer.						
CO2	Students will be able to learn about technique of paper chromatography.						
CO3	Students will be able to learn about technique of electrophoresis.						
CO4	Students will be able to estimate DNA and RNA in any sample.						

LABORATORY EXPERIMENTS

1. To verify the validity of Beer-Lambert's law and determine the molar extinction coefficient of NADH/NAD
2. Separation of amino acids/ sugars by paper chromatography.
3. Extraction and estimation of total lipid content in a given sample of oil seed.
4. Partial purification of an enzyme by ammonium sulphate fractionation,
5. Native gel electrophoresis of proteins.
6. To demonstrate the working of HPLC.
7. Quantitative determination of DNA and RNA by spectrophotometric method.

Reference Books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.
2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.
3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw-Hill, Book Company, UK.

BTE-216L	Industrial Microbiology Lab (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the Practical Aspects of Industrial Microbiology						
Course Outcomes							
CO1	Learning of Sterilization Techniques used in Microbiology Lab						
CO2	Learning of Identification of industrially important microorganisms						
CO3	Students will learn production of antibiotics and enzymes from microbes						
CO4	Students will learn determination of microbial cell growth						

LABORATORY EXPERIMENTS

1. Sterilization Techniques (Media, air & water)
2. Construction of various fermenters (bioreactors)
3. Identification of industrially important microorganisms e.g. molds, yeasts and bacteria.
4. Production of various products in the lab. Alcohol, wine, cellulase, protease and bread.
5. Isolation of antibiotic producing microorganisms from the soil.
6. Penicillin production and testing of antimicrobial activity.
7. Isolation of streptomycin-resistant mutants by replica plating method.
8. Isolation of UV induced auxotrophic mutants.
9.Determination of cell growth.
10.Production of organic acids (Citric and lactic) by microorganisms.
11. Production of industrially important enzymes (protease, amylase) by microorganisms.

Reference Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology. Aneja, K.R.(2003) 4th Edition. New Age International Publishers, New Delhi.
2. Fermentations & Biochemical Hand Book: Principles, Process Design and Equipment. HC Vogel and Noyes(1983).
3. Microbiology Labortary Manual. Cappuccino, J. and Sheeman, N.(2000), 4th Edition, Addison Wesley, California.
4. Manual of Industrial Microbiology and Biotechnology. 2nd Edition. Ed. Arnold L. Demain and Julian E. Davies (1999) ASM Press Washington D.C.

BT-218L	Immunology Lab (B.Tech. Biotechnology) Semester -IV						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the practical aspects of Immunology						
Course Outcomes							
CO1	Students will be able to learn basic techniques in handling laboratory animals.						
CO2	Learning of techniques for purification of immunoglobulins.						
CO3	Students will learn the technique of Immunoprecipitation and Agglutination.						
CO4	Students will learn the principles of ELISA.						

LABORATORY EXPERIMENTS

1. Routine techniques in handling laboratory animals: feeding, cleaning and bleeding procedure for mice and rabbit.
2. ABO blood group typing
3. Estimation of heamoglobin in blood sample
4. Detection of antigen/antibody from test sample
5. Purification of immunoglobulins.
6. Immunoprecipitation techniques
7. Agglutination techniques
8. ELISA

Reference Books:

1. Using Antibodies: A Laboratory Manual. Harlow & Lane(1998) Cold Spring Harbor Lab Press.
2. Immunological Techniques Made Easy. Cochet, et al.(1998)Wiley Publishers,Canada.

MC-901	ENVIRONMENTAL SCIENCES (B.Tech. Biotech IV th Sem)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To learn the multidisciplinary nature, scope and importance of Environmental sciences.**						
Course Outcomes							
CO1	**The students will be able to learn the importance of natural resources.**						
CO2	**To learn the theoretical and practical aspects of eco system.**						
CO3	**Will be able to learn the basic concepts of conservation of biodiversity.**						
CO4	**The students will be able to understand the basic concept of sustainable development.**						

UNIT I

The multidisciplinary nature of environmental studies.Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
(b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food Resources- World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem.Sturcture and function of an ecosystem.Producers, consumers and decomposers.Energy flow in the ecosystem.Ecological Succession.Food Chains, food webs and ecological pyramids. Introduction, types,characteristic features, structure and function of the following ecosystem-

a. Forest Ecosystem
b. Grassland Ecosystem
c. Desert Ecosystem
d. Aquatic Ecosystems(ponds, streams, lakes, rivers, oceans, estuaries

Field Work. Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain.Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India.Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards
Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment.From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns. Case Studies.

Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.Wasteland Reclamation.Consumerism and waste products.

Environment Protection Act.Air (Prevention and Control of Pollution) Act.Water (Prevention and Control of Pollution) Act.Wildlife Protection Act.Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness.

Human population and the Environment.Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health.

Human rights.Value Education.HIV/AIDS, Women and Child Welfare.Role of Information Technology in Environment and Human Health.Case Studies.Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressan drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

A. Definition of Credit:

1 Hour Lecture (L) per week	1 credit
1Hour Tutorial (T) per week	1 credit
1 Hour Practical (P) per week	0.5 credit
2 Hours Practical (Lab) per week	1 credit

B. Range of Credits:

A total credit of 160 is required for a student to be eligible to get Under Graduate degree in **Mechanical Engineering**. A student will be eligible to get Under Graduate degree **(B.Tech.) with Honours**, if he/she completes an additional 20 credits. These could be acquired through MOOCs at Swayam portal or with in-house examination being conducted. In order to have an Honours degree, a student may choose minimum 20 credits provided that the student must ensure the course is approved by the Competent Authority, Government of India.

Bachelor of Technology (Mechanical Engineering), UIET, KUK

Credit-Based (2018-19 Onwards)

*SCHEME OF STUDIES/EXAMINATIONS (***Semester -II***)*

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						Major Test	Minor Test	Practical	Total	
1A	BS-119	Introduction to Electromagnetic theory	3:1:0	4	4	75	25	0	100	3
1B	BS-101	Chemistry	3:1:0	4	4	75	25	0	100	3
2A	ES-105	Programming for Problem Solving	3:0:0	3	3	75	25	0	100	3
2B	HM-101	English	2:0:0	2	2	75	25	0	100	3
3	BS-136	Calculus & Ordinary Differential Equations	3:1:0	4	4	75	25	0	100	3
4A	ES-109	Engineering Graphics & Design	1:2:0	3	3	75	25	0	100	3
4B	ES-111L	Manufacturing Processes Workshop	0:0:3	3	1.5	-	40	60	100	3
5A	BS-141	Biology	2:1:0	3	3	75	25	0	100	3
5B	ES-101	Basic Electrical Engineering	4:1:0	5	5	75	25	0	100	3
6A	BS-121L	Electromagnetics Lab	0:0:3	3	1.5	--	20	30	50	3
6B	BS-103L	Chemistry Lab	0:0:3	3	1.5	--	20	30	50	3
7A	ES-107L	Programming for Problem Solving Lab	0:0:2	2	1	--	20	30	50	3
7B	ES-103L	Basic Electrical Engineering Lab	0:0:2	2	1	--	20	30	50	3
8A	ES-113L	Engineering Graphics & Design Practice	0:0:3	3	1.5	--	20	30	50	3
8B	HM-103L	Language Lab	0:0:2	2	1	--	20	30	50	3
		Total	12:5:8/ 12:3:10	25/ 25	21.0/ 20.0	375/ 300	185/200	90/150	650A/ 650B	

Note: (1) A branch will study either the subjects corresponding to Sr. No. Marked A or corresponding to Sr. No. Marked B in one particular semester.
(2) All students have to undertake the industrial training for 4 to 6 weeks after 2nd semester which will be evaluated in 3rd semester

BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING) CREDIT BASED
KURUKSHETRA UNIVERSITY KURUKSHETRA
SCHEME OF STUDIES/EXAMINATION
SEMESTER III (w.e.f. session 2019-2020)

S. No.	Course No.	Course Name	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	BS-201	Optics & Waves	3:0:0	3	3	75	25	0	100	3
2	BS-204	Higher Engineering Mathematics	3:0:0	3	3	75	25	0	100	3
3	ES-203	Basic Electronics Engineering	3:0:0	3	3	75	25	0	100	3
4	MEC-201	Theory of Machines	3:1:0	4	4	75	25	0	100	3
5	MEC-203	Mechanics of Solids-I	3:1:0	4	4	75	25	0	100	3
6	MEC-205	Thermodynamics	3:1:0	4	4	75	25	0	100	3
7	MEC-207L	Theory of Machines Lab	0:0:2	2	1	0	40	60	100	3
8	MEC-209L	Mechanics of Solids Lab	0:0:2	2	1	0	40	60	100	3
9	*MEC-211	Industrial Training-I	2:0:0	2	-	-	100	-	100	
10	**MC-901	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
			Total	**30**	**23**	**450**	**230**	**120**	**800**	

*MEC-211 is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.
**MC-901 is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING) CREDIT BASED

KURUKSHETRA UNIVERSITY KURUKSHETRA

SCHEME OF STUDIES/EXAMINATION

SEMESTER IV (w.e.f. session 2019-2020)

S. No.	Course No.	Course Name	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	ES-204	Materials Engineering	3:0:0	3	3	75	25	0	100	3
2	MEC-202	Applied Thermodynamics	3:0:0	3	3	75	25	0	100	3
3	MEC-204	Fluid Mechanics & Fluid Machines	3:1:0	4	4	75	25	0	100	3
4	MEC-206	Mechanics of Solids-II	3:1:0	4	4	75	25	0	100	3
5	MEC-208	Instrumentation& Control	3:0:0	3	3	75	25	0	100	3
6	ES-206L	Materials Engineering Lab	0:0:2	2	1	0	40	60	100	3
7	MEC-210L	Fluid Mechanics & Fluid Machines Lab	0:0:2	2	1	0	40	60	100	3
8	*MC-902	Constitution of India	3:0:0	3	-	75	25	-	100	3
			Total	**24**	**19**	**375**	**205**	**120**	**700**	

*MC-902 is a mandatory credit-less course in which the students will be required to get passing marks in the major test.

Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester.

Third Semester

B. Tech (3rd Semester) Mechanical Engineering							
BS - 201	**Optics and Waves**						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3h**
Purpose	To introduce the fundamentals of wave and optics for the applications in Engineering field.						
Course Outcomes							
CO 1	Familiarize with basic phenomenon used in propagation of waves.						
CO 2	Introduce the fundamentals of interference, diffraction, polarization and their applications.						
CO 3	To make the students aware to the importance of Laser in technology.						

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent 's half shade polarimeter, Biquartzpolarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein's Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping schemes, Main components of Laser, Gas lasers (He-Ne, CO_2), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd*., *India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd*., *India.*
3. A. Ghatak, Optics, *McGraw Hill Education(India) Pvt. Ltd., India*.
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B. Tech (3rd Semester) Mechanical Engineering							
BS-204	**HIGHER ENGINEERING MATHEMATICS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Theory**	**Sessional**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 h**
Purpose	The objective of this course is to familiarize the prospective Engineers with Laplace Transform, partial differential equations which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:						
Course Outcomes							
CO 1	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.						
CO 2	To introduce the Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.						
CO 3	To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.						
CO 4	To familiar with essential tool of Numerical differentiation and Integration needed in approximate solutions for the ordinary differential equations.						

UNIT-I

Laplace Transform

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

UNIT-2

Partial Differential Equations

Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

UNIT-3

Numerical Methods-1

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequalintervals: Newton's divided difference and Lagrange's formulae.

UNIT-4

Numerical Methods-2

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993. AICTE Model Curriculum in Mathematics.
2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
10. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
11. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.

Note: The examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B. Tech (3rd Semester) Mechanical Engineering							
ES-203	**Basic Electronics Engineering**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Purpose :	To provide an overview of electronic devices and components to Mechanical engineering students.						
Course Outcomes							
CO 1	To introduce the basic electronics devices along with their applications.						
CO 2	To become familiar with basic operational amplifier circuits with applications and oscillators.						
CO 3	To understand the fundamentals of digital electronics.						
CO 4	To become familiar with basic electroniccommunication system.						

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-Icharacteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. BJT structure, its input-output and transfer characteristics, BJT as a Common Emitter amplifier, frequency response and bandwidth.

UNIT-II

Operational amplifier and its applications: Introduction to operational amplifiers, inverting, non-inverting and differential modes, basic parameters of Op-amp, Op-amp in open loop configuration, study of practical op-amp IC 741, Op-amp applications: adder, subtractor, scale changer, averaging amplifer,comparator, integrator and differentiator.

Timing Circuits and Oscillators: IC 555 timer pin diagram: Astableand mono-stable operation, Barkhausen's criteria for oscillations, R-C phase shift and Wein bridge oscillators using BJT and Op-Amp and their frequency of oscillation.

UNIT-III

Digital Electronics Fundamentals : Difference between analog and digital signals, Booleanalgebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-maps, Logic ICs, half and full adder, multiplexers, de-multiplexers, flip-flops, basic counters.

UNIT-IV

Electronic Communication Systems: The elements ofcommunication system,
Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Text Books:

1. Integrated Electronics, Millman&Halkias (Mc-Graw Hill)
2. Electronics Devices & Circuit Theory, RL Boylestead& L Nashelsky (PHI)

Reference Books:

1. Modern Digital Electronics, R P Jain, Tata McGraw Hill.
2. Electronic Communication Systems, G. Kennedy, McGraw Hill, 4th Edition

Note: The paper setter will set the paper as per the question paper templates provided.

B. Tech (3rd Semester) Mechanical Engineering							
MEC-201	THEORY OF MACHINES						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs)
3	1	0	4	75	25	100	3
Purpose:	To familiarize the students with design of various types of linkage mechanisms for obtaining specific motion, their analysisand applicability for optimal functioning.						
Course Outcomes							
CO 1	To understand the kinematics of simple mechanisms and methods of determining the link velocities.						
CO 2	To understand the acceleration of different mechanisms and profilegeneration of cams and followers.						
CO 3	To understand the concepts of static and dynamic force analysis of different mechanisms and balancing of different components.						
CO 4	To familiarize with gear, gear trains, belts and chain drives.						

UNIT-I

Simple Mechanisms: Introduction to mechanism and machine, Kinematic links, pairs and chains, Mobility of mechanisms, Equivalent mechanisms,Four bar chain, Inversion of four bar chain, slider crank chain and inversions.

Velocity Analysis: Determination of link velocities, Relative velocity method, Velocities in four bar mechanism, Slider crank mechanism, crank and slotted lever mechanism and quick return motion mechanism, Instantaneous center method: Types & location of instantaneous centers, Arnold Kennedy theorem, methods of locating instantaneous centers, steering gear mechanisms. Problems.

UNIT-II

Acceleration Analysis: Acceleration of a point on a link, four bar mechanism and slider crank mechanism, Coriolis component of acceleration, Klein's construction, Problems.

Cams and Followers: Classification & terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, simple harmonic, constant acceleration and deceleration and cycloidal motion of followers, Problems.

UNIT-III

Static and Dynamic Force Analysis:constraints and applied forces, static equilibrium, equilibrium of two and three-force member, equilibrium of four-forces and torque, free body diagrams. Dynamic Force Analysis:D'Alembert'sprinciple, equivalent offset interia force, Dynamic analysis of four-link,Dynamic analysis of slider-crank mechanisms, velocity and acceleration of piston, angular velocity and angular acceleration of connecting rod, turning moment on crank shaft, turning moment diagrams, fluctuation of energy, flywheels, Problems.

Balancing:rotating masses: Static and Dynamic Balancing, Single Rotating mass, Many Masses rotating in same plane and in different planes. Analytical method for balancing of rotating masses.Reciprocating masses: Balancing of reciprocating engine, Balancing of Multi-cylinder in line engines, balancing machines.

UNIT-IV

Belts and Chain Drives:classifications of belt, law of belting, Length of open and cross flat belt, Ratio of tensions,Centrifugal tension, power transmission, condition for maximum power transmission, creep of belt, V-belt drives: driving tensions, Chain drives: classifications, terminology of chains, kinematics of chains, Problems.

Gears and Gear Trains: Classification & terminology, Law of gearing, Tooth forms & comparisons, Length of path of contact, Contact ratio, Interference & undercutting in involute gear teeth, Minimum number of teeth on gear and pinion to avoid interference. Gear Trains**:**simple, compound, reverted andplanetary gear trains, Problems.

Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East-West Press.
2. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
3. Cleghorn W.L., Mechanisms of Machines, Oxford University Press, 2005. 3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.

Reference Books:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati Second Edition New age International.
2. Theory and Machines: S.S. Rattan, Tata McGraw Hill.
3. Kinematics of Machines-Dr. Sadhu Singh, Pearson Education

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (3rd Semester) Mechanical Engineering						
MEC-203	**MECHANICS OF SOLIDS-I**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**1**	**0**	**4**	**75**	**25**	**100**	**3**
Purpose	The objective of this course is to make the students aware of Stress, Strain and deformation of solids with the applications to beams, shafts and column and struts. The course will help the students to build the fundamental concepts in order to solve engineering problems.						
Course Outcomes							
CO1	Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering, determine centroid and moment of inertia of a different geometrical shapes and able to understand its importance. Explain the basic concepts of stress and strain and solve the problems						
CO 2	Determine and calculate the values of principal stresses. Express the concept of shear force and bending moment of beams. Construct shear force and bending moment diagram for beams.						
CO 3	Express the concept of torsion of circular shaft and able to solve the problems on torsion of circular shaft. Illustrate and solve the problems on bending and shear stresses on beams						
CO 4	Solve the problems on column and strut and Derive the derivations and solve the problems on slope and deflection.						

Unit-I

Introduction: Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces, forces in equilibrium, principle and laws of equilibrium, Free body diagrams, Lami's Theorem, equations of equilibrium, Concept of center of gravity and centroid, centroid of various shapes: Triangle, circle, semicircle and trapezium, theorem of parallel and perpendicular axes, moment of inertia of simple geometrical figures, polar moment of inertia. Numerical Problems

Simple Stresses & Strains: Concept & types of Stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hook's law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numerical problems.

Unit-II

Principle Stresses: Two dimensional systems, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stresses, Numerical Problems.

Shear Force & Bending Moments: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contraflexture under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii)combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Numerical Problems.

. **Unit-III**

Torsion of Circular Members: Derivation of equation of torsion, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, Numerical problems.

Flexural and Shear Stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T, Angle, channel sections, composite beams, shear stresses in beams with derivation, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections. combined bending and torsion, equivalent torque,. Numerical problems.

Unit-IV

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relaions, Numerical problems.

Slope & Deflection : Relationship between bending moment, slope & deflection, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical problems.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert l. Mott, Pearson, New Delhi
3. Strength of Material – Shaums Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (3rd semester) Mechanical Engineering						
MEC-205	**THERMODYNAMICS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**1**	**0**	**4**	**75**	**25**	**100**	**3**
Purpose	The objective of this course is to make the students aware of Energy, Entropy, and Equilibrium, various laws of thermodynamics, concepts and principles. The course will help the students to build the fundamental concepts to apply in various applications like IC engines and Air conditioning systems.						
Course Outcomes							
CO 1	Analyze the work and heat interactions associated with a prescribed process path and to perform an analysis of a flow system.						
CO 2	Define the fundamentals of the first and second laws of thermodynamics and explain their application to a wide range of systems.						
CO 3	Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.						
CO 4	Solve the problems related to Steam and plot the processes on H-S and T-S diagram. Understand thermodynamics relations.						

Unit-I

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Zeroth Law of Thermodynamic and its utility.

First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process.

Unit-II

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale, Numericals

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature-Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of thermodynamics.

Unit -III

Availability, Irreversibility and Equilibrium: High and Low Grade Energy, Available Energy and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility.

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling , Saturated and Superheated Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam.

Unit-IV

Thermodynamic Relations: TDS Relations, Enthalpy and Internal Energy as a Function of Independent Variables, Specific Heat Capacity Relations, Clapeyron Equation, Maxwell Relations.

Gas Power Cycles: Air standard efficiency, Otto cycle, Diesel cycle, Dual cycle, Atkinson cycle, Stirling and Ericsson cycles, Brayton or Joule cycle, Lenoir cycle

Text Books:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill
3. Thermodynamics – An Engineering Approach; Y. A. Cengel, M. A. Boles; Tata McGraw Hill

Reference Books:

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y R Longman

Note: The paper setter will set the paper as per the question paper templates provided.

	B.Tech (3rd Semester) Mechanical Engineering							
MEC-207L	**THEORY OF MACHINES LAB**							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time (Hrs)**
0	**0**	**2**	**1**	**0**	**40**	**60**	**100**	**3**
Purpose :	To familiarize and practice the students with various kinds of mechanisms andmachines.							
	Course Outcomes							
CO 1	To learn about various types of basic mechanism & their applications in different machines.							
CO 2	To study the effect of static and dynamic force on the components of single slider crank mechanism.							
CO 3	To find gyroscopic couple of a motorized gyroscope experimentally.							
CO 4	To study the design and working of various gear, gear trains, steering systems, belt drives, brakes and dynamometers.							

List of experiments

1. To study inversions of 4 bar mechanisms, single and double slider crank mechanisms.
2. To determine the ratio of times and tool velocities of Whitworth quick-return mechanism.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find out experimentally the Coriolis component of acceleration and compare with theoretical value.
5. To determine the moment of inertia of a flywheel.
6. To plot follower displacement v/s cam rotation for various cam follower systems.
7. To find gyroscopic couple on motorized gyroscope and compare with applied couple.
8. To calculate the torque on planet carrier and torque on internal gear using epicycle gear train and holding torque apparatus.
9. To determine the coefficient of friction between belt and pulley and plot a graph between $\log_{10} T_1/T_2$ v/s θ
10. To study the different types of centrifugal and inertia governor with demonstration.
11. To study different types of brakes and dynamometers with demonstration.
12. To study various types of steering mechanisms.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B.Tech. (3rd semester) Mechanical Engineering							
MEC-209L	**MECHANICS OF SOLIDS LAB**							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time (Hrs.)**
0	**0**	**2**	**1**	**0**	**40**	**60**	**100**	**3**
Purpose	To make the students aware of different properties of material using different experiments.							
Course Outcomes								
CO1	Ability to design and conduct experiments, acquire data, analyze and interpret data							
CO 2	Ability to determine the behavior of ferrous metals subjected to normal and shear stresses by means of experiments.							
CO 3	Ability to determine the behavior of structural elements, such as bars subjected to tension, compression, shear, bending, and torsion by means of experiments.							
CO 4	Physical insight into the behavior materials and structural elements, including distribution of stresses and strains, deformations and failure modes.							
CO5	Write individual and group reports: present objectives, describe test procedures and results, synthesize and discuss the test results.							

List of Experiments:

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod&Charpy).
6. To study the Universal testing machine and perform the tensile, compression & bending tests.
7. To perform the shear test on UTM.
8. To study the torsion testing machine and perform the torsion test.
9. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under point and distributed Loads.
10. To prepare the composite specimen using hot compression molding machine and test for different mechanical properties.

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Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B.Tech. (3rd semester) Mechanical Engineering							
MEC-211	**INDUSTRIAL TRAINING-I**							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time (Hrs.)**
2	**0**	**0**	**--**	**--**	**100**	**--**	**100**	
Purpose	To provide comprehensive learning platform to students where they can enhance their employ ability skills and exposure to the industrial environment.							
Course Outcomes								
CO1	Capability to acquire and apply fundamental principles of engineering.							
CO 2	Become updated with all the latest changes in technological world.							
CO 3	Capability and enthusiasm for self-improvement through continuous professional development and life-long learning							
CO 4	Awareness of the social, cultural, global and environmental responsibility as an engineer.							

Note:MEC-211 is a mandatory non-credit course in which the students will be evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

The candidate has to submit a training report of his/her work/project/assignment completed in the industry during the training period. The evaluation will be made on the basis of submitted training report and viva-voce/presentation.

	B.Tech. (3rd semester) Mechanical Engineering						
MC-901	Environmental Sciences						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time
3	0	0	-	75	25	100	3 Hrs.
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT I

The Multidisciplinary Nature of Environmental Studies. Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water Resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral Resources- Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food Resources- World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
(f) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an Ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological Succession. Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem-

a. Forest Ecosystem
b. Grassland Ecosystem
c. Desert Ecosystem
d. Aquatic Ecosystems(ponds, streams, lakes, rivers, oceans, estuaries

Field Work. Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain. Visit to a local polluted site- Urban /Rural Industrial/Agricultural. Study of common plants, insects and birds. Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and Its Conservation. Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Bio-diversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts.

Endangered and endemic species of India. Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition. Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment. From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns. Case Studies.

Environmental Ethics-Issues and Possible Solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland Reclamation. Consumerism and waste products.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public Awareness.

Human Population and the Environment. Population growth, variation among nations. Population explosion-Family Welfare Programme. Environment and human health. Human rights. Value Education. HIV/AIDS, Women and Child Welfare. Role of Information Technology in Environment and Human Health. Case Studies. Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressan drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Text Books

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India

Reference Books:

1. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
2. Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The paper setter will set the paper as per the question paper templates provided.

Fourth Semester

	B.Tech. (4th Semester) Mechanical Engineering						
ES-204	MATERIALS ENGINEERING						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	0	0	3	75	25	100	3
Purpose:	To understand internal structure- properties relationship of different types of materials and learn about Metallographic analysis and Characterization.						
CourseOutcomes							
CO 1	To understand the Crystal structures and deformation mechanism in various materials.						
CO 2	To study various types of phase diagrams, TTT curve and Iron carbon diagram. To learn about different heat treatment processes.						
CO 3	To learn about the failure mechanisms like Creep and Fatigue and designation of materials.						
CO 4	To study Basics of Metallography and Basic Principle involved in the working of various types of Material characterization techniques.						

UNITI

Crystallography: ReviewofCrystalStructure,SpaceLattice,Co-ordinationNumber,NumberofAtomsperUnitCell,AtomicPackingFactor;Numerical Problems Related toCrystallography.

Imperfection in Metal Crystals: Crystal Imperfections and their Classifications, Point Defects,LineDefects,Edge&ScrewDislocations,SurfaceDefects,VolumeDefects.

Introduction to Engineering materials and Standard Materials Designation: Introduction to Engineering materials,Steel Terminology, Standard Designation System for Steels, Indian Standard specifications for steels as per BIS: Based on Ultimate Tensile Strength and based on Composition, AISI-SAE standard designation for Steels and Aluminium Alloys

UNIT II

PhaseDiagrams: Alloy Systems, Solid solutions, Hume Rothery's Rules, Intermediate phases, Phase Diagrams, Gibbs Phase Rule, Cooling curves,TheLever Rule,binary phasediagrams, Applications of Phase Diagrams, PhaseTransformation, Micro constituentsof Fe-Csystem,Allotropic FormsofIron,Iron-ironcarbide phase diagram, ModifiedIron CarbonPhaseDiagrams, Isothermal Transformation, TTT Curve,

Heat Treatment: Heattreatmentof steels,Annealing,Normalising,Hardening,Tempering, Case Hardening, Ageing, Austemperingand Martempering, Surface Hardening, Mass Effect, EquipmentsforHeatTreatment,MajorDefectsinMetalsorAlloysduetofaultyHeattreatment.

UNIT III

DeformationofMetal: ElasticandPlasticDeformation,MechanismofPlasticDeformation, Slip; Critical Resolved Shear Stress, Twinning,ConventionalandTrue Stress Strain Curvesfor Polycrystalline Materials,Yield Point Phenomena, Bauschinger Effect, Work Hardening.

FailureofMaterials: Fatigue,Fatiguefracture,fatiguefailure,MechanismofFatigueFailure,FatigueLifecalculations,Fatigue Tests, Theories ofFatigue.

Creep:CreepCurve,TypesofCreep,Factorsaffecting Creep, Mechanismof Creep,CreepResistantMaterial,Creep Fracture,CreepTest,StressRupture test.

UNITIV

Introduction to Metallography: Metallography, Phase analysis, Dendritic growth, Cracks and other defects Corrosion analysis, Intergranular attack (IGA), Coating thickness and integrity, Inclusion size, shape and distribution, Weld and heat-affected zones (HAZ), Distribution and orientation of composite fillers, Graphite nodularity, Intergranular fracturing

Materials CharacterizationTechniques: Characterization techniques suchas X-Ray Diffraction (XRD), Scanning Electron Microscopy, transmission electron microscopy,atomicforce microscopy, scanning tunneling microscopy, Atomicabsorption spectroscopy.

Text Books:

1. Material SciencebyS.L.Kakani, New AgePublishers.
2. TheScienceand EngineeringofMaterials, DonaldR. Askeland , Chapman&Hall.
3. Fundamentals of Material Science and EngineeringbyW. D. Callister, Wiley.
4. FundamentalofLightMicroscopyandElectronicImagingbyDouglasB.Murphy, Kindle Edition 2001
5. Materials Science and Engineering, V. Raghvan
6. Phase Transformation in Metals and Alloys,D. A.Porter &K.E. Easterling

Reference Books:

7. Material SciencebyNarula, TMH
8. Metallographic Handbook by Donald C. Zipperian, Pace Technologies, USA.
9. RobertCahnConciseEncyclopediaofMaterialsCharacterization,SecondEdition:2nd Edition (Advances inMaterials Scienceand Engineering) Elsevier Publication 2005.
10. Smart Materials and Structures by Gandhi and Thompson, Chapman and Hall.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4^{th} Semester) Mechanical Engineering						
MEC-202	**APPLIED THERMODYNAMICS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Purpose:	This course aims to provide a platform to students to understand, model and analyze concept of dynamics involved in thermal energy transformation. To prepare them to carry out experimental investigation and analysis of problems related to applied thermodynamics.						
Course Outcomes							
CO1	Understand the working of boilers, types of boilers, accessories and mountings used on boilers.						
CO 2	Learn about simple and modified Rankine cycles.						
CO 3	Understand the design and analysis of steam flow through steam nozzles. To learn about the working of different types of condensers.						
CO 4	Analyze the working and design of the steam turbine and apply the knowledge in solving the engineering problems of turbines.						

UNITI

Steam Generators: Introduction; classification of boilers; comparison of fire tube and water tube boiler; their advantages; description of boiler; Lancashire; locomotive; Babcock; Wilcox etc.; boiler mountings; stop valve; safety valve; blow off valve; feed check etc.; water level indicator; fusible plug; pressure gauge; boiler accessories; feed pump; feed water heater; preheater; super heater; economizer; natural draught chimney design; artificial draught; stream jet draught; mechanical draught; calculation of boiler efficiency and equivalent evaporation.

UNIT II

Vapour Power Cycles: Simple and modified Rankine cycle; effect of operating parameters on Rankine cycle performance; effect of superheating; effect of maximum pressure; effect of exhaust pressure; reheating and regenerative Rankine cycle; types of feed water heater; reheat factor; binary vapour cycle. Simple steam engine, compound engine; function of various components.

UNIT III

Steam Nozzle: Function of steam nozzle; shape of nozzle for subsonic and supersonics flow of stream; variation of velocity; area of specific volume; steady state energy equation; continuity equation; nozzle efficiency; critical pressure ratio for maximum discharge; physical explanation of critical pressure; super saturated flow of steam; design of steam nozzle. Advantage of steam condensation; component of steam condensing plant; types of condensers; air leakage in condensers; Dalton's law of partial pressure; vacuum efficiency; calculation of cooling water requirement; air expansion pump.

UNIT IV

Steam Turbines: Introduction; classification of steam turbine; impulse turbine; working principle; compounding of impulse turbine; velocity diagram; calculation of power output and efficiency; maximum efficiency of a single stage impulse turbine; design of impulse turbine blade section; impulse, reaction turbine; working principle; degree of reaction; parsons turbine; velocity diagram; calculation of power output; efficiency of blade height; condition of maximum efficiency; internal losses in steam turbine; governing of steam turbine.

Text Books:

1. Thermal Engineering – P L Ballaney, Khanna Publishers.
2. Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House

3. Engineering Thermodynamics Work and Heat Transfer - G. F. C Rogers and Y. R. Mayhew, Pearson.
4. Applied Thermodynamics for Engineering Technologists - T. D. Eastop and A. McConkey, Pearson.

Reference Books:

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A. McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4th Semester) Mechanical Engineering						
MEC-204	**FLUID MECHANICS&FLUID MACHINES**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**1**	**0**	**4**	**75**	**25**	**100**	**3**
Purpose: To build a fundamental understanding of concepts of Fluid Mechanics and their application in rotodynamic machines.							
Course Outcomes							
CO1	Upon completion of this course, students will be able to apply mass and momentum conservation laws to mathematically analyze simple flow situations.						
CO2	The students will be able to obtain solution for boundary layer flows using exact or approximate methods.						
CO3	The students will be able to estimate the major and minor losses through pipes and learn to draw the hydraulic gradient and total energy lines.						
CO4	The students will be able to obtain the velocity and pressure variations in various types of simple flows.						
CO5	They will be able to analyze the flow and evaluate the performance of pumps and turbines.						

Unit I

Fluid Properties: Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, weight density, specific volume, specific gravity, viscosity, compressibility, surface tension and capillarity.

Fluid Kinematics: Types of fluid flows, stream, streak and path lines; flow rate and continuity equation, differential equation of continuity in cartesian and polar coordinates, rotation and vorticity, circulation, stream and potential functions, flow net. Problems.

Fluid Dynamics: Concept of system and control volume, Euler's equation, Navier-Stokes equation, Bernoulli's equation and its practical applications, Impulse momentum equation. Problems.

Unit II

Viscous Flow:

gradient. Exact flow solutions, Couette and Poisuielle flow, laminar flow through circular conduits. Problems.

Turbulent Flow Through Pipes: Darcy Weisbach equation, friction factor, Moody's diagram, minor losses in pipes, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes. Problems.

Boundary Layer Flow: Concept of boundary layer, measures of boundary layer thickness, Blasius solution, von-Karman momentum integral equation, laminar and turbulent boundary layer flows, separation of boundary layer and its control. Problems.

Unit III

Dimensional Analysis: Need for dimensional analysis – methods of dimension analysis – Dimensionless parameters – application of dimensionless parameters. Problems.

Hydraulic Pumps: Introduction, theory of Rotodynamic machines, Classification, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles; Centrifugal pumps, working principle, work done by the impeller, minimum starting speed, performance curves, Cavitation in pumps, Reciprocating pumps, working principle, Indicator diagram, Effect of friction and acceleration, air vessels, Problems.

Unit IV

Hydraulic Turbines: Introduction, Classification of water turbines, heads and efficiencies, velocity triangles, Axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines, working principles, work done, design of turbines, draft tube and types, Specific speed, unit quantities, performance curves for turbines, governing of turbines. Problems.

Text Books:

1. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
2. Fluid Mechanics – Frank M. White, McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
4. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
5. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.

Reference Books:

1. Mechanics of Fluids – I H Shames, Mc Graw Hill
2. Fluid Mechanics: Fundamentals and Applications - YunusCengel and John Cimbala, McGraw Hill.
3. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4th Semester) Mechanical Engineering						
MEC-206	MECHANICS OF SOLIDS-II						
Lecture	Tutorial	Practical	Credits	Major Test	Minor Test	Total	Time (Hrs.)
3	1	0	4	75	25	100	3
Purpose	The objective of this course is to show the development of strain energy and stresses in springs, pressure vessel, rings, links, curved bars under different loads. The course will help the students to build the fundamental concepts in order to solve engineering problems						
Course Outcomes							
CO1	Identify the basics concepts of strain energy and various theories of failures and solve the problems						
CO 2	Differentiate different types of stresses induced in thin pressure vessel and solve the problems. Use of Lame's equation to calculate the stresses induced in thick pressure vessel.						
CO 3	Able to compute stresses in ring, disk and cylinder due to rotation. Classify the different types of spring and analyze the stresses produced due to loading						
CO 4	Determine the stresses in crane hook, rings, chain link for different cross section and also the deflection of curved bars and rings. Analyze the stresses due to unsymmetrical bending and determine the position of shear centre of different section.						

Unit I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's theorem, Numerical.

Theories of Elastic Failures: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.

Unit II

Thin Walled Vessels: Hoop & Longitudinal stresses & strains in cylindrical &spherical vessels & their derivations under internal pressure, wire would cylinders, Numericals.

Thick Cylinders & Spheres: Derivation of Lame's equations, radial & hoop stresses and strains in thick, and compound cylinders and spherical shells subjected to internal fluid pressure only, hub shrunk on solid shaft, Numericals.

Unit III

Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals.

Springs: Stresses in closed coiled helical springs, Stresses in open coiled helical springs subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

Unit IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem, stresses in simple chain links, deflection of simple chain links, Problems.

Unsymmetrical Bending: Introduction to unsymmetrical bending, stresses due to unsymmetrical bending, deflection of beam due to unsymmetrical bending, shear center for angle, channel, and I-sections, Numericals.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert l. Mott, Pearson, New Delhi
3. Strength of Material – Shaums Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4th Semester) Mechanical Engineering						
MEC-208	**Instrumentation & Control**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Purpose	To understand the basics of the measurement of various quantities using instruments, their accuracy and range and the techniques for controlling devices automatically.						
Course Outcomes							
CO1	Students will have basic knowledge about measurement systems and their components.						
CO2	Students will learn about various sensors used for measurement of mechanical quantities.						
CO3	Students will have basic knowledge of process monitoring and control.						

Unit I

Instrumentation System: introduction, typical applications of instrument systems, functional elements of a measurement system, classification of instruments, standards and calibration, static and dynamic characteristics of measurement systems.
Statistical Error Analysis: statistical analysis of data and measurement of uncertainty: probability, confidence interval or level, mean value and standard deviation calculation, standard normal distribution curve and probability tables, sampling and theory based on samples, goodness of fit, curve fitting of experimental data.

Unit II

Sensors and Transducers: introduction and classification, transducer selection and specifications, primary sensing elements, resistance transducers, variable inductance type transducers, capacitive transducers, piezo-electric transducers, strain gauges.Smart Sensors: Introduction, architecture of smart sensor, bio sensor and physical sensor, Piezo-resistive pressure sensor, microelectronic sensor.

Measurement of force, torque, shaft power, speed and acceleration: force and weight measurement system, measurement of torque, shaft power, speed and velocity: electrical and contactless tachometers, acceleration: vibrometers, seismic and piezo-electric accelerometer.

Unit III

Measurement of pressure, temperature and flow: Basic terms, Pressure: Liquid column manometers, elastic type pressure gauges, electrical types for pressure and vacuum, temperature measuring instruments: RTD sensors, NTC thermistor, thermocouples, and semiconductor based sensors. Flow Measurement: drag force flow meter, turbine flow meter, electronic flow meter, electromagnetic flow meter, hot-wire anemometer.

Instruments for measuring Humidity, Density, and Viscosity: Humidity definitions, Humidity measuring devices, Density and Specific Gravity, Basic terms, Density measuring devices, Density application considerations, Viscosity, Viscosity measuring instruments, basic terms used in pH, pH measuring devices, pH application considerations. Problems.

Unit IV

Basic Control System: Introduction, basic components of control system, classification : closed loop and open loop control system, transfer function, block diagram representation of closed loop system and its reduction techniques, mathematical modelling of various mechanical systems and their analogy with electrical systems, signal flow graph and its representation.

Mechanical Controllers: Basics of actuators: pneumatic controller, hydraulic controller and their comparison.

Text Books:

1.Instrument and control by Patranabis D., PHI Learning.

2.Fundamental of Industrial Instrumentation and Process control by W.C.DUNN, McGrawHill,

3. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition), Pearson Education India, 2007

4. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999.

Reference Books:

1. Mechanical Measurement and Control by A K Sawhney

2. Modern control Engineering by Katsuhiko Ogata, PHI publication

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4th Semester)MechanicalEngineering							
ES-206L	**MATERIALS ENGINEERING LAB**							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time (Hrs.)**
0	**0**	**2**	**1**	**-**	**40**	**60**	**100**	**3**
Purpose	Tomakethestudentsawareofmaterialstructureandpropertiesofmaterialusing differentexperiments.							
CourseOutcomes								
CO 1	Ability to design and conduct experiments, acquire data, analyze and interpret data							
CO 2	Ability to determine the grain size and microstructure in different Ferrous alloys by means of experiments.							
CO 3	Ability to learn about microstructures of different Non-Ferrous alloys by means of experiments.							
CO 4	To learn about heat treatment processes through experiments.							
CO 5	Ability to Analyze microstructure of Heat-treated specimens and perform Fatigue and creep test on different materials.							

List ofExperiments:

1. To Study various Crystal Structures through Ball Models.
2. To study the components and functions of Metallurgical Microscope.
3. To learn about the process of Specimen Preparation for metallographic examination.
4. To perform Standard test Methods for Estimation of Grain Size.
5. To perform Microstructural Analysis of Carbon Steels and low alloy steels.
6. To perform Microstructural Analysis of Cast Iron.
7. To perform Microstructural Analysis of Non-Ferrous Alloys: Brass & Bronze.
8. To perform Microstructural Analysis of Non-Ferrous Alloys: Aluminium Alloys.
9. To Perform annealing of a steel specimen and to analyze its microstructure.
10. To Perform Hardening of a steel specimen and to analyze its microstructure.
11. To performFatiguetest on fatiguetestingmachine.
12. To perform Creep test oncreep testingmachine.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B. Tech. (4th Semester) Mechanical Engineering							
MEC-210L	**FLUID MECHANICS &FLUID MACHINES LAB**							
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**0**	**40**	**60**	**100**	**3**
Purpose	To familiarize the students with the equipment and instrumentation of Fluid Mechanics and Machines							
Course Outcomes								
CO1	Operate fluid flow equipment and instrumentation.							
CO2	Collect and analyse data using fluid mechanics principles and experimentation methods.							
CO3	Determine the coefficient of discharge for various flow measurement devices.							
CO4	Calculate flow characteristics such as Reynolds number, friction factor from laboratory measurements.							
CO5	Analyze the performance characteristics of hydraulic pumps.							
CO6	Analyze the performance characteristics of hydraulic turbines.							

List of Experiments:

1. To verify the Bernoulli's Theorem.
2. To determine coefficient of discharge of an orifice meter.
3. To determine the coefficient of discharge of Venturimeter.
4. To determine the coefficient of discharge of Notch.
5. To find critical Reynolds number for a pipe flow.
6. To determine the friction factor for the pipes.
7. To determine the meta-centric height of a floating body.
8. Determination of the performance characteristics of a centrifugal pump.
9. Determination of the performance characteristics of a reciprocating pump.
10. Determination of the performance characteristics of a gear pump.
11. Determination of the performance characteristics of Pelton Wheel.
12. Determination of the performance characteristics of a Francis Turbine.
13. Determination of the performance characteristics of a Kaplan Turbine.
14. Determination of the performance characteristics of a Hydraulic Ram.

Note: At least ten experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B. Tech. (4th Semester) Mechanical Engineering						
MC-902	**Constitution of India**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**-**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To know the basic features of Constitution of India						
	Course Outcomes						
CO1	The students will be able to know about salient features of the Constitution of India.						
CO2	To know about fundamental duties and federal structure of Constitution of India.						
CO3	To know about emergencyprovisions in Constitution of India.						
CO4	To know about fundamental rights under constitution of India.						

UNIT I

Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.

Scheme of the fundamental rights

UNIT II

The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.

Parliamentary Form of Government in India – The constitution powers and status of the President of India

UNIT III

Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.

Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

UNIT IV

Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.

Scope of the Right to Life and Personal Liberty under Article 21.

Text Books

1. Constitution of India. Prof. Narender Kumar (2008) 8th edition. Allahabad Law Agency**.**

Reference Books:

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

Kurukshetra University, Kurukshetra

Course of Study for BBA.LL. B. (Hons) 5-Year Integrated Course

Commenced From the Session 2016-17

Syllabus for Fourth Year(Sem –VII & VIII)

Session 2019-20

BBALLB - 4th Year			
Paper	Semester-VII	Paper	Semester-VIII
Subject Code	Subject	Subject Code	Subject
701-A	Marketing Management	801-A	Human Resource Management
702-A	Civil Procedure Code – I	802-A	Civil Procedure Code –II and Limitation Act
703-A	Principles of Taxation Law	803-A	Indirect Taxation Laws
704-A	Interpretation of Statutes & Principles of Legislation	804-AA 804-AB	Intellectual Property Law OR Investment and Securities Laws
705-AA 705-AB	Human Rights Law and Practices OR International Trade Law	805-AA 805-AB	Gender Justice and Feminist Jurisprudence OR Media and Law
706-A	Professional Ethics, Accountancy for Lawyers & Bench Bar Relations (Compulsory Clinical Course- 1)	806-A	Alternative Dispute Resolution and Legal Aid (Compulsory Clinical Course-II)

BBA.LL.B. (Hons) 5 Year Integrated Course

VII - Semester

Marketing Management

Paper 701-A

Internal Assessment: 20Marks
Theory: 80 Marks

Total: 100Marks

Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT- I

Marketing Management - Meaning, Nature and Scope. Concepts of Marketing.Marketing Environment, Marketing Mix, STP (segmenting, targeting and positioning) approach to marketing.

UNIT- II

Marketing Information System- Meaning and Components. Marketing Research. Consumer Behaviour-Meaning and Importance of study for Marketers.

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UNIT- III

Product –Meaning, levels and product Mix. New Product Development,Product Life Cycle, Branding and Packaging decision.

Pricing-Meaning, procedure for setting a price. Price Variation.

UNIT- IV

Distribution Channels- Levels and Roles. Management of Physical Distribution.

Promotion- Promotion Mix- A study of advertising, sales promotion, personal selling, direct marketing and public relations. Marketing organization and Control.

Suggested Readings

1. Mc Carthy; E.J. : Basic marketing -A Managerial Approach
2. Rama Swamy & Nama Kumari : Marketing Management
3. Kotler, Philip : Marketing Management Analysis Planning and Control
4. Still and Cundiff : Basic Marketing.
5. Stanton et. al. : Marketing Management

BBA.LL.B.(Hons.) 5 –Year Integrated Course
VII- Semester
Civil Procedure Code -I

Paper 702-A

Internal Assessment: 20Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from eachUnit I-IV and question no. 9 in Unit- V shall be compulsory.
- d. Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT-I

1. Definitions : Decree, Decree Holder, Foreign Court, Foreign Judgment, Judgment, Judgment Debtor, Legal Representative, Mesne Profits, Order (Sec. 2)
2. Jurisdiction of Civil Courts, Nature of Suits (Sec. 9)
3. Stay of Suits, Res Judicata, Foreign Judgement (Sec. 10-14)
4. Place of Suing, Transfer of Suits (Secs.15-25)
5. Joinder of Parties, Representative Suits, Splitting of Claims and Relief, Joinder of Cause of Action (Order I & II)

Leading Case: Sinha Romanuja v. Ranga Romanuja, AIR 1961SC 1720

UNIT-II

1. Institution of Suits (Sec. 26 & Order IV)
2. Fundamentals Rules of Pleadings (Order VI, VII & VIII)
3. Summons to Defendants and Witnesses (Secs. 27-32 & Order V & XVI)
4. Appearance of Parties, Exparte Decree (Order IX, X)
5. Discovery and Inspection (Order XI)
6. Admission (Order XII)

Leading Case: Babbar Sewing Machine Co. v. Triloki Nath, AIR 1978SC 1436

UNIT-III

1. Production, Impounding and Return of Documents(Order XIII)
2. Settlement of Issues (Order XIV, XV)
3. Adjournment (Order XVII)
4. Hearing of Suits (Order XVIII), Affidavits (Order XIX)
5. Judgment and Decree (Sec. 33 & Order XX)
6. Awarding of Interest and Cost (Secs. 34-35B)

Leading Case: Arjun Singh v. Mohijder Kumar and others, AIR 1964 SC 993

UNIT-IV

1. Power and Jurisdiction of Executing Court (Secs.36- 47, 49- 50)
2. Procedure in Execution (Secs.51-54 & Order XXI Rules1 & 2, Rules 10- 25), Stay of Execution (Rules 26-29)
3. Mode of Execution (Rules 30-36), Arrest and detention (Secs.55-59 & Order XXI Rules 37-40)
4. Attachment of Property and Adjudication of Claims and Objections (Secs.60- 64 & Order XXI Rules 41-59)
5. Sale, Procedure in Sale and Distribution of Assets (Secs.65-73 & Order XXI Rules 64-96)
6. Resistance to Execution (Sec.74 & Order XXI Rules 96-106)

Leading Case: Uma Shanker v. Sarabjeet, AIR 1996 SC 1005

Statutory Material

Code of Civil Procedure, 1908

Suggested Readings

1.	Mulla	: The Code of Civil Procedure (Student Edition)
2.	Thakkar, C.K.	: The Code of Civil Procedure
3.	Sarkar, Sudipto	: The Code of Civil Procedure
4.	Saha, A.N.	: The Code of Civil Procedure
5.	Mulla D.F.	: Key to Civil Practice
6.	Takwani C.K.	: Civil Procedure Code

BBA.LL.B. (Hons.) 5-Year Integrated Course

VII - Semester

Principles of Taxation Law

Paper 703-A

Internal Assessment: 20Marks

Theory: 80 Marks

Total: 100 Marks

Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all. Two questions from each unit I-IV and one compulsory question.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all selecting one question each from Unit I-IV and question number 9 in Unit V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question number 9 in Unit V shall carry 20 Marks.

UNIT-I

Tax and Fee; Scope of Tax Laws; Distribution of Tax Resources between Union and the States (Article 268-279); Surcharge; Grant-in-Aid; Constitution of Finance Commission and Functions; Principles Governing the Share of Income Tax; Inter-Government Tax Immunities (Article 285-289).

Leading Case: Commissioner, Hindu Religious Edowments v. Sri Lakshmindra Thirtha Swamiar of Sri Shirur Mutt, 1954 SCR 1005.

UNIT-II

Concept & Definition; Income [Section2(24)], Total Income [Section2 (45)], Agriculture Income [Section 2 (1A)], Assessee [Section-2(7)], Assessment Year & Previous Years 2(9), Assessing Officer. Income which do not form part of total income (Section-10-13A), Capital Receipt, Revenue Receipt, Capital Expenditure & Revenue Expenditure.

Leading Case: C.I.T. v. Raja Benoy Kumar Sahas Roy, 32 ITR 466 SC 1957.

UNIT-III

Income: Salary (Sections 15-17), Income from House Property (Sections 22-27), Profits & Gains of Business and Profession (Sections 28 & 32,33,33A, 34, 36-37), Capital Gains (Sections 45-55A), Income from Other Sources (Sections 56, 58).

Leading Case:Bharat Development Pvt. Ltd. V. CIT, 133 ITR 470 (Del)

UNIT-IV

Set off and Carry forward of Losses (Sections 70-80); Income Tax Authorities (Sections 116-138), Appeal Reference & Revision, Collection Recoveries and Refund (Sections 190-234, 237 to 245), Penalties, Offences & Prosecution (S. 271-280).

Leading Case : K.C. Builders and Another v. Asstt. Commissioner Income Tax (2004) 265 ITR 562 (SC)

Suggested Readings

1. Ahuja, Grish, : Income Tax Law and Practice, Bharat Law House 2010.
2. HC Mehrotra : Income Tax Law & Accounts, Shahitya Prakashan
3. Kailash Rai : Taxation Laws, Bharat Law House
4. N.A.Palkhivala : Income Tax Law, Modern Law House
5. Saxena, A.K. : Income Tax Act, 1961
6. SR Myneni : Law of Taxation, Allahabad Law Agency
7. Vinod & Monica Singhania : Income Tax, Taxmann

BBA.LL.B. (Hons) 5-year Integrated Course
VII - Semester
Interpretation of Statutes & Principles of Legislation

Paper 704-A

Internal Assessment: 20Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all. Two questions from each unit I-IV and one compulsory question.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all selecting one question each from Unit I-IV and question number 9 in Unit V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question number 9 in Unit V shall carry 20 Marks.

UNIT-1

Statute: Meaning and Classification of Statute.
Interpretation: Meaning,Object and Necessity.
General Principles of Interpretation –Literal or Grammatical Rule, Golden Rule,Harmonious Construction,*Noscitur - A Sociis; Ejusdem Generis, Contemporanea Expositio est Optima Et fortissima in lege, Statute should be read as a whole, Statutes in Pari materia.*

Prescribed Case: Harbhajan Singh v. Press Council of India, AIR 2002 SC 1351

UNIT-II

Internal Aids to Construction- Short Title, Long Title, Preamble, Marginal Notes, Headings, Section and Subsection, Definitions,Interpretation Clauses, Provisos, Illustrations, Exceptions and Saving Clauses, Explanations, Schedules and Punctuation Marks and non obstante clause.

Prescribed Case: Special Officer and Competent Authority Urban Land Ceiling, Hyderabad v. P.S. Rao, AIR 2002 SC 843

External Aids to Construction- Dictionaries, Use of foreign decisions, Text Books, Historical Background, LegislativeHistory, Administrative Conveyancing and Commercial Practice.

Prescribed Case:R.S. Nayak v. A. R. Antulay AIR 1984 SC 684

UNIT-III

Construction of Taxing Statutes and Evasion of Statutes; Remedial and Penal Statutes – Distinction between the two; Liberal Construction of Remedial Statutes; Strict Construction of Penal Statutes; *Mens Rea* in Statutory Offences, Vicarious responsibility in Statutory Offences, Mandatory and Directory Statutes.

Prescribed Case: Amery Pharmaceuticals v. State of Rajasthan, AIR 2001 SC 1303

UNIT-IV

Commencement, Operation and Repeal of Statute; Prospective and Retrospective Operation of Statutes, Revival of Statutes, Interpretation of Constitution, Relation between Law and Public Opinion; Bentham's Principle of Utility; Delegated Legislation.

Prescribed Case: Aruna Rao v. Union of India, AIR 2002 SC 3176

Statutory Material

General Clauses Act, 1897

Suggested Readings

1. P.St. J. Langan: Maxwell on the Interpretation of Statutes
2. G.P. Singh : Principles of Statutory Interpretation
3. V.P. Sarathi : Interpretation of Statutes
4. Jagdish Swarup : Legislation and Interpretation
5. Maxwel : Interpretation of Statutes
6. Bindra :Interpretation of Statutes
7. T. Bhattacharya : The Interpretation of statutes
8. D.N. Mathur : Interpretation of Statute
9. K.P. Chakravarty : Interpretation of Statute
10. Ruthnaswamy :Legislative Principles and Practice
11. N.K Chakrabarti :Principles of Legislation and legislative drafting
12. Dicey :Law and Public opinion
13. Bentham :Theory of Legislation

BBA.LL.B. (Hons) 5 Year Integrated Course
VII - Semester
Human Rights Law and Practices

Paper 705-AA

Internal Assessment: 20Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all. Two questions from each unit I-IV and one compulsory question.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all selecting one question each from Unit I-IV and question number 9 in Unit V shall be compulsory
- **d.** Each question in Unit I-IV shall carry 15 marks and question number 9 in Unit V shall carry 20 Marks.

UNIT –I

Nature and scope of Human Rights, Evolution of Universal Human Rights, League of Nations and Human Rights, U.N. Charter and Human Rights, The Universal Declaration of Human Rights and its legal significance, Covenants of Human Rights :

I. International Covenant on Economic, Social and Cultural Rights, 1966.
II. International Covenant on Civil and Political Rights, 1966.

Leading case : People's Union for Civil Liberties v. Union of India and Anr.,(1997)3 SCC 433

UNIT-II

Terrorism and Human Rights, Human Rights of Minorities, Human Rights of Disabled, International Humanitarian Law and Rights of Disabled, International Humanitarian Law and Four Geneva Conventions of 1949 relating to :

I. Amelioration of the conditions of Wounded and Sick in Armed Forces.
II. Amelioration of the conditions of Wounded, Sick and Shipwrecked members of Armed Forces at Sea.
III. Treatment of Prisoners of War.
IV. Protection of Civilian Persons during War.

Leading case : Lilly Kurian v. St. Lewina, AIR 1979 SC 52.

UNIT-III

Human Rights in India including Constitutional Guarantee of Fundamental Rights, Judicial activism and the protection of Human Rights in India, Role of Non-Governmental Organizations in the Promotion and Protection of Human Rights, Human Rights of Accused person, Human Rights and Environment protection, Human Rights of Women, Human Rights of Children.

<u>Leading case</u> : Sunil Batra v.Delhi Administration (II), AIR 1980 SC 1579.

UNIT-IV

The Protection of Human Rights Act, 1993- Nature and Scope; Human Rights-Definition and Scope; National Human Rights Commission - Composition and appointment ; Inquiry into complaints and its procedure ; Functions and Powers of National Human Rights Commission ; State Human Rights Commission - Composition and appointment; Human Rights Courts - Constitution.

<u>Leading case</u>: National Human Rights Commission v. State of Arunachal Pradesh and Anr., 1996 SCC (1) 742.

Statutory Material

The Protection of Human Rights Act,1993

Suggested Readings

1. Ramajois : Human Rights in Ancient India
2. U.Baxi : The Rights to be Human
3. F.Kazmi :Human Rights
4. J.Sawrup :Human Rights and Fundamental Freedom.
5. Nagendra Singh :Human Rights and International Cooperation
6. S.C.Khare :Human Rights and United Nations
7. A.B.Kailash :Human Rights in International Law.
8. J.Menon :Human Rights in International Law
9. B.P.Singh Sehgal :Human Rights in India
10. A.B.Robertson : Human Rights in National and International Law
11. E.Lauterpact :International Law and Human Rights
12. A.N.Sen :Human Rights.
13. H.O. Aggarwal : International Law and Human Rights
14. S.K. Kapoor : Human Rights under International Law and Indian Law
15. Paras Diwan : Human Rights and Law
16. Mahendra Gaur : Terrorism and Human Rights

BBA.LL.B. (Hons) 5-year Integrated Course

VII - Semester

International Trade Law

Paper 705- AB

Internal Assessment: 20Marks
Theory: 80 Marks

Total: 100 Marks

Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT-I

Meaning of International Trade Law, Overview of Public International Law relating to Trade, WTO, IMF and World Bank, Private Law relating IT, Agencies for Promoting Unification of Trade Law- UNICITRAL, UNIDROIT,UNCTAD, ICC & IMO.

UNIT-II

Export Trade Transaction and International Commercial Contract, Types of International Contract and Law Governing Formation and Enforcement of International Contract, Rights and Liabilities of Parties to Contract, Unification of International Commercial Law, Vienna Convention on International Sale of Goods.

UNIT-III

Subsidies in I.T., Subsidies under GATT, Tokyo Round and Regional Trade Agreements and Customs Unions under GATT, GATT and New Issues e.g. Trade, Environment and Human Rights under the GATT dispensation.

UNIT-IV

Brief review of General Agreement on Trade in Services and TRIPS, Technical Barriers to Trade, Dispute Settlement Process under GATT and WTO, Legal Obligations under WTO Dispute Settlement.

Suggested Readings

1. Jackson : Jurisprudence of GATT and WTO
2. A Lowenfield : Law of International Trade
3. Arun Goyal : WTO in New Millennium
4. Jayanta Bagchi : World Trade Organisation
5. A.K. Kaul : Cases and Materials on I.T.
6. Leo D' Arey : The Law & Practice of IT

BBA.LL.B. (Hons) 5-year Integrated Course
VII- Semester
Professional Ethics, Accountancy for Lawyers & Bench Bar Relations

Paper 706-A

Internal Assessment: 40Marks
Theory: 60 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from eachUnit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-V shall carry 12 marks.

UNIT - I

Historical Introduction to Legal Profession in India-Barristers, Vakils, High Court Pleaders, Advocates etc. The All India Bar Committee 1951 and the Passing of Indian Advocates Act, 1961. The Advocates Act 1961: Definitions (Section 2), Constitution and Function of State Bar Councils, Bar Council of India, Terms of Office, Various Sub-committees Including Disciplinary Committee and the Qualification for their Membership. Power to Make Rules, Sections 3 to 15.

UNIT - II

The Advocate Act, 1961

Admission and Enrolment of Advocate-Senior and other Advocates; Common role of Advocates; Qualifications and Disqualifications for Enrolment and Procedure thereof; Sections 16 to 28.

Professional and Other Misconduct; Principles for Determining Misconduct; Disciplinary Committees for Misconduct; Selected opinions of the Disciplinary Committee of the Bar Councils; Appeals to the Supreme Court, sections 35 to 44.

UNIT - III

Nature of Legal Profession, Need for an Ethical Code Rights, Privileges and Duties of Advocates, Preparation of a Case and Fees of an Advocate, Bar Against Soliciting Work and Advertisement, Bar against Touting, Refusal of Briefs, Accountability to the Client, Confidentiality between an Advocate to Compromise, Study of Code of Ethics Prepared by the Bar Council of India.

Contempt of Courts Act, 1971

What is Contempt Civil and Criminal Contempt, Punishment for Contempt; Procedures in Contempt Cases; Supreme Court Rules to Regulate Contempt Proceedings.

UNIT – IV

The following 10 Judgments of the Supreme Court would be discussed and analyzed:

1. Supreme Court Bar Association v. Union of India & others, AIR 1998 SC 1895.
2. Re Ajay Kumar Pandey Advocate, AIR 1998 SC 3299.
3. Dr. I. P. Mishra v. State of U.P., AIR 1998 SC 3337.
4. Kashi Nath Kher and other v. Dinesh Kumar Bhagat and others, AIR 1998 SC 374.
5. P. D. Gupta v. Ram Murti, AIR 1998 SC 283.
6. Sadhvi Ritumbhara v. Digvijay Singh & others, (1997) 4 SCJ 64.
7. Delhi Judicial Service Association, Tis Hazari Court Delhi v. State of Gujarat and others, AIR 1991 SC 2176.
8. M. B. Sanghi v. High Court of Punjab & Haryana and others, AIR 1991 SC 1834.
9. Amrit Nahata v. Union of India, AIR 1986 SC 791.
10. State of Bihar v. Kripalu Shankar, AIR 1987 SC 1554.

Statutory Material

Advocates Act, 1961
Contempt of Courts Act, 1971

Suggested Readings

1. Rao, Sanjeev : Indian Advocates Act, 1961.
2. Jain, M. P. : India Legal History (Chap. On Legal Profession)
3. Iyer, Krishna Murthy : Book on Advocacy.
4. Journal of Bar Council of India.
5. Bar Council Code of Ethics.

NOTE: There shall be an internal assessment carrying 40 marks as follows:

(i) The subject teacher will assign minimum two case-studies of 10 marks each to the students: - 20 Marks

(ii) **The students are required to attend the Chamber of an Advocate for one week and maintain the Court Diary.**

(ii) Viva-voce examination* -20 Marks

Viva-voce examination will be conducted by a Committee consisting of Director/Principal, One External SubjectExpert and the teacher teaching the subject on the date and time fixed by the Director/Principal. The Quorum will consist of two and one of them will be external expert

BBA.LL.B. (Hons) 5 Year Integrated Course

VIII - Semester

Human Resource Management

Paper 801-A

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

a. Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
b. The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
c. The Candidate shall be required to attempt five questions in all, selecting one question from eachUnit I-IV and question no. 9 in Unit- V shall be compulsory.
d. Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT- I

Human Resource Management- Introduction, Concept and Functions, Scope and Significance of HRM, Personnel to HRM, Role and responsibilities of the Human Resource Manager, Essentials of Sound HR Policies. Objectives, Policies and Process of Human Resource Planning.

UNIT- II

Job analysis, Job description, Job specification, Recruitment, Selection, Induction, Placement, Promotion and Transfer, Job evaluation.

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UNIT- III

Training and Development, Evaluation and Performance Appraisal, Grievance procedure and handling,Industrial Relations and dispute settlement,Compensation.

UNIT- IV

International HumanResource Management, Managing inter country differences.
Separation Processes- Turnover, Retirement, Layoff, Retrenchment and discharge, VRS.

Suggested Readings

- **K Aswathappa** :Human Resource and Personnel Management; McGraw- Hill Companies
- **VSP Rao** : Human Resource Management; Excel Books
- **Bohlander** :Managing Human Resources; Thomson Learning. Ed. 13 2004
- **Edward, B. Flippo** :Personnel Management, Mc Graw Hill International Ed.
- **Dale Yoder** : Personnel Management and Industrial Relation,
- **Monappa & Sayiaddin** : Personnel Management, Vikas Publishing Company
- **Desimone** : Human Resource Development, Thomson Learning

BBA.LL.B.(Hons.) 5 –Year Integrated Course
VIII- Semester
Civil Procedure Code –II and Limitation Act

Paper 802-A

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT-I

1. Death, Marriage and Insolvency of Parties (Order XXII)
2. Withdrawal and Adjustment of Suits (Order XXIII)
3. Commissions (Secs. 75- 78, Order XXVI), Suit against Government (Secs.79-82)
4. Suit in case of Minors, Indigent Persons (Order XXXII, XXXIII)
5. Interpleader Suits (Sec.88 & Order XXXV), Settlement of Disputes outside the Court (Sec.89)

Leading Case: Amar Nath Dogra v. Union of India, AIR1963SC 424

UNIT-II

1. Public Nuisances and Other Wrongful acts Affecting the Public (Secs.91-93)
2. Supplemental Proceedings- Arrest and Attachment before judgment, Temporary Injunction, Interlocutory Orders, Appointment of Receivers (Secs. 94-95 & Order XXXVIII to XL)
3. Appeals from Original Decrees, Procedure in Appeals and Powers of Appellate Court (Secs. 96-99A, 107-108 & Order XLI)
4. Appeals from Appellate Decrees [Secs. 100-103 & Order XLII)]
5. Appeals to the Supreme Court (Sec.109)

Leading Case: Chunilal V. Mehta v. Century spinning & Manufacturing Co. Ltd., AIR 1962 SC 1314

UNIT-III

1. Reference to High Court (Sec.113,Order XLVI)
2. Review (Sec.114 & Order XLVII)
3. Revision (Sec.115)
4. Exemption of certain women and other persons from Personal Appearance and Arrest (Secs. 132-135A), Application for Restitution (Sec.144), Right to lodge Caveat (Sec.148A)
5. Inherent Powers of the Court (Secs. 151-153B)

Leading Case: Major S.S. Khanna v. Brig. F. J. Dillion, AIR 1964 SC 497

UNIT-IV

1. Salient features of the Limitation Act
2. Limitation of Suits, Appeals and Application (Secs.3-11)
3. Exclusion of Time (Secs.12-15)
4. Effect of Death, Fraud, Acknowledgement, Payments etc. on Limitation (Secs. 16-22)
5. Acquisition of Ownership by Possession (Secs. 25- 27)

Leading Case: Ram Lal v. Rewa Coal Fields Ltd., AIR 1962 SC 361

Statutory Material

Code of Civil Procedure, 1908
Indian Limitation Act, 1963

Suggested Readings

1.	Mulla	: The Code of Civil Procedure (Student Edition)
2.	Thakkar, C.K.	: The Code of Civil Procedure
3.	Sarkar, Sudipto	: The Code of Civil Procedure
4.	Saha, A.N.	: The Code of Civil Procedure
5.	Mulla D.F.	: Key to Civil Practice
6.	Takwani C.K.	: Civil Procedure Code
7.	Mitra, B.B.	: H.C. Mitra's Indian Limitation Act
8.	Dayal, R.D.	: Limitation Act
9.	Row, Sanjiva	: Limitation Act

BBA.LL.B. (Hons.) 5-Year Integrated Course

VIII- Semester

Indirect Taxation Laws

Paper 803-A

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

(a) Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in Unit-V.

(b) The compulsory question in Unit-V shall consist of four parts, one from each Unit I-IV.

(c) The candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit-V shall be compulsory.

(d) Each question in Unit I-IV shall carry 15 marks and question no.9 in Unit-V shall carry 20 marks.

Unit- I

Goods and Services Tax Act, 2017:

Definitions: Business, Capital Goods, Consideration, Continuous Supply of Goods and Services, Exempt Supply, Goods, Input Tax, Local Authority, Manufacturer, Market Value, person, Place of Business, Reverse Charge, Service.

Historical Background, Nature & Scope, Object and Constitutional Amendment.

Principles and Kinds of GST- CGST, SGST & IGST.

Tax liability on Composite Supplies- Input Tax Credit.

Eligibility and Conditions for Taking Input Tax Credit.

Unit –II

Officers under the Act; Appointment & Powers; Scope of Supply.

Levy and Collection; Powers to Grant Exemption from Tax.

Time of Supply of Goods and Services.

Assessment: Accounts and Records, Return, Assessment, Audit, Payment of Tax, Refund, Search and Seizure

Unit-III

Registration, Return, demand & Recovery, Appeals & Revision:

Registration- Person liable for Registration, Persons not Liable for Registration.

Procedure for Registration, Compulsory Registration, Cancellation of Registration, Exemption from GST Registration.

Returns –Furnishing Details of Outward and Inward Supplies, Furnishing of Returns, Payments of Tax, Interest, Penalty and other Amounts, Tax Deduction at Source, Collection of Tax at Source.

Demand and Recovery- Advance Ruling, Definitions for Advance Ruling.

Appeal and Revision- Appeals to Appellate Authority, Powers of Revision Authority.

Constitution of Appellate Tribunal and benches thereof, Offences and Penalties

Unit-IV

The Integrated Goods and Services Tax Act,2017:

Definitions - Central Tax, Export and Import of Goods or Services or both, Integrated Tax, Intermediary, Location of the Recipient and Supplier of Services Non Taxable Online Recipient, Online Information Data Base Access or Retrieval Services, Output Tax, Special Economic Zone, Supply.

Administration and Collection of Tax

Determination Nature of Supply, Place of Supply

Refund: Zero Rated Supply

Apportionment of Tax and Settlement: Taxability of E-Commerce, Anti –Profiteering, Avoidance of dual control, E-way bills, Offences and Penalties, Appeals.

Statutory Material:

The Constitution (One hundred and First Amendment) Act,2016.

The Goods and Services Tax Act, 2017.

The Central Goods and Services Tax act, 2017.

The Union Territory Goods and Services Tax Act,2017.

The Integrated Goods and Services Tax Act, 2017.

Suggested Readings:

Government of India	GST Law Manual and Vastu and Sevakar Vidhan.
V.S Datey,	GST Law & Practices with Custom & FTP, 2018.
Singhania, Dr. Vinod K. &, Dr. Monica Singhania	Student's Guide to Income Tax including GST, 2018.
Jain, Sweta,	GST Law and Practice- A Section Wise Commentary on GST.
V S Datey	GST E-way bill
C A Kashish Gupta	GST (Goods and Services Tax)

BBA.LL.B. (Hons) 5-year Integrated Course

VIII - Semester

Intellectual Property Law

Paper 804 -AA

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT-I

International Law on Intellectual Property –

1. Concept of Intellectual Property,
2. The World Intellectual Property Organization (WIPO) convention, 1967.
3. Paris Convention, Berne Convention and Universal Copyright Convention
4. TRIPS Agreement of World Trade
5. Phonogram Treaty

Leading Case: **R.G. Anand v. Delux Films, AIR 1978 SC 1673.**

UNIT-II

The Law of Copyright 1957–

1. Meaning, Nature and Scope of Copyright (Ss 13-16)
2. Author and Ownership of Copyright and Rights Conferred by Copyright (Ss 17-21)
3. Term of Copyright (Ss 22-29)
4. Licenses (Ss 30-32)
5. Registration of Copyright (Ss 44 – 50 A)
6. Infringement of Copyright and Remedies (Ss 51-62)

Leading Case : **State of Tamil Nadu v. Thiru Murugan Brothers AIR 1988 SC 336**

UNIT-III

The Law of Trade Mark Act 1999–

1. Definition and Kinds of Trade Mark (Sec. 2)
2. Registration of Trade Marks – Conditions, Procedure, Duration and Effect (Ss 6-26)
3. Certification of Trade Marks (Ss 69-82)
4. Infringement of Trade Mark and Remedies (Ss 29, 102, Ss 134-135)

Leading Case : **Vishnu Dass v. Sultan Tobacco Co. Ltd. Hyderabad AIR 1996 SC 2275**

UNIT-IV

Law of Patent in India (Patent Act 1970 as amended by Patent Act, 2005) and The Designs Act, 2000-

1. Patentable and Non-Patentable Invention (Ss 2-3)
2. Procedure for obtaining Patent (Ss 6-14, 25, 43, 45, 47, & 53)
3. Rights of Patentee (Ss 48 & 50, 68 & 70, 63, 104-108, 154 & 118)
4. Infringement of Patent and Remedies (Ss 47 & 107, 104, 106, 108, 140)

The Designs Act, 2000

1. Definitions
2. Registration of Designs
3. Copyright in Registered Designs

Leading Case : **M/s S.M. Dye Chemical Ltd. v. M/s Cadbury (India) AIR 2000 SC 2114**

Suggested Readings

1. Narayanan, P : Patent law, Trademarks and Passing off
2. Puri, K.K. : Law of Patent System in India
3. Lyenger : Copyright Act
4. Mustafa Faizan : Copyright Law: A Comparative study
5. Lal`s : The Copyright Act
6. Nagrajan RK : Intellectual Property Law
7. Narayan P : Intellectual Property Law
8. Mittal DP : Indian Patent's Law and Procedure
9. Cornish W : Intellectual Property
10. Wadera BL : Patents, Trade Marks, Copy Right, Designs and Geographical Indications
11. Reddy G.B. : Intellectual Property Rights and the Law

BBA.LL.B. (Hons) 5-Year Integrated Course
VIII - Semester
Investment and Securities Laws

Paper 804-AB

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT-I

Nature and Scope of SEBI, Establishment; Powers and Functions of the Board; Registration Certificates, Adjudication and Penalties. Establishment, Jurisdiction, Authority and Procedure of Appellate Tribunal.

UNIT-II

Bonds and Convertible Securities, Features of Equities, Investment. Valuation theories of Bonds and Equities, Procedure for Issuance of Shares and Debentures; Prospectus; Book Building.

UNIT-III

Securities Laws Act 1999: Definitions; Recognized Stock Exchanges; Contracts and Options in Securities; Listing of Securities; Listing Agreement; Penalties and Procedure.

UNIT-IV

Nature and Scope of Depositories Act; Constitution; Role and Functions of Depository; Rights and Obligations of Depositories; Depository participant; Issuers and Registrars.

Suggested Readings

1. V.K.Bhalla : Investment Management- Security Analysis and Portfolio Management
2. SEBI Mumbai : SEBI Annual Report, SEBI Monthly Bulletin
3. Taxman : SEBI and Corporate Laws
4. N.Gopalaswamy : Inside Capital Market, Securities Laws Act, 1999 & Depositories Act

BBA.LL.B. (Hons) 5-Year Integrated Course
VIII - Semester
Gender Justice and Feminist Jurisprudence

Paper 805-AA

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT-I

Concept of Gender Justice and Feminist Jurisprudence; United Nations and Human Rights of Women, Universal Declaration of Human Rights, 1948; Convention on Elimination of All forms of Discrimination Against Women, 1979; Declaration on Elimination of Violence Against Women, 1993.

Leading Case : Vishakha v. State of Rajasthan AIR 1997 SC 3011

UNIT-II

Constitutional Safeguards for the Protection of Women – Right to equality, Right to life and personal liberty, Right against exploitation, Directive Principles of State Policy, Protection of Women from Sexual Harassment at Workplace, National Commission for Women- Composition, Powers and Functions.

Leading Case : Air India v. Nargesh Mirza AIR 1981 SC 1929

UNIT-III

The Dowry Prohibition Act, 1961**-** Definition of Dowry, Penalty for giving, taking and demanding dowry; Ban on advertisement; Dowry for the benefit of the wife or her heirs; Cognizance of offences; Dowry prohibition officers; Dowry Prohibition (Maintenance of Lists of Presents to the Bride and Bridegroom) Rules, 1985;

The Protection of Women from Domestic Violence Act, 2005 **–** Definition of Domestic Violence, Powers and duties of Protection Officers, Service Provider etc.; Procedure for obtaining orders of reliefs.

Leading Case:S.R. Batra v. Taruna Batra, AIR 2007 SC 1118.

UNIT-IV

The Pre-conception and Pre-natal Diagnostic Techniques (Prohibition of Sex Selection) Act, 1994- Preliminary regulation of genetic counseling centers, Genetic laboratories and genetic clinics; Regulation of pre-natal diagnostic techniques; Central Supervisory Board; Appropriate authority and Advisory Committee; Offences and Penalties.
Protection of Women under Immoral Traffic (Prevention) Act 1956 – an Overview

Leading Case: Centre for Enquiry into Health and Allied Themes (CEHAT) and others v. Union of India and others, (2001) 5 SCC 2007.

Suggested Readings

1.	Paras Diwan	: Law relating to Dowry, Dowry Death, Bride Burning, Rape andRelated Offences.
2.	J.N. Pandey	: Constitutional Law of India
3.	V.N. Shukla	: Constitution of India
4.	Tripathi and Arora	: Law Relating to Women & Children
5.	Devender Singh	: Human Rights, Women and Law
6.	Shobha Sexena	: Crimes against Women and Protective Laws
7.	Indira Jaisingh	: Handbook on Law of Domestic Violence
8.	Indira Jaisingh	: Pre-conception & Pre-Natal Diagnostic Techniques Act: UsersGuide to the Law
9.	Anjani Kant	: Law relating to Women and Children
10.	Mamta Rao	: Law Relating to Women and Children
11.	A.S. Anand	: Justice for Women: Concerns and Expressions.

BBA.LL.B. (Hons) 5-year Integrated Course
VIII - Semester
Media and Law

Paper 805-AB

Internal Assessment: 20 Marks
Theory: 80 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit-V.
- **b.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **c.** The Candidate shall be required to attempt <u>five</u> questions in all, selecting <u>one</u> question from each Unit I-IV and question no. 9 in Unit- V shall be compulsory.
- **d.** Each question in Unit I-IV shall carry 15 marks and question no. 9 in Unit –V shall carry 20 Marks.

UNIT – I

Press Law – Concept and Need
History of Indian Media Law
Freedom of Expression in Indian Constitution
Interpretation of Media freedom
Issues of Privacy
Right to Information
Emergency Provisions Media Censorship: Indian Experience

UNIT – II

Media & Criminal Law (Defamation/Obscenity/Sedition)
Media & Tort Law (Defamation & Negligence)
Media & Legislature – Privileges of the Legislature
Media & Judiciary – Contempt of Court
Media & Executive – Official Secrets Act
Media & Journalists – Working Journalists (Conditions of Service) Act & Press Council Act

UNIT – III

Media and Ethics
Self-Regulation v. Legal regulation
Media & Human Rights
Issues relating to entry of Foreign Print Media

UNIT – IV

Public policy issues on Airwaves
Community Radio Advocacy
Telegraph Act and Broadcast interface

<u>Suggested Readings</u>

1. Dr. Jan R. Hakemulder, Dr. Fay AC de Fange, P.P. Singh : Media Ethics and Law
2. Y.K. D'souza : Principles and Ethics of Journalism and Mass Communication
3. Dr. Durga Das Basu : Law of the Press
4. Prof. Nandkishor Trikha : Press Vidhi (Hindi)

BBA.LL.B. (Hons) 5-year Integrated Course
VIII - Semester
Alternative Dispute Resolution and Legal Aid
(Compulsory Clinical Course-II)

Paper 806-A

Internal Assessment: 40 Marks
Theory: 60 Marks
Total: 100 Marks
Time: 3 Hours

Note:

- **a.** The paper will consist of two of parts: Theory (60 marks) and Practical (40 marks).
- **b.** In theory paper, Nine questions shall be set in all, two questions in each unit I-IV and one compulsory question in unit – V.
- **c.** The compulsory question in unit-V shall consist of four parts, one from each Unit I-IV.
- **d.** The candidate shall be required to attempt five questions in all, selecting one question from each Unit I-IV and question no. 9 in Unit-V shall be compulsory.
- **e.** Each question in Unit I-V shall carry 12 marks.

UNIT – I

Meaning of Alternate Dispute Resolution (ADR); Various procedures of ADR-Negotiation, Mediation, Conciliation, Arbitration; Advantages of ADR; Arbitration Agreement; Composition of Arbitral Tribunal; Jurisdiction of Arbitral Tribunal.

Leading Case: International Airport Authority of India v. K.D. Bali AIR 1988 SC 1099.

UNIT - II

Conduct of Arbitral Proceedings; Making of Arbitral Awards and Termination of Proceedings; Setting Aside an Award; Enforcement of Award; Enforcement of Foreign Awards; International Arbitration; New York Convention Award and Geneva Convention Awards.

Leading Case: Allen Berry & Co (P) Ltd v. Union of India, AIR 1971 SC 696.

UNIT – III

Conciliation; Appointment of Conciliators; Stages of Conciliation proceedings; Settlement Agreement in Conciliation, Termination of Conciliation Proceedings, Resort to Arbitral or Judicial Proceedings.

Leading Case: **Haresh Dayaram Thakur v. State of Maharashtra, AIR 2000 SC 2281.**

UNIT – IV

Lok Adalats- Concept, Meaning and Growth of Lok Adalats, Positions of Lok Adalats under Legal Services Authority Act 1987, Organisation of Lok Adalats, Cognizance of Cases by Lok Adalats, Award of Lok Adalats, Power of Lok Adalats, Analysis of Working of Lok Adalats in India, Legal Aid-Legal Aid under the Constitution of India, Legal Aid Schemes.

Leading Case: **Guru Nanak Foundation v. Rattan Singh and Sons, AIR 1981 SC 2075.**

Suggested Readings

1. Chitkara, M.G. : Lok Adalat and the Poor- A Socio-Constitutional Study.
2. Deshta, Sunil : Lok Adalat in India
3. Kwatra G.K : The New Law of Arbitration & Conciliation
4. NV Paranjape : Arbitration and Alternative Dispute Resolution
5. Rao, P.C : Alternative Dispute Resolution
6. SC Tripathi : Arbitration and Conciliation Act, 1996
7. Tewari, O.P : The Arbitration & Conciliation Act

NOTE: There shall be an internal Assessment of 40 Marks as follows:

(i) **The subject teacher will assign minimum two case-studies of 10 marks each to the students on the following: - 20 Marks**

- **(a) Arbitral Cases**
- **(b) Proceedings of Lok Adalat**
- **(c) Conciliation Proceedings**

(ii) The students will maintain a proper file of case studies and will submit to the subject teacher by the date fixed by him/her.

(iii) Viva-voce examination * - 20 Marks

Viva-voce examination will be conducted by a Committee consisting of Director/Principal, One External SubjectExpert and the teacher teaching the subject on the date and time fixed by the Director/Principal. The Quorum will consist of two and one of them will be external expert

STATISTICS

Scheme of Examination of B.A/B. Sc three year degree course w.e.f. 2019-2020

There will be two theory papers of Statistics and Practical in B.A / B. Sc three year degree course Part-I, II & III consisting of two semesters each. Practical examinations will be held annually (based on the constituent semesters).

B.A /B. Sc Part-I
(Semester-I)

			Marks	
Paper	**Code/Time**	**Nomenclature**	**B.A**	**B. Sc**
I	ST-101/3 hours	Statistical Methods-I	28+7*	40+10*
II	ST-102/3 hours	Probability Theory	28+7*	40+10*
—	—	Practical	—	—

(Semester-II)

I	ST-201/3 hours	Statistical Methods-II	28+7*	40+10*
II	ST-202/3 hours	Probability Distributions	28+7*	40+10*
III	ST-203/3 hours	Practical	60**	100**

B.A /B. Sc Part-II

(Semester-III)

I	ST-301/3 hours	Elementary Inference	28+7*	40+10*
II	ST-302/3 hours	Sample Surveys	28+7*	40+10*
—	—	Practical	—	—

(Semester-IV)

I	ST-401/ 3 hours	Parametric and Non-parametric Tests	28+7*	40+10*
II	ST-402/ 3 hours	Design of Experiments	28+7*	40+10*
III	ST-403/ 3 hours	Practical	60**	100**

B.A /B. Sc Part-III

(Semester-V)

I	ST-501/ 3 hours	Applied Statistics-I	28+7*	40+10*
II	ST-502/3 hours	Numerical Methods and Fundamentals of Computers	28+7*	40+10*
—	—	Practical	—	—

(Semester-VI)

I	ST-601/ 3 hours	Applied Statistics-II	28+7*	40+10*
II	ST-602/ 3 hours	Operations Research	28+7*	40+10*
III	ST-603/ 3 hours	Practical	60**	100**

* Marks of internal assessment will be based on the following criteria:

(i) Two Handwritten Assignments : 10%
(1st Assignment after one month &
2nd Assignment after two months)

(ii) One Class Test : 5%
(One period duration)

(iii) Attendance : 5%

Marks for attendance will be given as under:

(1) 91% onwards : 5 Marks
(2) 81% to 90% : 4 Marks
(3) 75% to 80% : 3 Marks
(4) 70% to 74% : 2 Marks***
(5) 65% to 69% : 1 Mark***

**Practical Examinations will be held annually in the even semesters i.e. IInd, IVth & VIth semesters. The distribution of marks will be as under:

		B.A	**B. Sc**
Practical	:	48	80
Class Record	:	06	10
Viva-Voce	:	06	10

***For students engaged in co-curricular activities of the colleges only/authenticated medical grounds duly approved by the concerned Principal.

<u>B.A/B. Sc-I Semester-I</u>

Paper-I (ST-101)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Statistical Methods-I

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Introduction of Statistics: Origin, development, definition, scope, uses and limitations.

Types of Data: Qualitative and quantitative data, nominal and ordinal data, time series data, discrete and continuous data, frequency and non-frequency data.

Collection and Scrutiny of Data: Collection of primary and secondary data- its major sources including some government publications, scrutiny of data for internal consistency and detection of errors of recording, classification and tabulation of data.

UNIT-II

Presentation of Data: Frequency distribution and cumulative frequency distribution, diagrammatic and graphical presentation of data, construction of bar, pie diagrams, histograms, frequency polygon, frequency curve and ogives.

Measures of Central Tendency and Location: Arithmetic mean, median, mode, geometric mean, harmonic mean; partition values-quartiles, deciles, percentiles and their graphical location along with their properties, applications, merits and demerits.

UNIT-III

Measures of Dispersion: Concept of dispersion, characteristics for an ideal measure of dispersion. Absolute and relative measures based on: range, inter quartile range, quartile deviation, coefficient of quartile deviation, Mean deviation, coefficient of mean deviation, variance, standard deviation (σ), coefficient of variation and properties of these measures, root mean square deviation and their relationship, variance of the combined series.

Moments: Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard's correction for moments (without derivation), Charlier's checks; Pearson's β and γ coefficients.

UNIT-IV

Skewness and Kurtosis: Coefficients of Skewness and Kurtosis with their interpretations.

Theory of Attributes: Symbolic notations, dichotomy of data, class frequencies, order of class frequencies, consistency of data, independence and association of attributes, Yule's coefficient of association and coefficient of colligation and their relationship.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Fundamental of Statistics Vol. I	Goon A.M., Gupta M.K., Dasgupta B.	World Press, Calcutta
2.	Statistics	Johnson R.	Wiley Publishers
3.	Basic Statistics	Aggarwal B.L.	New Age International
4.	Fundamentals of Mathematical Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons
5.	Programmed Statistics	Aggarwal B.L.	New Age International

<u>B.A/B. Sc-I Semester-I</u>

Paper-II (ST-102)

Time: 3 Hours M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Probability Theory

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, equally likely, mutually exclusive and independent events; Definition of probability-classical, relative frequency, statistical and axiomatic approach.

UNIT-II

Conditional probability. Addition and multiplication laws of probability and their extension to *n* events. Boole's inequality; Baye's theorem and its applications.

UNIT-III

Random Variable and Probability Functions: Definition of random variable, discrete and continuous random variable, probability function, probability mass function and probability density functions, distribution function and its properties, functions of random variables, joint, marginal and conditional probability distribution function.

UNIT-IV

Mathematical Expectation: Definition and its properties-moments, addition and multiplication theorem of expectation. Conditional expectation and conditional variance.

Generating Functions: Moments generating function, cumulant generating function, probability generating function along with their properties. Characteristic function.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Fundamentals of Mathematical Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons
2.	Elementary Probability	David S.	Oxford Press
3.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Pub. House
4.	New Mathematical Statistics	Bansi Lal & Arora S.	Satya Prakashan
5.	Introduction to Mathematical Statistics	Kapoor & Saxena.	S.Chand

B.A/B. Sc-I Semester-II

Paper-I (ST-201)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Statistical Methods-II

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Correlation: Concept and types of correlation, methods of finding correlation - scatter diagram, Karl Pearson's Coefficient of correlation (r), its properties, coefficient of correlation for a bivariate frequency distribution. Rank correlation with its derivation, its merits and demerits, limits of rank correlation coefficient, tied or repeated ranks.

UNIT-II

Curve Fitting: Principle of least squares, fitting of straight line, second degree parabola, power curves of the type $Y=aX^b$, exponential curves of the types $Y=ab^X$ and $Y=ae^{bX}$.

UNIT-III

Linear Regression: Two lines of regression, regression coefficients, properties of regression coefficients, angle between two regression lines, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values, distinction between correlation and regression.

UNIT-IV

Multivariate Data: Plane of regression, properties of residuals, variance of the residual. Multiple and partial correlation for three variables: coefficient of multiple correlation and its properties, coefficient of partial correlation and its properties, multiple correlation in terms of total and partial correlations and coefficient of determination.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Introduction to Theory of Statistics	Mood A.M., Graybill F.A. & Boes D.C.	McGraw Hill
2.	Applied General Statistics	Croxton F.E., Cowden D.J. & Kelin S.	Prentice Hall
3.	Introduction to Mathematical Statistics	Kapoor & Saxena.	S.Chand
4.	Statistical Methods	Snedecor G.W. & Cochran W.G.	Iowa State Uni. Press
5.	Fundamentals of Mathematical Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons

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B.A/B. Sc-I Semester-II

Paper-II (ST-202)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Probability Distributions

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: -
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Bernoulli distribution and its moments, Binomial distribution: Moments, recurrence relation for the moments, mean deviation about mean, mode, moment generating function (m.g.f), characteristic function, additive property and recurrence relation for the probabilities of Binomial distribution.

UNIT-II

Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, moments, mode, recurrence relation for moments, m.g.f., additive property of independent Poisson variates. Negative Binomial distribution: m.g.f., deduction of moments of negative binomial distribution from those of binomial distribution. Geometric distribution: moments, m.g.f, and lack of memory.

UNIT-III

Continuous uniform distribution: Moments, m.g.f., characteristic function and mean deviation. Gamma distribution: m.g.f., and additive property. Exponential distribution: m.g.f., moments and lack of memory.

UNIT-IV

Normal distribution as a limiting form of binomial distribution, chief characteristics of Normal distribution; mode, median, m.g.f., and moments of Normal Distribution, A linear combination of independent normal variates, points of inflexion, mean deviation about mean, area property of Normal distribution, importance and fitting of normal distribution.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Statistics:A Beginner's Text Vol. II	Bhat B.R., Srivenkatramana T. & Rao Madhava K.S.	New Age International
2.	Fundamentals of Mathematical Statistics	Gupta S.C. & Kapoor V.K.	Sultan chand & Sons
3.	Introduction to Mathematical Statistics	Kapoor & Saxena.	S.Chand
4.	Statistics	Johnson R.	Wiley Publishers
5.	Mathematical Statistics With Applications	Freund's J.E.	Prentice Hall

B.A/B. Sc-I

Paper-III (Practical ST-203)

Time: 3 Hours Max. Marks: B. Sc: 100

B.A: 60

Practical

Note: Five questions will be set. The candidate will be required to attempt any three.

1. To construct frequency distributions using exclusive and inclusive methods
2. Representation of data using Bar and pie diagrams
3. Representation of data using Histogram, Frequency Polygon, Frequency Curve and Ogives.
4. To toss a coin at least 100 times and plot a graph of heads with respect to number of tosses.
5. To compute various measures of central tendency and dispersion.
6 To obtain first four moments for the given grouped frequency distribution.
7 To apply Charlier's checks while computing the moments for a given frequency distribution.
8. To obtain moments applying Sheppard's correction.
9. To obtain various coefficients of skewness and kurtosis.
10. To discuss the association of attributes for a 2x2 contingency table using Yule's coefficient of association and colligation.
11. To compute Karl Pearson's coefficient of correlation for given bivariate frequency distribution.
12. To find Spearman's rank correlation coefficient for given data.
13. To fit the straight line for the given data on pairs of observations.
14. To fit the second degree curve for the given data.
15. To fit the curve of the type $Y = aX^b$ for the given data on pairs of observations.
16. To obtain the regression lines for given data.
17 To compute partial and multiple correlation coefficients for the given trivariate data.
18. To obtain plain of regression for the given trivariate data.
19. To fit binomial distribution to given data.
20. To fit Poisson distribution to given data.
21. To fit normal distribution to given distribution using area under the normal curve.

Distribution of marks:

	B. Sc.	**B.A**
Class Record:	**10**	**06**
Viva Voce:	**10**	**06**
Practical:	**80**	**48**

B.A/B. Sc-II Semester-III

Paper-I (ST-301)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Elementary Inference

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Statistical Estimation: Parameter and statistic, Basic concept of sampling distribution. Point and interval estimate of a parameter, concept of bias and standard error of an estimate. Standard errors of sample mean, sample proportion, standard deviation, Properties of a good estimator: Unbiasedness, Efficiency, Consistency and Sufficiency (definition and illustrations).

UNIT-II

Methods of Estimation: Method of moments, method of maximum likelihood and its properties (without proof). Estimation of parameters of Binomial, Poisson and Normal distributions

UNIT-III

Testing of Hypotheses: Statistical Hypothesis:- Simple and composite, test of statistical hypothesis, Null and alternative hypotheses, critical region, types of errors, level of significance, power of a test, one tailed and two tailed testing, p-value, BCR, most powerful test, Neyman-Pearson Lemma, Test of simple hypothesis against a simple alternative in case of Binomial and Normal distributions.

UNIT-IV

Large Sample Tests: Testing of a single mean, single proportion, difference of two means, two standard deviations and two proportions. Fisher's Z transformation. Determination of confidence interval for mean, variance and proportion.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	A First Course on Parametric Inference	Kale B.K.	Narosa
2.	Introduction to Theory of Statistics	Mood A.M., Graybill F.A. & Boes D.C.	McGraw Hill
3.	Mathematical Statistics With Applications	Freund's J.E.	Prentice Hall
4.	Fundamentals of Mathematical Statistics	Gupta S.C. & Kapoor V.K.	Sultan chand & Sons

B.A/B. Sc-II Semester-III

Paper-II (ST-302)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Sample Surveys

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Concepts of census and sample survey, basic concepts in sampling. Sampling and Non-sampling errors. Principal steps involved in a sample survey; bias, precision and accuracy, advantages of sampling over complete census, limitations of sampling, different methods of data collection.

UNIT-II

Basic sampling methods: Simple random sampling (SRS) with and without replacement, use of random number tables, estimation of mean and variance in case of SRS. Simple random sampling of attributes, size of simple random sample.

UNIT-III

Stratified random sampling, estimation of population mean, variance of the estimate of population mean in stratified random sampling, allocation of sample size, proportional allocation, optimum allocation. Comparison of Stratified random sampling with SRS.

UNIT-IV

Systematic random sampling, estimation of mean and variance. Comparison of Systematic random sampling with SRS and Stratified random sampling, Ratio and regression methods of estimation under SRSWOR.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Sampling Techniques	Cochran W.G.	Wiley Publishers
2.	Sampling Theory	Des Raj and Chandok	Narosa
3	Sample Theory of Surveys with Applications	Sukhatme et. all	Iowa State Uni. Press & IARS
4.	Fundamentals of Applied Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons
5.	Sampling Techniques	Daroga Singh & Chaudhry, F.S	New age International

B.A/B. Sc-II Semester-IV

Paper-I (ST-401)

Time: 3 Hours M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Parametric and Non-parametric tests

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Chi-square distribution: Definition, derivation, moment generating function, cumulant generating function, mean, mode, skewness, additive property, conditions for the validity, chi-square test for goodness of fit. Contingency table, coefficient of contingency, test of independence of attributes in a contingency table.

UNIT-II

Student's 't' and Snedecor's 'F' statistics: Definition and derivation of Student's 't', constants of t-distribution, limiting form of t-distribution. Definition & derivation of Snedcor's F-distribution, constants of F-distribution, mode of F-distribution. Relationship between t, f and chi-square distribution.

UNIT-III

Testing for the mean and variance of univariate normal distribution, testing of equality of two means and testing of equality of two variances of two univariate normal distributions. Testing for the significance of sample correlation coefficient and regression coefficient in sampling from bivariate normal distribution.

UNIT-IV

Nonparametric Tests: Concept of non-parametric tests, advantages of non-parametric test over parametric test, Definition of order statistics. Sign test for univariate and bivariate distribution, run test, median test, Kolmogorov-Smirnov one sample test, Kolmogorov-Smirnov two sample test, Mann Whitney U-test (only applications without derivation).

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Fundamentals of Statistics, Vol. I	Goon A.M., Gupta M.K. & Dasgupta B.	World Press Calcutta
2.	Random Variable and Probability Distribution	Cramer H.	Cambridge Uni. Press
3.	Fundamentals of Mathematical Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons
4.	Practical Nonparametric	W.J. Conover	Wiley Publisher

B.A/B. Sc-II Semester-IV

Paper-II (ST-402)

Time: 3 Hours | M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Design of Experiments

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Analysis of variance (ANOVA): Definition and assumptions for ANOVA. Analysis of variance for one-way classification and two-way classifications for fixed effect models with one observation per cell.

UNIT-II

Introduction to design of experiments, terminology: experiment, treatment, experimental unit, blocks, experimental error, replication, precision, efficiency of a design, need for design of experiments, size and shape of plots and blocks. Fundamental principles of design: randomization, replication and local control.

UNIT-III

Completely randomized design (CRD), Randomized Block Design (RBD): their layout, statistical analysis, applications, advantages and disadvantages. Efficiency of RBD relative to CRD.

UNIT-IV

Latin square design (LSD): Layout, statistical analysis, applications, merits and de-merits of LSD. Factorial designs: Definition, advantages and disadvantages, concept of main effects and interaction in 2^2 design.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Design and Analysis of Experiments	Das M.N. & Giri	Springer Verlage
2.	Linear Models	Searle S.R.	John Wiley & Sons
3.	Linear Estimation and Design of Experiments	Joshi D.D.	Wiley Eastern
4.	Fundamentals of Applied Statistics	Gupta S.C. &. Kapoor V.K.	Sultan Chand & Sons

B.A/B. Sc-II

Paper-III (Practical ST-403)

Time: 3 Hours | Max. Marks: B. Sc: 100

B.A: 60

Practical

Note: Five questions will be set. The candidate will be required to attempt any three.

1. To apply large sample test of significance for single proportion and difference of two proportions and obtained their confidence intervals.
2. To apply large sample test of significance for single mean and to obtained confidence interval.
3. To apply large sample test of significance for difference between two means and standard deviations.
4. To apply *t*-test for testing single mean and difference between means and to obtain their confidence intervals.
5. To apply paired *t*-test for difference between two means.
6 To apply Chi-square test for goodness of fit.
7 To apply Chi-square test for independence of attributes.
8. To apply test of significance of sample correlation coefficient.
9. To apply F-test for testing difference of two variances.
10. To apply sign test for given data.
11. To apply Run test for given data.
12. To apply Median test for given data.
13. To apply Mann Whitney U-test for given data.
14. To find standard error of estimate of population mean in case of SRSWR & SRSWOR and comparison of these estimates.
15. To find standard error of estimate of population mean in case of stratified random sampling.
16. To find standard error of estimate of population mean in case of systematic sampling.
17 To perform ANOVA in case of CRD and test whether the treatments/varieties are equally effective.
18. To perform ANOVA for an RBD.
19. To perform ANOVA for an LSD.

Distribution of marks:

	B. Sc.	**B.A**
Class Record:	**10**	**06**
Viva Voce:	**10**	**06**
Practical:	**80**	**48**

B.A/B. Sc-III Semester-V

Paper-I (ST-501)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Applied Statistics-I

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Index Number: Definition, problems involved in the construction of index numbers, calculation of index numbers-simple aggregate method, weighted aggregates method, simple average of price relatives, weighted average of price relatives, link relatives, chain indices, value index numbers, price and quantity index numbers.

UNIT-II

Laspeyre's, Paasche's, Marshall-Edgeworth and Fisher's index numbers, time and factor reversal tests of index numbers, consumer price index number and its uses. Base shifting, splicing and deflating of index numbers.

UNIT-III

Time Series Analysis: Definition, components of time series-trend, seasonal variations, cyclic variations, irregular component, illustrations, additive and multiplicative models, determination of trend: graphic method, semi-averages method, method of curve fitting by principle of least squares, moving average method. Analysis of seasonal fluctuations, construction of seasonal indices using method of simple averages, ratio to trend method and ratio to moving average method.

UNIT-IV

Demographic methods: Sources of demographic data-census, register, adhoc survey, hospital records, measurement of mortality, crude death rate, specific death rate, standardized death rates, complete life tables and its main features, assumptions, descriptions and construction of life tables, uses of life tables, stationary and stable population, measurement of fertility-crude birth rate, general fertility rate, specific fertility rate, total fertility rate, measurement of population growth, gross reproduction rate, net reproduction rate.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Applied General Statistics	Croxton F.E., Cowden D.J. & Kelin S.	Prentice Hall
2.	Demography	Cox P.R.	Cambridge Uni. Press
3.	Technical Demography	Ramakumar R.	New Age International
4.	Fundamentals of Applied Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons

B.A/B. Sc-III Semester-V

Paper-II (ST-502)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Numerical Methods and Fundamentals of Computers

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: -
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Numerical Methods: Concept of interpolation and extrapolation, difference tables for operators, forward, backward and shift, and their relationship, methods of interpolation, Newton's formula for forward and backward interpolation with equal intervals, factorial notations, equidistant terms with one or more missing terms.

UNIT-II

Divided differences and their properties, Newton formula for unequal intervals, Lagrange's method of interpolation, Numerical integration, General quadrature formula for equidistant ordinates, Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ formulae.

UNIT-III

Basics of Computer: Introduction, origin, development, uses and limitation of computers. Types of computers, computer structure, input unit, CPU, output unit, secondary storage, High Level and low level languages, compiler and interpreter.

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalized floating point numbers. Number systems- Binary, decimal, octal and hexadecimal number systems and their conversions into each other. Binary arithmetic's, (Addition, subtraction, multiplication & division).

UNIT-IV

Flow charts and Algorithms: Concepts of flow chart, algorithm and programming. Flow charts and algorithms for the following: Mean, median, mode, variance, covariance, coefficient of correlation and Straight line fitting. Trapezoidal rule, Simpson's 1/3 and $3/8^{th}$ rules. Elementary idea of statistical software: SPSS

Books recommended

S. No.	**Title of Book**	**Name of author**	**Publisher**
1.	Computer Fundamentals	Sinha P.K.	BPB Publication
2.	Introductory Methods of Numerical Analysis	Sastry S.S.	Prentice Hall
3.	Computer Based Numerical Algorithms	Krishnamurthy E.V. & Sen S.K.	Affiliated East West Press
4.	Computer Oriented Numerical Methods	Rajaraman V.	Prentice Hall

B.A/B. Sc-III Semester-VI

Paper-I (ST-601)

Time: 3 Hours

M.M.:B.Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Applied Statistics-II

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Indian official statistics: Introduction, Indian statistical system, Statistical offices at the centre, Statistical offices in the states, Population statistics, Agricultural statistics, Industrial statistics, Trade statistics, Price statistics, Statistics of labour and employment, Statistics of transport and communication, Financial and banking statistics.

UNIT-II

Statistical Quality Control: Meaning and uses of SQC, causes of variations in quality, product and process control, control charts, 3- control limits, control chart for variables-$\overline{X}$ and R chart, criteria for detection of lack of control in $\overline{X}$ & R Charts, Interpretation of $\overline{X}$ & R charts.

UNIT-III

Control chart for standard deviation (σ chart), control charts for attributes: 'p' chart and 'c' chart, natural tolerance and specification limits.

UNIT-IV

Acceptance sampling : Problem of lot acceptance, stipulation of good and bad lots, producer's and consumer's risks, single and double sampling plans, their OC functions, concepts of AQL, LTPD, AOQL, average amount of inspection and ASN function.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Statistical Quality Control	Grant E.L.	McGraw Hill
2.	Statistical Methods in Quality Control	Cowden D.J.	Asia Pub. Society
3.	Fundamentals of Applied Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons
4.	Fundamentals of Statistics, Vol. II	Goon A.M., Gupta M.K. & Dasgupta B.	World Press Calcutta

B.A/B. Sc-III Semester-VI

Paper-II (ST-602)

Time: 3 Hours

M.M.:B. Sc: 40+10*
B.A: 28+7*
* Internal Assessment

Operations Research

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows:-
B.Sc.8 marks and B.A. 6 marks.

UNIT-I

Objective of O.R., nature and definitions of O.R., Scope of O.R., Meaning and necessity of O.R. models, classification of O.R. models, Advantages & disadvantages of O.R. models. Steps in model formulation, principles of modeling. Characteristics of a good model, Allocation problems.

UNIT-II

Linear programming problem (LPP): Definition, objective function, constraints, graphical solution of L.P.P., limitations of graphical method, Simplex method to solve L.P.P., concept of initial basic feasible solution, computation procedure for Simplex method.

UNIT-III

Artificial variable techniques: Big-M method, Two-phase method. Duality in Linear Programming; Concept of duality, Fundamental properties of duality.

UNIT-IV

Transportation Problem (T.P.): Formulation, Basic feasible solution. Different methods to find initial feasible solution: North-West corner rule, Row minima method, column minima method, Matrix minima method (Least cost entry method), Vogel's Approximation method (or Unit cost penalty method). UV-method (Modi's method) for finding the optimum solution of T.P.

Books recommended

S. No.	Title of Book	Name of author	Publisher
1.	Linear Programming	Hadley G.	Narosa
2.	Operations Research: An Introduction	Taha H.A.	Macmillan Pub. Co.
3.	Operations Research	Goel B.S. & Mittal S.K.	Pragati Prakashan
4.	Operations Research	Sharma S.D.	KedarNath & Co.
5.	Operations Research	Sharma J.K.	Macmillan Pub.

B.A/B. Sc-III

Paper-III (Practical ST-603)

Time: 3 Hours Max. Marks: B. Sc: 100

B.A: 60

Practical

Note: Five questions will be set. The candidate will be required to attempt any three.

1. To construct $\overline{X}$ and R-chart, and comment on the state of control of the process.
2. To construct p-chart and d-chart, and comment on the state of control of the process.
3. To obtain control limits for number of defects and comment on the state of control plotting the appropriate chart.
4. To calculate price and quantity index numbers using the formulae given by Laspyre, Paasche, Marshal-Edgeworth and Fisher.
5. To obtain cost of living index numbers for the given data using (i)Aggregate Expenditure Method. (ii) Family Budget Method
6 To test the given data whether the formulae given by Laspyre, Paasche, Marshal-Edgeworth and Fisher, satisfy reversal tests.
7 To work out trends using curve fitting method for given data.
8. To work out trends using moving average method for given data.
9. To obtain seasonal variation indices using simple average method.
10. To obtain seasonal variation indices using ratio to moving average method.
11. To calculate the crude and standardized death rates of the population using Direct Method and Indirect Method regarding one of the populations as standard population.
12. To calculate the following for the given data CDR, CBR, Sex/Age SDR, GFR, TFR, GRR, NRR.
13. To complete the given incomplete life table by computing various elements of life table.
14. To interpolate the required value for the given data using Newton's Forward/backward interpolation formula for equal intervals.
15. To interpolate the required value for the given data of using Newton's divided difference and Lagrange's interpolation formula.
16. To evaluate the integral of the type $\int_a^b f(x)\,dx$ using (i) Trapezoidal rule, (ii) Simpson's one-third rule (iii) Simpson's three-eight rule

Distribution of marks:

	B. Sc.	**B.A**
Class Record:	**10**	**06**
Viva Voce:	**10**	**06**
Practical:	**80**	**48**

P.G. DIPLOMA IN FLORICULTURE
(ANNUAL SYSTEM)

SCHEME OF EXAMINATION w.e.f. session 2019-20 under CBS

Code	Nomenclature	Duration	Max. Marks	Credit
Theory Papers				
PGDF-101	Essentials of Floriculture	3 Hrs.	80	4
PGDF-102	Improvement of Ornamental Plants	3 Hrs.	80	4
PGDF-103	Seed Production and Micro-Propagation	3 Hrs.	80	4
PGDF-104	Agro technology and Marketing	3 Hrs.	80	4
Practical Papers				
PGDF-105	Based on Paper PGDF-101 & 102	4 Hrs.	80	4
PGDF-106	Based on Paper PGDF-103 & 104	4 Hrs.	80	4
PGDF-107	Seminar		20	1
		Total	**500**	**25 Credit**

SYLLABUS

PGDF-101 Essentials of Floriculture

Max. Marks: 80 (Theory),
Duration: 3 hours Credit-4

Note: Nine question will be set in all. Question No. 1 will be compulsory and short answer type covering the entire syllabus. Remaining eight questions will be set unit-wise and four questions from each unit. The candidates will be required to attempt Question no. 1 and four more selecting two questions from each unit. All questions carry equal marks.

UNIT-1

1. History and scope of Floriculture
2. Layout structure and management of nursery.
3. Green House Plants.
4. Types and varieties of Dahlia, Chrysanthemum, Gladiolus and Bougainvillea.
5. Cultivation of cacti, succulents, orchids, and water plants.
6. Prolonging the vase life of flowers.

UNIT-2

1. Importance and types of house plants.
2. Effects of factors light, temperature, mineral nutrients, fertilizers, integrated nutrient use.
3. Soil formation, soil structure, soil characteristics and soil fertility assessment.
4. Plant care, training, diseases, pests, control measures.
5. Mycorrhiza and soil fertility management.
6. Methods of growing indoor plants, containers for house plants, dish garden, terrarium, hanging basket.
7. Managing Plant environment-green house, green house covering material, environmental controls, mist chambers.
8. Media and soil mixtures for growing plants.

Suggested Readings:

1. S.K. Bhattacharjee and Lakshman Chandran De. 2010. Advanced Commercial. Floriculture, Vols. I and II Aavishkar Pub., Second Revised and Enlarged Edition, 798.
2. D. Ravinath. 2007. Floriculture: A Viable Business. Excel Books
3. S.Prasad, U. Kumar. 2010. A Handbook of Floriculture). Agrobios (India)
4. John M. Dole and Harold F. Wilkins. 2004. Floriculture: Principles and Secies : Prentice Hall; 2 edition (2nd Edition)

5. Paul V. Nelson (Author). 2002. Greenhouse Operation and Management. Prentice Hall; 6 edition (6th Edition)

PGDF-102 Improvement of Ornamental Plants

Max. Marks: 80 (Theory),
Duration: 3 hours Credit-4

Note: **Nine question will be set in all. Question No. 1 will be compulsory and short answer type covering the entire syllabus. Remaining eight questions will be set unit-wise and four questions from each unit. The candidates will be required to attempt Question no. 1 and four more selecting two questions from each unit. All questions carry equal marks.**

UNIT-1

1. History and overview.
2. Role of Introduction and selection for domestication.
3. Variation and genetic mechanism associated with flower characters like double ness and color in important annuals, bulbs and shrubs.
4. Vegetative propagation: Principles and practices of clone selection.
5. Techniques of cutting, budding, grafting and layering
6. Propagation by specialized stems and roots.

UNIT-2

1. General account of improvement of Roses, Chrysanthemum, Dahlia, Gladiolus, Lilies, Marigold, Zinnia, Carnation, Bougainvillea, Hibiscus rosa sinensis**.**

Suggested Readings:

1. J.S. Arora.2007, introductory ornamental horticulture. Kalyani Publications.
2. Allan M. Armitage and Judy M. Laushman. 2008 Speciality Cut Flowers: The Production of Annuals, Perennials, Bulbs and Woody Plants for Fresh and Dried Cut Flowers. Timber Press; REV
3. Gwen Kelaidis and Saxon Holt. 2008. Hardy Succulents: Tough Plants for Every Climate. Storey Publishing, LLC.
4. Christopher Brickell. Royla Horticulture Society. Encyclopedia of Plants and Flowers (Rhs).
5. D.G. Hessayon. 2005. The House Plant Expert. Expert; 2nd edition.

PGDF-103 Seed production and Micro propagation

Max. Marks: 80 (Theory),
Duration: 3 hours Credit-4

Note: Nine question will be set in all. Question No. 1 will be compulsory and short answer type covering the entire syllabus. Remaining eight questions will be set unit-wise and four questions from each unit. The candidates will be required to attempt Question no. 1 and four more selecting two questions from each unit. All questions carry equal marks.

UNIT-1

1. Seed development, structure and stages of seed development.
2. Apomixis and Polyembryony: a general account.
3. Seed production systems
4. Techniques for seed production and handling
5. Seed testing and seed storage
6. Seedling production system
7. Field seedlings, field nurseries

UNIT-II

1. Principles of tissue culture and microprapogations
2. Types of tissue culture systems.
3. Media preparation, sterilization, types of media, methods and applications
4. Protoplast and cell suspension cultures
5. Synthetic seeds
6. Microprapogation of orchids and Carnation.
7. Clonal selection of microprapogated plant

Suggested Readings:

1. Introductory ornamental Horticulture 2007. J.S. Arora, Kalyani Publishers.
2. Advances in ornamental Horticulture, S.K. Bhattacharjee. 2006, Pointer Publishers.
3. Post Harvest Technology of flowers and ornamental plants. S.K. Bhattacharjee 2005, Pointer Publishers.
4. Advanced Commercial Floriculture, S.K. Bhattacharjee 2010. Aaviskar Publishers.
5. Ornamental Horticulture by Vishnu Swarup, Mac Milan Publishers.
6. Plant Propagation by M.K. Sadhu 1989. New Age International Publishers.
7. Propagation of tropical and sub-tropical horticulture crops. Bose, T.K., Mitra, S.K. and Sadhu, M.K. Noya Prakash Publisher

PGDF-104 Agro technology and Marketing

Max. Marks: 80 (Theory),
Duration: 3 hours Credit-4

Note: Nine question will be set in all. Question No. 1 will be compulsory and short answer type covering the entire syllabus. Remaining eight questions will be set unit-wise and four questions from each unit. The candidates will be required to attempt Question no. 1 and four more selecting two questions from each unit. All questions carry equal marks.

UNIT-1

1. Scope and importance of commercial floriculture in India
2. Production techniques- both conventional and modern for ornamental plants like Roses, Chrysanthemum, Gladiolus, Tuberose and Gerbera for domesticated and expert markets.
3. Hybrid seed production, Post harvest technology of cut flowers in respect of commercial flower crop production of dry flowers.

UNIT- II

1. Indian floriculture industry: An overview
2. Strategies for marketing of floriculture products, IPR and quarantine laws
3. Cut flowers as specialty crops, cut flower industries
4. Trading flowers and potted plants
5. Value addition in floriculture: cosmetics and perfume industry and outdoor designing.
6. Cutting, grading, packaging and marketing of cut flower crops (Aster, Carnation, Chrysanthemum, Gladiolus, Narcissus, Orchids and Antirrhinum) for national and International market.

Suggested Readings:

1. Introductory ornamental Horticulture 2007. J.S. Arora, Kalyani Publishers.
2. Advances in ornamental Horticulture, S.K. Bhattacharjee. 2006, Pointer Publishers.
3. Post Harvest Technology of flowers and ornamental plants. S.K. Bhattacharjee 2005, Pointer Publishers.
4. Advanced Commercial Floriculture, S.K. Bhattacharjee 2010. Aaviskar Publishers.
5. Ornamental Horticulture by Vishnu Swarup, Mac Milan Publishers.
6. Plant Propagation by M.K. Sadhu 1989. New Age International Publishers.
7. Propagation of tropical and sub-tropical horticulture crops. Bose, T.K., Mitra, S.K. and Sadhu, M.K. Noya Prakash Publisher.

BOTANY DEPARTMENT
KURUKSHETRA UNIVERSITY KURUKSHETRA
M.Sc. BOTANY Scheme of Examination (CBCS)w.e.f. 2019-20

Semester I

Paper code	**Title of paper**	**Type of paper**	**Hours /week**	**Credits**	**Marks + Internal Assessment**	**Total**
BOT-101	Algae & Fungi	Core	4	4	80 + 20	100
BOT-102	Bryophytes & Pteridophytes	Core	4	4	80 + 20	100
BOT-103	Cytogenetics & plant breeding	Core	4	4	80 + 20	100
BOT-104	Ecology	Core	4	4	80 + 20	100
BOT-105	Practical based on 101 + 102	Core	8	4	80 + 20	100
BOT-106	Practical based on 103 + 104	Core	8	4	80 + 20	100
Total				24		600

Semester II

Paper code	**Title of paper**	**Type of paper**	**Hours/ week**	**Credits**	**Marks + Internal Assessment**	**Total**
BOT-201	Microbiology and Biostatistics	Core	4	4	80 + 20	100
BOT-202	Natural Resources & Biodiversity	Core	4	4	80 + 20	100
BOT-203	Gymnosperms & Ethnobotany	Core	4	4	80 + 20	100
BOT-204	Molecular genetics	Core	4	4	80 + 20	100
BOT-205	Seminar	Core	1	1	25	25
BOT-206	Plants for human welfare	Open Elective	2	2	40 + 10	50
BOT-207	Practical based on 201 + 202	Core	8	4	80 + 20	100
BOT-208	Practical based on 203 + 204	Core	8	4	80 + 20	100
Total				27		675

Semester III

Paper code	Title of paper	Type of paper	Hours/ week	Credits	Marks + Internal Assessment	Total
BOT-301	Plant physiology & biochemistry	Core	4	4	80 + 20	100
BOT-302	Taxonomy & economic botany	Core	4	4	80 + 20	100
BOT-303	Biotechnology & genetic engineering	Core	4	4	80 + 20	100
BOT-304	a) Advanced Phycology (elective) b) Applied Mycology (elective) c) Restoration Ecology (elective) d) Advanced Plant Physiology (elective) e) Biophysical & biochemical techniques (elective)	Elective	4	4	80 + 20	100
BOT-305	Seminar	Core	1	1	25	25
BOT-306	Biodiversity and its conservation	Open Elective	2	2	40 + 10	50
BOT-307	Practical based on 301	Core	6	3	60 + 15	75
BOT-308	Practical based on 302 + 303	Core	6	3	60 + 15	75
BOT-309	Practical based on 304	Core	4	2	40 + 10	50
Total				27		675

Semester IV

Paper code	Title of paper	Type of paper	Hours/ week	Credits	Marks + Internal Assessment	Total
BOT-401	Plant growth & development	Core	4	4	80 + 20	100
BOT-402	Biology of Reproduction and Anatomy	Core	4	4	80 + 20	100
BOT-403	Plant Tissue Culture	Core	4	4	80 + 20	100
BOT-404	a) Applied phycology (elective) b) Principles of Plant Pathology (elective) c) Conservation Biology (elective) d)Plant Growth Regulators (elective) e) Genomics (elective)	Elective	4	4	80 + 20	100
BOT-405	Practical based on 401	Core	6	3	60 + 15	75
BOT-406	Practical based on 402 + 403	Core	6	3	60 + 15	75
BOT-407	Practical based on 404	Core	4	2	40 + 10	50
Total				24		600

Total Credits = 102

Total Marks = 2550

SEMESTER – I

Paper – BOT-101 Algae & Fungi Credit -4 MM-80

Objectives: To educate and train the students for professional and research career in the field of Algology & Mycology.

Outcome: The learning outcome is an advanced academic education to broaden the knowledge in comparison to that obtained in Bachelor's degree programme. The acquired knowledge will provide professional qualification for work in biological laboratories and research centres.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. Criteria for algal classification (pigments, reserve food, flagella etc.) and their taxonomic importance.
2. Comparative account of important systems of classification and recent trends.
3. Thallus organization in algae and evolutionary trends.
4. Economic importance of algae as food, feed, uses in industries etc and algal biofertilizers.

Unit-II

5. (a) Biodiversity of algae in different habitats (terrestrial, freshwater and marine).
   (b) Ecological diversity of algae in unusual habitats (thermal, psychrophilic, subaerial, symbiotic etc.).
6. Thallus organization in algae and evolutionary trends.
7. Dynamics and consequences of algal blooms and red tides (Freshwater and Marine). Algae as major components of phytoplankton.
8. Morphological features and life cycle patterns of major divisions with suitable examples (Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta, and Rhodophyta).

Unit- III

9. General characters of fungi: Thallus organization, nutrition and reproduction.
10. Classification of fungi by Ainsworth & Bisby (1983), Alexopoulus et. Al (1996).- phylogeny of fungi- characters used in classification.
11. General account of Myxomycota, mastigomycota, Zygomycota, Ascomycota, Basidiomycota and Mitosporic gungi. Different kinds of spores and their dispersal.
12. Concept of Homothallism, Heterothallism, alternation of generations and parasexualuality.

Unit – IV

13. Economic importance of fungi in nutrient cycling, decomposition, humus formation, decay and deterioration of wood & timber.
14. Causal organisms, sysptoms and management of : late and early blight of potato, downy mildew of grapes, green ear disease of ground nut, apple scab, karnal bunt of wheat, rust of wheat, tikka disease of ground nut
15. Lichens: structure, reproduction and economic importance

Suggested Readings:

1. Ahluwalia, A.S. (Ed.). *Phycology: Principles, Processes and Applications.* Daya Publishing House, New Delhi. 2003.
2. Carr, N.G. & Whitton , B.A. (1982): The biology of Cyanobacteria Blackwell Scientific Publ., Oxford, U.K.
3. Dubey, R.C. (2014): Advanced Biotechnology, S Chand & Cmpany Pvt. Ltd., New Delhi.
4. Fatma, T. (2005): Cyanobacterial and Algal Metabolism and Environmental Biotechnology, Narosa Publihers.
5. Fay, P & C van Baalen (1987): The cyanobacteria, Elsevier Science Publishers, B.V. Amsterdam, Netherlands.
6. Gupta, R.K. & Pandey, V.D. (2007): Advaces in Applied Phycology, Daya Publishing House, Daryaganj, New Delhi.
7. Hoek, C. Van Den, Mann, D.G. & Jahns, H.M. (1995): Algae: An Introduction to Phycology, Cambridge University Press, U.K.
8. Kaushik, B.D. (1987): Laboratory methods for Blue-green Algae, Associated Publishing Co., New Delhi.
9. Morris, I. (1980): The Physiological Ecology of Phytoplankton (studies in Ecology, Vol.7), Blackwell Scientific Publ., USA.
10. Prescott, L.M., Harley, J.P. & Klein, D.A. (1996): Microbiology, 3rd edition, Wm. C. Brown Publishers, USA.
11. Singh, B.D. (1998): Biotechnology, Kalyani Publishers, New Delhi.
12. Singh, R.P. (1990): Introductory Biotechnology, Central Book Depot, Allahabad, India.
13. Sze, P. (1993): A. Biology of the Algae, Wm. C. Brown Publishers, U.K.
14. Venkataraman, G.S. ((1969): The Cultivation of Algae, IARI, New Delhi.
15. Alexopoulos, C.J. Mins, C.W. & Blackwell, M. 1995: Introductory Mycology, John Willy and Sons. Inc.
16. Bilgrami, K.S. & Dubey H.C. (1986): A text book of Modern Plant Pathology, Vikas, Publ Ltd., N.Delhi.
17. Bilgrami, K.SA. & Verma R.N. (1981): Physiology of fungi, Vikas Publ. Ltd., New Delhi.
18. Biswas, S.P. & Biswas, A. 1984: An Introduction to Viruses, Vani Education Books, New Delhi.
19. Butler, E.J. & Jones, S.G. (1978): Plant Pathology, Periodical Expert Book Agency, New Delhi.
20. Clifton, A. 1958: Introduction to the Bacteria. McGraw Hill Books Co. New York.
21. Mehrotra, R.S. & Aneja, K.R. 1990: An introduction of Mycology, New Age International Press, N.Delhi.
22. Moore-landeckar, E.J. (1972): Fundamentals of the fungi, Prentice Hall, Eaglewood, U.K.
23. Mundukar, B.B. (1967): Fungi & Plant Diseases, Mac million Co. Ltd., USA.
24. Webster, J. 1985: Introduction of Fungi. Cambridge University, Press.

Paper – BOT-102 – BRYOPHYTES & PTERIDOPHYTES Credit -4 MM-80

Objectives: The course has been conceived to equip students with the knowledge of characteristics, structure and development of gametophyte and sporophyte in bryophytes & pteridophytes.

Outcome: After studying this paper students will be able to classify bryophytes and distinguish these from other groups of plants. They will also be able to understand origin and evolution of sporophyte in bryophytes & pteridophytes.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. General characteristics features of Bryophytes. General account of structure and development of gametophyte, sporophyte of Marchantia, Pellia and Anthoceros.
2. General account of structure and development of gametophyte and sporophyte of Sphagnum, Funaria & Polytrichum.

Unit -II

3. Biology of reproduction- *In Vitro* regulation of gametangia formation: effect of physical and chemical factors
4 Ecological importance of bryophytes: Bryophytes as indicators of pollution and minerals; role of Bryophytes in succession

Unit-III

5. General characteristics of Pteridophytes and their classification
6. Comparative morphology and reproduction of the following:
   Psilophytales (Rhynia, Zosterophyllum), Psilotales (Psilotum), Lycopodiales (Lycopodium, Selaginella), Lepidodendrales (Lepidodendron),
   Sphenophyllales (Equisetum)

Unit- IV

7. Comparative morphology and reproduction of the following :
   Ophioglossales(Ophioglossum, Botrychium), Marattiales (Marattia, Angiopteris),
   Osmundales, Filicales (Pteris, Dryopteris),Marsileales and Salviniales
8. Economic and Ecological significance of Pteridophyte in succession.

Suggested Readings:

1. Parihar, N.S. 1965. An Introduction to Embryophyta Vol. I. Bryohpyta, Central Book Depot, Allahabad, India.
2. Schofield, W.B. 1985. Introduction to Bryology, Macmillan, New York.
3. Chopra, R.N. and Kumra, P.K. 1988. Biology of Bryophytes. Wiley Eastern Ltd., New Delhi.
4. Chopra, R.N. & Bhatla, S.C. 1990. Bryophyte Development: Physiology and Biochemistry.CRC Press, Boca Raton, USA.
5. Rashid, A. 1998. An Introduction to Bryophyta. Vikas Publishing House Pvt. Ltd. New Delhi.

6. Watson, E.V. 1967. The Structure and Life of Bryophytes. B.I. Publications, New Delhi.
7. Glime, J.M and Saxena D. 1991. Uses of Bryophytes. Today and Tomorrow's Printers and Publishers, New Delhi.

8. Richardson, D.H.S. 1981. The Biology of Mosses. Blackwell Scientific Publications, Oxford, London.

9. Parihar, N.S. 1977. The Biology and Morphology of Pteridophytes. Central Book Depot. Allahabad.
10. Rashid, A. 1976. An Introduction to Pteridophyta (Diversity and Differentiation). Vikas Publishing House Pvt. Ltd., New Delhi.
11. Sporne, K.R. 1985 (reprint) The Morphology of Pteridophytes. B.I. Publications Pvt. Ltd., Delhi.

Paper – BOT-103 - CYTOGENETICS AND PLANT BREEDING Credit -4 MM-80

Objective: The purpose of this paper is to acquaint the students about structure and functions of a chromosome in detail. The course also explains the chromosomal variations and their effects on biological system. Further, it aims to draw attention to methods used for crop improvement.

Outcome: This paper would help the students to know the role of chromosomes and chromosomal rearrangements in generation of variations. They will also be familiar with methods used to change the traits of a plant to create the desired genotype/phenotype.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. Chromatin structure and organization: Chromosome structure and DNA packaging; euchromatin and heterochromatin.
2. Organization of plastid and mitochondrial genomes.
3. Special Chromosomes: Structure, occurrence and behaviour of polytene, lampbrush, B and sex chromosomes.
4. Karyotype: Karyotype analysis and its evolution; FISH, CGH and flow cytometery.

Unit-II

5. Cell cycle: Cell cycle phases, checkpoints and regulation.
6. Chromosome banding techniques and their applications.
7. Linkage and crossing over: Molecular mechanism of crossing over and role of different enzymes; linkage groups.
8. Chromosome mapping- Two point and three point test crosses.

Unit-III

9. Sex determination: Chromosomal and gene determining sex in plants, animals, *Drosophila* and humans; Gene dosage compensation.
10. Structural alterations in chromosomes – Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterozygotes.
11. Variation in chromosome number: Haploids, aneuploids and euploids- origin, production, effects and uses; polyploidy and crop improvement.

Unit-IV

12. Principles of plant breeding: Principles and objectives; methods of breeding self and cross pollinated crops, heterosis and hybrid vigour; utility of hybrids in genetics and plant breeding.
13. Asexual breeding systems: Methods of breeding of vegetatively propagated crops; Non-conventional methods; gene variability.
14. Male sterility: Concept; classification; genetic control; inheritance pattern and breeding utility.

Suggested Readings:

1. Alberts B, Johnson A, Lewis J. Raff M, Roberts K and Walter P (2008) Molecular Biology of the Cell (5th Ed.). Garland Publishing Inc., New York.
2. Gustafron JP (2002) Genomes, Kluwer Academic Plenum Publishers, New York, USA.
3. Karp G (1999) Cell and Molecular Biology, John Wiley and Sons, USA.
4. Krebs JE, Goldstein ES and Kalpatrick ST (2010) Lewin's Essential Genes (2nd Ed.), Jones and Barlett Publishers.

5. Lewin B (2010) Gene X, Jones and Barlett Publishers.
6. Lodish H, Berk A, Kaiser, CA, Krieger M, Scott MP Bretscher A Ploegh H and Matsudaira P (2008) Molecular Cell Biology (6th Ed), W.H. Freeman and Company, New York, USA.
7. Pierce BA (2012) Genetics- A Conceptual Approach (4th Ed.), W.H. Freeman and Company, New York, USA.
8. Poehlman JM and Sleper DA (1995) Breeding Field Crops, AVI. Publ., U.S.A.
9. Russell PJ (2006) Genetics (5th Ed.), Addison Wesley Longman, California, USA.
10. Snustad P and Simmons MJ (2011) Principles of Genetics. (6th Ed.), John Wiley, New York.
11. Weaver RF (2005) Molecular Biology, McGraw Hill International Edition.
12. Watson, JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene (6th Ed.), CSHLP, New York

Paper – BOT-104 – ECOLOGY **Credit -4** **MM- 80**

Objectives: Critically engage with concepts of Ecological principles and importance of environment and the problems related with it at global and local level.

Outcome: By understanding the concepts of ecological principles and environmental issues, the student will be able to develop attitude, value system and ethics towards environment related issues.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. The Environment: Physical environment, biotic environment, biotic and abiotic interactions; Tolerance range and limiting factors, ecotypes
2. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.
3. Population ecology: Concept, characteristics, population growth and regulation, species interactions—mutualism, competition, allelopathy, predation, parasitism, Life-history strategies and r-and K selection, concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations

Unit-II

4. Community structure and organization; Nature of communities, community structure and its attributes; species diversity, Edges and ecotones, vegetation characteristics (analytical and synthetic characters, methods of analysis.
5. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit-III

6. Ecosystem organization: structure and functions; primary production (global pattern and controlling factors); energy dynamics—trophic levels, energy flow pathways and ecological efficiencies.
7. Decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P, & S, ecosystem stability (resistance and resilience).

Unit-IV

8. Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
9. Global atmosphere changes: Environmental pollution, global environmental change and its consequences (CO2 fertilization, global warming sea level rise and UV radiation).
10. Biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

Suggested Readings :

1. Botkin, D.B. and E.A. Keller (2004). Environment Science: Earth as a Living Planet, John Wiley & Sons Inc., New York.
2. Miller (Jr.) and G. Tyler (1994) : Living in the Environment. Wadsworth Publishing Company, Belmont, California.
3. Odum, E.P. (1983), Basic Ecology, Sanders, Philadelphia.
4. Peter H. Raven, P.H. and Berg , L. R. Berg. 2005. Environment, 5th Edition. John Wiley & Sons Inc., New York.
5. Ramakrishnan, P.S. 2000. Ecology and Sustainable Development. National Book Trust, India
6. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
7. Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
8. Smith, R.L. (1996), Ecology and Field Biology, Harper Collins, New York.
9. Steffen, W., A. Sanderson, P. D. Tyson, J. Jager, P. M. Matson, B. Moore, III, F. Oldfield, K. Richardson, H. J. Schnellnhuber, B. L. Turner, II, and R. J. Wasson. 2004. Global change and the Earth system: a Planet under Pressure. Springer-Verlag, New York, New York, USAReference books.
10. Townsend, C.R., Begon, M. And Harper, J.L. 2003. Essentials of Ecology. Second Edition. Blackwell Publishing, Oxford.

Paper – BOT-201 – Microbiology and Biostatistics

Credit -4 MM- 80

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. Structure & replication of viruses and bacteriophage; transmission & control of viruses; Isolation & purification of Plant Viruses.
   Diseases caused by Viruses**:** TMV, Tristeza of citrus
2. Cyanobacteria: Salient features and Biological Importance.

Unit-II

3. Growth, culture and maintenance of microorganisms
   Microbial growth and measurement, environmental factors influencing growth.

4. Control of micro organisms: Physical methods(High temperature, dry hot or hot air sterilization, moist air sterilization, low temperature, filtration, lycophilisation, Radiation), Chemical methods (Disinfectants and antiseptics)

Unit-III

5. Microbial interaction: Functions of symbiotic relationships, types of symbiosis, commensalism, synergism, mutualism-(Lichens, Bacterial endosymbionts of protozoa, Nitrogen fixing symbiosis,mycorrhizae), parasitism.
6. Environmental Microbiology**:** Microbiology of fresh, marine and extreme environment, Biofilms, Bioremediation of polluted environment, Bioleaching.

Unit-IV

7. Biostatistics: Brief description and tabulation of data and its graphical representation.

8. Measures of central tendency and dispersion.

9. Mean, mode, median, range standard deviation, variance idea of two types of errors and level of significance, tests of significance (F & t test); chi-square test.

10. Simple Linear Regression and Correlation.

Suggested Readings:

1. Gupta R & Mukherji K G (2001). Microbial technology, APH Publ. co., New Delhi.
2. Pelezar, MJ, Chaing, ECS & Krieg, NR (1993). Microbiology, Tata McGrawHill Publ. New Delhi.
3. Prescott, LM., Harley, JP & Klein, DA (1996). Microbiology Wm. C. Brown Publ. USA.
4. Ronald, M Atlas (1995). Principles of microbiology. Mosby-Year Book, Inc. St. Louis, Missouri, USA.
5. Singh R.P. (1990): Introductory Biotechnology, Central Book Depot, Allahabad, India.
6. Sumbali, G. 2005: The Fungi, Narosa Publ. House, New Delhi.
7. Statistics for Biologists (1974) Campbell R.C. Cambridge University Press, Cambridge.

8. Statistics in Biology, Vol. 1 (1967) Bliss, C.I.K, McGraw Hill, New

Paper 202: Natural Resources and Biodiversity Credit -4 MM-80

Note:-

1. Nine questions will be set in all.
2. Question No. 1, which will be objective/short –answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set section-wise with two questions from each unit I, II, III & IV. The candidates will be required to attempt Q. No. 1 and four more selecting one question from each section.

Unit-I

1) Resources: Types, Renewable and non-renewable resources; resources degradation and conservation.
2) Land resources: Land degradation and desertification; management of waste lands in India.
3) Water resources: Pools of water and Hydrological cycles, surface water and ground water; water-use and management.
4) Environmental pollution of air, water and soil-types, sources and effects.

Unit-II

5) Forest resources: Forests and their importance, Non timber forest produce, forest resources of India and forest management.
6) Types of energy resources, renewable sources of energy-wine energy, wave energy, Energy from biomass, bioconversion technologies, energy plantation and petrocrops.
7) Ecosystem restoration and Environment impact assessment- Brief account.

Unit- III

8) Principals of resources conservation and conservation strategies.
9) Biological diversity: importance, concept and levels biodiversity, threats to biodiversity-habitat loss and fragmentation, exotic species, pollution, species extinctions; IUCN categories of threat.
10) Distribution and global patterns of biodiversity.
11) Terrestrial and marine hotspots of biodiversity; Hotspots of biodiversity in India.

Unit- IV

12) *In situ* conservation of biodiversity: Protected area in India-sanctuaries, national parks, biosphere reserves.
13) Conservation of biodiversity of wetlands, mangroves and coral reefs.
14) *Ex situ* biodiversity conservation: principles and practices, field gene banks, seed banks and cryopreservation.
15) Sustainable development: concept, principles and strategies; sustainability indicators.

Suggested Readings:

1. Ball, J.B. 2001. Global forest resources: history and dynamics. In: *Forest Handbook Volume* 1, Evans, J. (ed.) Blackwell Science, Oxford.
2. Chape, S., Fish, L. Fox, P. and Spalding, M. 2003. United Nations list of protected areas. UCN/UNEP/World Conservation Monitoring Centre, Gland, Switzerland/Cambridge.
3. Gopal, B. (ed.) 1987. Ecology and Management of Aquatic Vegetation of the Indian Subcontinent. W. Junk by. The Hague.
4. Heywood, V.(Ed.) (1995) Global Biodiversity Assessment. United Nations Environment Programme, Cambridge University Press, Cambridge.
5. Huston, M.A. 1994. *Biological Diversity*: The Coexistence of Species on Changing Landscapes. Cambridge University Press, Cambridge.
6. Owen, O.S., Chiras, D.D. and Reganold, J.P. 1998. Natural Resource Conservation: Management for Sustainable Future. Seventh Edition. Prentice Hall. Upper Sadle River, New Jersey.
7. Raven, P.H. and Berg, L.R. 2005. Environment , 5^{th} Edition, John Wiley & Sons Inc., New York.
8. Singh, J.S. and Singh, S.P. 1992. *Forests of Himalaya, Structure, Functioning and Impact of Man*. Gyanodaya Prakashan, Nainital, India.
9. Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.

Paper – BOT-203 – Gymnosperms &Ethnobotany Credit -4 MM- 80

Objective: This course is intended to provide the basic understanding of morphology and reproduction in pteridophytes and gymnosperms. It also describes the modern methods of propagation of gymnosperms.

Outcome: After studying this paper students will be able to classify pteridophytes and gymnosperms. They will also be able to describe heterospory, origin of seed habit and evolutionary trends in stele and spore producing organs. Besides above, they will also be able to understand the phenomena of apogamy, apospory and their experimental induction.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. Classification of gymnosperms and their distribution in India.
2. Brief account of the following families:
   Lyginopteridaceae, Medullosaceae, Glossopteridaceae, Caytoniaceae.

Unit – II

3. General account of the following orders:
   Cycadeoidales(Cycadeoidea), Pentoxylales, Cordiatales
4. Comparative account of Structure and reproduction in the following orders:
   Cycadales (Cycas), Ginkgoales (Ginkgo).

Unit- III

5. Coniferales (Pinus, Cedrus), Ephedrales (Ephedra), Welwitschiales, Gnetales
6. Economic importance of gymnosperms, Role of Gymnosperms in Biodiversity.
7. Modern methods of propagation of gymnosperms: somatic embryogenesis, haploids and protoplast culture

Unit-IV

8. Ethnobotany: History and importance of ethnobotany, ethnomedicobotany, ethnozoology, ethnoveterinary, ethnomusicology and ethnoagriculture

9 Wild edible plants used as emergency food by triblals in India, methods and techniques in ethnobotanical study and research.

10. Traditional plants: Cereals, pulses, vegetables, spices and mushrooms, wild edible fruits and seeds. Plants in folk songs and proverbs. Sacred grooves, Impact of moderenization.

Suggested Readings:

1. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age International Pvt. Ltd., New Delhi.
2. Sporne, K.R. 1965. The Morphology of Gymnosperms. B.I. Publications Pvt. Ltd., New Delhi.
3. Bierhorst, D. W. 1971. Morphology of Vascular Plants. Macmillan. New York.
4 . Cotton, C.M. 1996. Ethnobotany- Principles and Appliations, Centruy School Book by service Film setting Ltd.
5. Dahlgren. R.H., Clifford, T and P.F Yeo 1985.The families of the monocotyledons; structure, Evolution and Taxonomy. SpingeVerag, NY.

6. Gary J, Martin, 2004. Ethnobotany- A Methods Manual, Chapman and Hall. U.K.
7. Jain S.K. 1981. Glimpses of Indian Ethnobotany. Oxford and IBH, New Delhi.
8. Jain S.K. 1987. A manual of ethnobotany. Scientific publisher Jodhpur.
9. Jain S.K. and Mundgal, 1999. Handbook of ethnobotany, London.
10. Pursrglove, J.W. 1972. Tropical Crops-Monocotyledons and Dicotyledons of ethnobotany, ethnomedicine, ethnoecology, ethnic communities.
11. Rao, P.C. 2006. Medicinal plants: Ethanobotanical Approach, Agribios, India.
12. Trivedi, P.C. 2006. Medicinal plants: Ethanobotanical Approach, Agribios, India.
13. Yoganarasimhan, S.N. Medicinal Plants of India-Vol-I- Karnataka, Interline Publishing Pvt. Ltd.

Paper – BOT-204 – MOLECULAR GENETICS Credit -4 MM- 80

Objective: This course is intended to provide the basic understanding of biological processes such as DNA replication, transposition and mutations. A key thrust of this paper is towards the molecular mechanisms involved in the control of gene expression and regulation.

Outcome: The students are expected to have better understanding of basic life processes. It will also impart knowledge about the regulation of various metabolic pathways.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

UNIT-I

1. Eukaryotic genome: Different forms of DNA, C- value paradox, unique and repetitive DNA, gene families, hybridization kinetics and split genes.
2. Transposable elements: Mechanisms of transposition; transposons in bacteria, maize, *Drosophila* and yeast.
3. DNA Replication: Semi-conservative, bidirectional, replication origins, replication machinery.

UNIT-II

4. Mutations: types, isolation of mutants, molecular basis of mutations.
5. DNA damage and repair: Causes of DNA damage; Photoreactivation, excision, mismatch, post replication and error prone repair systems.
6. Fine structure of gene: *cis-trans* test, rII locus, fine structure analysis of eukaryotes.
7. Bacterial genetics: conjugation, transduction and transformation.

UNIT- III

8. Transcription: Initiation, elongation and termination in prokaryotes and eukaryotes, RNA polymerases.
9. RNA Processing: Processing of mRNA, rRNA and tRNA.
10. Genetic code: Deciphering the genetic code, characteristics.
11. Translation: Initiation, elongation and termination in prokaryotes and eukaryotes.

UNIT-IV

12. Regulation of gene expression in prokaryotes: Operon concept, lac operon regulation by positive and negative mechanism, trp operon, regulation by negative and attenuation.
13. Regulation of gene expression in eukaryotes:
    a) Transcriptional level – Regulatory sequences, nucleosome positioning, chromatin 647itrogenis, histone modifications.
    b) Post-transcriptional level – RNA splicing, RNA stability.
    c) Translational level and post-translational level.

Suggested Readings:

1. Alberts B, Johnson A, Lewis J. Raff M, Roberts K and Walter P (2008) Molecular Biology of the Cell (5^{th} Ed.). Garland Publishing Inc., New York.
2. Brown TA (1999) Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.
3. Burns GW and Bottino PJ (1989) The Science of Genetics, Macmillan Publishing Co. New York.
4. Clark D (2005) Molecular abiology, Understanding the Genetic Revolution. Elsevier Inc. C. California.
5. Gustafron JP (2002) Genomes.Kluwer Academic Plenum Publishers, New York, USA.
6. Hartl DL (1999) Genetics Principles and analysis. (4^{th} Ed.) Jones and Bartle, Boston.
7. Henry RJ (1997) Practical Applications of Plant Molecular Biology, Chapman & Hall, London, UK.

8. Klug WS and Cunning MR (1996) Essentials of Genetics. Prentice Hall London.
9. Krebs JE, Goldstein ES and Kalpatrick ST (2010) Lewin's Essential Genes (2nd Ed.), Jones and Barlett Publishers.
10. Lewin B (2005) Genes VIII. Oxford University Press, New York.
11. Lodish H, Berk A, Kaiser, CA, Krieger M, Scott MP Bretscher A Ploegh H and Matsudaira P (2008) Molecular Cell Biology (6th Ed), W.H. Freeman and Company, New York, USA.
12. Pierce BA (2012) Genetics- A Conceptual Approach (4th Ed.), W.H. Freeman and Company, New York, USA.
13. Russell PJ (2006) Genetics (6th Ed.), Addison Wesley Longman, California, USA.
14 Snustad P and Simmons MJ (2011), Principles of Genetics. (6th Ed.), John Wiley, New York.
15. Swanson CP, Mertz T and Young WJ (1981) Cytogenetics- The Chromosome in Division, Inheritance and Evolution (2nd Ed.), Englewood Cliffs, Prentice Hall, New Jersey.
16. Weaver RF and Hedrick PW (1997). Genetics (3rd Ed.) WMC Brown, Chicago.
17. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene (6th Ed.), CSHLP, New York.

PAPER – BOT-206 – PLANTS FOR HUMAN WELFARE CREDIT -2 MM-50

Objective: This course is intended to provide the basic understanding the origin, morphology, cultivation of major crops. It also deals with the traditional knowledge and utility of some common spices, condiments, medicinal plants and horticulture crops.

Outcomes: The students are expected to have better understanding of origin of agriculture. They will also be able to identify the plant sources of medicines, spices, oil, fibres, dyes, gum and timbers.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Plants and Civilization: Origin of agriculture
Origin crop plants: Idea about centre of origin of common crop plants
Major cereals and pulses
Spices and condiments (Saffron, Clove, Cardamom, Ginger, Turmeric, Cinnamon, Capsicums, Asafetida, Coriander, Fennel, Fenugreek**)**

Unit –II

Medicinal plants: Importance of medicinal plants – role in human health care
Traditional knowledge and utility of some common medicinal plants-*Sarpgandha, Isabgol,Vasaka, Neem, Bhiringraj, Amla, Harrad, Bahera, Arjun ,Punarnava , Brahmi, Kasondi, Ghritkumari, Quinine and Eucalyptus*

Hallucinogenic plants – general account

Unit –III

Nutritive and medicinal value of some fruits and vegetables (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate, Moringa, Cabbage)
Beverages (Coffee, Tea, Chocolate, Cola)
Common ornamental plants
Common food adultrants

Unit-IV

Common timber yielding plants and minor forest products
General account of Fibers, dyes, tannins, gums and resins
Insecticides from plants (Pyrethrum**)**

Suggested Readings:

Kochar, S.L. 1981. Economic Botany in the Tropics. Macmillan India Ltd., Delhi.
Hill, A.F. 1952. Economic Botany (2nd Ed.) McGraw Hill, New York.
Cobley, L.S. and Steele, W.M. 1976. An Introduction to the Botany of Tropical Crops (2nd Ed.) Longmans, London.
Simmonds, N.W. 1976. Evolution of Crop Plants Longman, London, New York.
SambaMurthy, AVS and Subrahmanyam, N.S. 1989. A Text Book of Economic Botany. Wiley Eastern Ltd.,Delhi
Schery, R.W. 1972. Plants for Man. Prentice Hall. Englewood Cliffs, N.J. USA
Simpson B. B. M. C. Ogorzaly 2001. Economic botany: plants of our world, 3rd ed. McGraw-Hill, New York, New York, USA.

SEMESTER – III

Paper – BOT-301 Plant Physiology and Plant Biochemistry Credit -4 MM-80

Objective: The course would deal with the study of plant physiology especially the water transport, absorption, mineral nutrition, photosynthesis, respiration and nitrogen metabolism.

Outcome: The students will be able to understand the physiology and basic metabolism of plants. They will able to answer the questions regarding water transport, absorption, mineral nutrition, photosynthesis, respiration and nitrogen metabolism.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Water: Passive and active absorption of water.
Plant water relations: Concept and components of water potential, soil water relationship, transpiration and factors governing transpiration, antitranspirants.

Unit-II

Mineral Nutrition: Role and mode of action of micro and macro-nutrients.
Photosynthesis: Photo-oxidation of water, cyclic and non-cyclic photophosphorylation, photorespiration and its significance. The sequence of reactions in photosynthesis, the path of carbon assimilation (C3 and C4 cycles, CAM pathway).

Unit-III

Respiration: Glycolysis, Krebs cycle, electron transport chain and ATP synthesis, pentose phosphate pathway, glyoxylate cycle.
Nitrogen Metabolism: Biochemistry of nitrogen fixation, 650itrogenise, nitrogen fixation in legumes, nitrate assimilation, ammonium assimilation, biosynthesis of amino acids.

Unit-IV

Lipid Metabolism:
Fatty acid biosynthesis, Alpha and beta oxidation and conservation into carbohydrates.
Enzymes: Structure, properties and functions of enzymes, factors affecting rates of enzymatic reactions, isozymes, allosteric enzymes.

Suggested Readings:

Bonner, J. And Varner, J.E. (1976). Plant Biochemistry, IIIrd Edition, Academic Press, New York and London.
Buchanan, B.B., Gruissem, W. And Jones, R.L. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
Davies, Peter J. (1995). Plant Hormones: Physiology, Biochemistry and Molecular Biology. 2nd Edition. Kluwer Academic Publishers, The Netherlands.
Dey, P.M. and Harborne, J.B. (1997), First Indian Edition, Plant Biochemistry. Academic Press, Harcourt Asia Pvt. Ltd.
Garrett, R.H. and Grisham, C.M. (1999). Biochemistry. Second edition. Saunders College Publishing, Philadelphia.
Hopkins, W.G. (1995) Introduction to Plant Physiology, John Wiley and Sons.
Krishnamoorthy, H.N. (1993). Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.

Kumar, H.D. and Singh, H.N. (1993). Plant Metabolism. Second edition, Affiliated East-West Press Pvt Ltd. New Delhi.
Lehninger, A.L. (1978). Biochemistry. Kalyani Publishers, Ludhiana, India (Indian edition).
Lehninger, A.L, Nelson, D.L. and Co MM 1993Principles of Biochemistry Second edition, CBS Publishers.
Moore, Thomas. C. (1989). Biochemistry and Physiology of Plant Hormones. Second edition (Reprint 1994), Narosa Publishing House, New Delhi..
Noggle, G.R. and Fritz, G.J. (1983). Introductory Plant Physiology, Prentice-Hall of India Pvt. Ltd., New Delhi, Second edition Seventh reprint, 1993.
Salisbury, F.B. and Ross, C.W. (1992). Plant Physiology. Fourth edition, Wadsworth Publishing Co. Belmont, California, USA.
Singhal, G.S. Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee (editors) (1999). Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
Srivastava, L.M. (2006). Plant Growth and Development : Hormones and Environment. Academic Press. Published by Elsevier India Pvt. Ltd., New Delhi.
Taiz, L and Zeiger, E. (1998). Plant Physiology. Second edition. Sinauer Associates, Inc., Publishers, Massachusetts, USA
Trehan, K. (1990). Biochemistry. Second edition, Wiley-Eastern Ltd., New Delhi.
Trivedi, P.C. (2006). Plant Molecular Physiology: Current Scenario and Future Projections. Aavishkar Publishers, Distributors, Jaipur.
Weil, J.H. (1990). General Biochemistry. Sixth edition. Wiley-Eastern, New Age International Publishers, New Delhi.
Wilkins, M.B. (1987). Advanced Plant Physiology, ELBS, Longman, England. Zubay, Geoffrey. (1989).
Biochemistry. Mc.Millan Publishing Co. New York.

Paper – BOT-302 Plant Taxonomy and Economic Botany Credit -4 MM-100

Objective: The course would deal with the study of the basic concepts of plant taxonomy and botanical nomenclature. The course is also designed to know about the origin of agriculture and economic importance of major crop plants.

Outcome: The students will be able to understand the different systems of classification of angiosperms. They will also be able to identify the plant sources of medicines, spices, oil, fibres, dyes, gum and timbers.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

The Species concept, Taxonomic hierarchy, Species, Genus and Family

Taxonomic evidence: Morphology, anatomy, palynology.

Taxonomic Tools: Herbarium and Floras.

Botanical Gardens and herbaria in India; Botanical Survey of India its organization and role.

Unit-II

Salient Features of the International Code of Botanical Nomenclature.

Systems of angiosperm classifications of Benthom and Hooker, Engler and Prantl, Hutchinson, Cronquist, Takhtajan, Dahlgren and Thorne,

Relative merits and demerits of these systems.

Unit-III

Origin of agriculture: World centers of primary diversity of domesticated plants.

Origin, botany, cultivation and uses of cereals (wheat, rice), Sugarcane, Potato

Oil yielding plants (groundnut, mustard, sunflower)

Unit-IV

Botany, origin, uses of important fibres (Cotton, Jute),

General account of important spices (Ginger, Turmeric, Cinnamon, Clove, Cardamom, Chilies, Pepper, Fennel, Coriander, Cumin, Asafetida, Nutmeg, Mace, and Saffron),

General account of important medicinal plants (Aconite, Cinchona, Belladonna, Digitalis, Glycyrrhiza, Rauvolfia, Papaver, Vasaka, Aloe and Ginseng). A brief account of major Indian Medicinal plants(Amla, Neem, Arjun, Harad, Bahera, Isabgol, Ashwagandha, Bhringraj and Senna)

General account of important timber, dye, gums and tannin yielding plants

Suggested Readings:

Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row Publishers Inc.

Lawrence, G.H.M. 1951. Taxonomy of vascular plants. The Macmillan C., New York.

Davis, P.H. and Heywood, V.H. 1965. Principles of Angiosperm Taxonomy. D Van Nostrand Co. , New York.

Sivarajan, V.V. 1984. Introduction to Principles of Plant Taxonomy. Oxford IBH Pub. Co., New Delhi.

Kochar, S.L. 1981. Economic Botany in the Tropics. Macmillan India Ltd., Delhi.

Hill, A.F. 1952. Economic Botany (2nd Ed.) McGraw Hill, New York.

Cobley, L.S. and Steele, W.M. 1976. An Introduction to the Botany of Tropical Crops (2nd Ed.) Longmans, London.

Simmonds, N.W. 1976. Evolution of Crop Plants Longman, London, New York.

SambaMurthy, AVS and Subrahmanyam, N.S. 1989. A Text Book of Economic Botany. Wiley Eastern Ltd.,Delhi

Judd, W.S.; Campbell. C.S., Kellogg, E.A. and Stevens, P.F. 1999. Plant Systematics A Phylogenetic Approach. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, U.S.A.

Schery, R.W. 1972. Plants for Man. Prentice Hall. Englewood Cliffs, N.J. USA

Simpson B. B. M. C. Ogorzaly 2001. Economic botany: plants of our world, 3rd ed. McGraw-Hill, New York, New York, USA.

Hancock. J. F. 2004. Plant evolution and the origin of crop species. 2nd edition. CABI Publishing, Cambridge, MA USA.

Radford, A. E., W. C. Dickison, J. R. Massey, C. R. Bell. 1976. Vascular Plant Systematics Harper and Row, New York.

Paper – BOT-303 Biotechnology and Genetic Engineering Credit -4 MM-80

Objective: This course is intended to provide knowledge about Recombinant DNA Technology, DNA cloning, gene amplification, genetic transformation methods and transgenic plants.

Outcome: The students will have better understanding of genetic engineering, PCR, genetic transformation and transgenic plants.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Techniques used in DNA Technology: Gel Electrophoresis, PFGE, Southern and Western blotting, Dot blots, Chemical synthesis of genes, DNA chip technology.

Isolation of genes, Sequencing of genes: Maxam & Gilbert's method, Sanger's method and next-generation sequencing technologies,

Brief account of proteomics and genomics.

Unit-II

DNA cloning methods, using vectors (Plasmids, phages, cosmids, phagemids, transposons, artificial chromosomes, BAC, YAC, MAC), cloning in bacteria and eukaryotes, genomic and C-DNA Libraries.

Gene amplification by PCR: different types, DNA finger printing, molecular probes: 653itrogeni and applications.

Unit-III

Gene transfer methods in plants: plasmid mediated, electroporation, cation precipitation, liposomes, microinjection and particles gun technology, expression of transgenes.

Transgenic plants: production of transgenic plants with respect to insect resistance, herbicide resistance, resistance against biotic and abiotic factors, transgenics for male sterility and edible vaccines

Unit-IV

Yeast and algal biomass as source of single cell protein, oils and vitamins, microbial fermentation technology in food industry.

Plant and microbial biopesticides, bioremediation and phytoremediation.

Suggested readings

Bajaj, Y.P.S. 2000. Biotechnology in Agriculture and Forestry-44- Transgenenic Trees, Springer Pub., New York, USA

Bajaj, Y.P.S. 2000. Biotechnology in Agriculture and Forestry-46-Transgenic Trees, Springer Pub., New York, USA

Brown, T.A. 1999 Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore

Dawson, M.T. Powell, R, and L. Gannon, F.1996. Gene Technology, BIOS Sci. Pub. Ltd., Oxford, UK.

Erlich, H.A.(Ed.) 1989, PCR Technology – Principles and applications for DNA Amplification, Stockton Press, New York, USA

Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology, W.H. Freeman & Company, New York, USA

Glover, D.M. and Hames, B.D.(Eds.) 1995. DNA Clonning 1 – A Practical Approach, OIRL Press, Oxford, UK

Gupta, P.K. 1996. Elements of Biotechnology, Rastogi & Co., Pub., New Pub., Meerut, India.

Hammond, J., McGarvey, P. And Yusibov, V. (Eds.) 1999. Plant Biotechnology – New Products and Applications, Springer Pub., New York, USA.

Henry, R.J. 1998. Practical Applications of Plant Molecular Biology, Chapman & Hall, London, UK

Keller, G.H. and Manak, M.M. 1993. DNA Probes, Mac Millan Pub. Ltd. UK.

Lea, P. And Leegood, R.C. 1999. Plant Biotechnology and Molecular Biology (2nd Ed.) John Wiley & Sons, Ltd., England.

Lewin, B. 2005. Genes VIII,Osford University Press, Oxford, UK

Lindsey, K. And Jones, M.G.K. 1990. Plant Biotechnology in Agriculture, Prentice Hall Int. Pub., London, UK

Malaacinski, G.M. and Freifilder, D. 1998. Essentials of Molecular Biology 3rd Ed.), Jones & Bartlett Pub., London, UK

Miesfield, R.L. 1999. Applied Molecular Genetics, Wiely Liss, New York, USA.

Nicklin,J., Graeme-Cook, K.Paget, T. And Killington, R. 1999. Instant Notes in Mircobiology, VIVA Books Pvt. Ltd., New Delhi, India

Purohit, S.S., Kothari, P.R. and Mathur, S.K. 1993. Basic and Agricultural Biotechnology, Agro Botanical Pub. Bikaner, India.

Rehm;, H.I. and Reed, S.G. (Eds.) 1995. Fundamentals of Genetic Engineering, Pallicut, London, UK.

Scragg, A. 1999. Environmental Biotechnology, Pearson Education Ltd., England, UK

Shantharam, S. And Montogomery, J.F. 1999. Biotechnology, Biosafety and Biodiversity. Oxford & IBH Pub. Pvt. Ltd., New Delhi, India.
Sheehan, D. (Ed.) 1997. Bioremediation Protocols, Humana Press, Totowa, USA
Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd Ed.) John Wiley & Sons. Inc., New York, USA
Trehan, K. 1990. Biotechnology, New Age Int. Pvt. Ltrd. New Delhi India.
Twyman, R.M. 1999. Advanced Molecular Biology, VIVA Books Pvt. Ltd., New Delhi, India.

Paper – BOT-304(a) – ADVANCED PHYCOLOGY (ELECTIVE) Credit -4 MM-80

Objectives: To acquaint the PG students with importance of Phycology (Algology) towards its contribution to the famous ***'Green Revolution'*** of the nation, thereby making India self-reliant in food grain production.

Outcome: To come out with the trained professionals having the knowledge of nutritional requirements of algae for their mass/ large scale cultivation with particular reference to ecological biodiversity of algae & algal bio-fertilizers in Haryana.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1) Limits to algal growth in natural waters.
2) Dynamics and consequences of freshwater marine & algal blooms; Causative factors for eutrophication and its impact.
3) A brief account of phycological researches in India.

Unit-II

4) Mineral nutrition in algae with emphasis on Calcium, Magnesium, Sodium, Iron, Molybdenum, & Silica.
5) Synchronous & continuous cultures and their uses; Physiology of nutrient regulated algal growth.
6) A brief account of culture techniques, media for algal growth and measurement techniques.

Unit-III

7) Algae in water supplies, on ancient monuments and bio-fouling of ships.
8) Ecological biodiversity of algae in unusual habitats with suitable examples.
9) Paddy field algal flora as N_2-economy builders of the nation.

Unit-IV

10) Physiological and biochemical aspects on algal flora exposed to heavy metals.
11) Kinetics of heavy metal uptake and its bioaccumulation.
12) Mechanisms of adaptation against tolerance to toxicants, pesticides and salt.

Suggested Readings:

1. Ahluwalia, A.S. (Ed.). *Phycology: Principles, Processes and Applications.* Daya Publishing House, New Delhi. 2003.
2. Becker, E.W. (1994): Microalgae – Biotechnology & Microbiology, Cambridge University Press, Cambridge, U.K.
3. Carr, N.G. & Whitton , B.A. (1982): The biology of Cyanobacteria Blackwell Scientific Publ., Oxford, U.K.
4. Dubey, R.C. (2006): Introduction to Biotechnology, Delhi Book Trust, New Delhi.
5. Dubey, R.C. (2014): Advanced Biotechnology, S Chand & Cmpany Pvt. Ltd., New Delhi.
6. Fatma, T. (2005): Cyanobacterial and Algal Metabolism and Environmental Biotechnology, Narosa Publihers.
7. Fay, P & C van Baalen (1987): The cyanobacteria, Elsevier Science Publishers, B.V. Amsterdam, Netherlands.
8. Graham, L.E. & Wilcox, L.W. (1999): Algae, Benjamin Cummings, USA.
9. Gupta, R.K. & Pandey, V.D. (2007): Advaces in Applied Phycology, Daya Publishing

Paper – BOT-304(b) – APPLIED MYCOLOGY (ELECTIVE) Credit -4 MM-80

Objectives: The course has been envisaged to make the students aware about the role of fungi in Industry, as biofertilizer, as biocontrol agents, and biodeteriorating agents. Besides this, the course will be helpful in acquainting the students with the various techniques of culturing and isolation of fungi from various sources, culture media and preservation of fungi**.**

Outcome: After successfully completing the course, the students will understand the role of fungi as biofertilizers, as food spoilers and in production of some industrially important products. The students will also learn the various techniques used for culturing of fungi, sterilization of media and maintenance of cultures.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Primary metabolites production by fungi: industrial alcohol, organic acid, beer.

Secondary metabolites production by fungi: Antibiotics, steroid transformation,. Enzymes, amino acids, growth regulators, vitamins

Unit-II

Fungi as biofertilizers : Endomycorrhizae and ectomycorrhizae.

Fungi as biocontrol of plant pathogens and weeds.

Biodeterioration of materials: Paper, painted surface, wood.

Unit-III

Food processing by fungi: Bread, cheese, oriental food and baker's yeast.

Fungal sources of health food: Single cell protein, edible mushrooms.

Spoilage of food and fungal toxicity.

Unit-IV

Culturing and preservation of fungi: isolation of fungi, culturing of fungi, establishing a pure culture, aseptic technique, maintenance of culture collection, culture collection and identification centres.

Common culture media and sterilization techniques.

Suggested Readings:

Alexopoulos, C.J. Mins, C.W. & Blackwell, M. (1995): Introductory Mycology, John Willy and Sons. Inc.

Bilgrami, K.SA. & Verma R.N. (1981): Physiology of fungi, Vikas Publ. Ltd., New Delhi.

Biswas, S.P. & Biswas, A. (1984): An Introduction to Viruses, Vani Education Books, New Delhi.

Butler, E.J. & Jones, S.G. (1976): Plant Pathology, Periodical Expert Book Agency, New Delhi.

Clifton, A. (1958): Introduction to the Bacteria. McGraw Hill Books Co. New York.

Dubey, R.C. (2005): A Text Book of Biotechnology, S Chand & Co. Ltd., New Delhi.

Bilgrami, K.S. & Dubey H.C. (1986): A text book of Modern Plant Pathology, Vikas, Publ. Ltd., N.Delhi.

Gupta, R. & Mukerji, K.G. (2001): Microbial Technology, APH Publ. Co., New Delhi.

Mehrotra, R.S. & Aneja, K.R. (1990): An introduction of Mycology, New Age International Press, N. Delhi.

Michael J. Pelezar, E.C.S. Chaing & N.R. Krieg, 1993: Microbiology. Tata McGraw Hill Publ. N. Delhi.

Mundukur, B.B. (1967): Fungi & Plant Diseases, Pochillion Co. Ltd., USA.

Prescott, L.M., Harley, J.P. & Klein, D.A. (1996): Microbiology, 3rd edition, Wm. C. Brown Publ., USA.

Ronald M. Atlas (1995): Principles of Microbiology. Mosby-Year Book, Inc. St. Louis, Missouri, USA.

Moore-landeckar, E.J. (1972): Fundamentals of the fungi, Prentice Hall, Eaglewood, U.K.

Sumbali, G. (2005): The Fungi, Narosa Publ. House, New Delhi.

Paper – BOT-304(c) – RESTORATION ECOLOGY (ELECTIVE) Credit -4 MM-80

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Objectives: To develop the abilities of students to critically engage with concepts and theory in Restoration ecology from interdisciplinary perspectives and at an advanced level.

Outcomes: Student will be able to embrace the implications of the basic principles of restoration ecology for the future of restoration of degraded ecosystems and their management.

Unit-I

1) Restoration-Terms and definitions, Importance of ecological restoration: strategies of Restoration-Natural recovery, active restoration, rehabilitation.
2) Restoration plan and rehabilitation measures.
3) Natural and anthropogenic disturbances: Characteristics and sources, effects on structural and functioning of terrestrial and aquatic ecosystems.

Unit-II

4) Rehabilitation of salt affected soils.
5) Prevention and mitigation of invasive species; Habitant fragmentation.
6) Ecosystem stability: Structural and functional stability.
7) Climate change mitigation and Biological carbon sequestration.

Unit-III

8) Sustainable forestry management and agroforestry.
9) Biotechnological Tools of Restoration.
10) Environmental impact and risk assessment.

Unit-IV

11) Degradation and Restoration of forest and grassland ecosystems.
12) Degradation and restoration of aquatic resources: River corridors, wetlands and lakes. Adaptive restoration of wetlands; Waste water recycling and waste management.
13) Reclamation of mining sites, Bioremediation and Phytoremediation.

Suggested Readings :

1. Botkin, D.B. and E.A. Keller (2004). Environment Science: Earth as a Living Planet, John Wiley & Sons Inc., New York.
2. Carson, Rachel . 1962. Silent spring. Boston, Houghton Mifflin
3. Manahan, S.E. 2000. Environmental Chemistry. Seventh Edition. Lewis Publishers, New York
4. Mitsch, W.J. and Jorgensen, S.E. (eds.) 1989. Ecological Engineering: An Introduction to Ecotechnology. John Wiley and Sons, New York.
5. Morgan, R.K. Environmental Impact Assessment; A methodological Perspective. Kluwer Academic Publishers, London.
6. Pierzynski, G.M., Sims, J.T. and Vance, G.F. 2000. Soils and Environmental Quality. Second Edition. CRC press, New York.
7. Singh,J.S., Singh,S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
8. Bradshaw, A.D. and Chadwick, M.J. (1980). The Restoration of Land Ecology and Reclamation f Derelict and Degraded Land Blackwell Scientific Publication, Oxford, England. 9. Pace, M.L. and Groffman, P.M. (Eds.) (1998). Success, limitations and Frontiers in Ecosystem Science, Springer Verlag, New York.
10. Packard, S. And Mutel C.F. eds. (1997). The Tall Grass Restoration Handbook, Island Press, Washington, DC.
11. Petts, G. And Calow P. Larsen, P. (1996). River Restoration a Blackwell Science, Oxford, England.
12. Urbanska, K.M. Webb, N.R. and Edwards, P.J. (1998). Restoration Ecology and Sustainable Development. (Cambridge University Press, Cambridge).
13. USEPA (2000). Principles for the Ecological Restoration of Aquatic Resources. EPA 841-F-00-003. Office of Water (4501F), United States Environmental Protection Agency, Washington, DC. 4pp.

Paper – BOT-304(d) – ADVANCED PLANT PHYSIOLOGY (ELECTIVE) Credit-4 MM-80

Objective: The course would deal with advances in plant physiology especially photosynthesis, respiration and responses of the plants to abiotic stresses.

Outcome: The students will be able to understand the physiological advances in response of plants to water, salt and temperature stress. They will also be acquainted with advances in photosynthesis and respiration.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Water stress:
Drought, its definition and quantification, water deficit and plant growth, physiological and biochemical functions, responses injury affected by drought, Adaptive strategies for drought resistance.
Osmotic adjustment, osmoprotectants.
Water logging/ oxygen deficiency and its effects on plant growth.

Unit-II

Salt and temperature stress:
Salt stress; Saline and alkaline soils, salt stress injury, mechanism of salt stress and halophytes.
Temperature stress; high temperature stress, heat shock proteins, chilling and frost injury and mechanism of tolerance.

Unit-III

Photosynthesis:
The four major complexes of thylakoids.
The path of carbon in photosynthesis (C3, C4 and CAM plants)
Rubisco, structure and its association with the mechanism of carboxylation and oxygenation of RUBP.
Effect of environmental factors on photosynthetic rates. Translocation of photosynthates and its importance in sink growth.

Unit-IV

Respiration:
Cyanide insensitive respiration: Mechanism and significance.
Comparison between normal electron transport chain and alternate oxidase pathway of respiration.
Glycolic acid metabolism and photorespiration.
Glyoxylate cycle.
Respiration in intact plants and tissues.

Suggested Readings:

Bonner, J. And Varner, J.E. (1976) Plant Biochemistry, Academic Press, New York and London (Third Edition).
Buchanan, B.B., Gruissem, w. And Jones, R.L. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
Cooper, T.G. (1977). Electrophoresis. In : The Tools of Biochemistry. John Wiley and Sons., New York.
Dey, P.M. and Harborne, J.B. (1997), First Indian edition, 2000). Plant Biochemistry. Academic Press, Harcourt Asia Pvt. Ltd.
Noggle, G.r. and Fritz, G.J. (1983). Introductory Plant Physiology. Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition (Seventh reprint, 1992).
Salisbury, F.B. and Ross, G.W. (1992). Plant Physiology. Fourth Edition, Wadsworth Publishing Co. Belmont, California, USA.
Sawhney, S.K. and Singh, Randhir. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
Solmos, T. (1977). Cyanide resistant respiration in higher plants. In : Ann. Rev. Pl. Physiol. 28: 279-297.

Paper – BOT-304(e) – Biophysical and Biochemical Techniques (ELECTIVE) Credit -4 MM-80

Objective: This paper aims to provide an introduction to various tools and techniques used to gain insight into cell structure and biological processes. The focus is on studying the techniques used for isolation, purification and characterization of biomolecules.

Outcomes: This paper is meant for students to gain in-depth knowledge of various methods used in characterization the biomolecules.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. **Microscopic techniques**: Introduction; Light microscope; Phase contrast microscope; Fluorescent microscope; Electron microscope (EM) – SEM, TEM and STEHM; Scanning probe microscopes- scanning 659itrogeni microscope and atomic force microscope; Different fixation and staining techniques.
2. **Centrifugation**: Principles of sedimentation; Types, care and safety aspects of centrifuges; Differential centrifugation; Density gradient centrifugation and their applications.

Unit-II

3. **Chromatographic techniques**: Theory of chromatography; Types of chromatography- Paper chromatography, Thin layer chromatography, Adsorption chromatography, Partition chromatography, Affinity chromatography, Ion exchange chromatography, HPLC and Size-exclusion chromatography.
4. **Spectrophotometery**: Colorimetery; UV and Visible spectrophotometery.

Unit-III

5. **Electrophoresis**: Principle; Agarose gel electrophoresis; Polyacrylamide gel electrophoresis; 2-Dimensional gel electrophoresis; Capillary electrophoresis; Microchip electrophoresis and Isoelectric focusing.
6. **Mass spectrometry:** Introduction; Theory; Mass spectrometer; Ionization of molecules; Mass analysers- MALDI; Detectors and Applications.

Unit-IV

7. **Immunotechniques**: Antibody generation; Detection of molecules using ELISA, RIA, Immunoprecipitation and Immunofluorescence microscopy; Detection of molecules in living cells.
8. **Radioisotope techniques**: Radioactive isotopes; Nature of radioactivity; Detection and measurement of different types of radioisotopes normally used in biology; Incorporation of radioisotopes in biological tissues and cells; Molecular imaging of radioactive material; Disposable of radioactive wastes and safety guidelines.

Suggested Readings:

1. Hegyi G, Kardos J, Kovacs M, Csizmadia AM, Nyitray L, Pal G, Radnai L, Remenyi A Venekei I (2013) Introduction to Practical Biochemistry, Eotvos Lorand University, Hungary.
2. Plummer DT (1990) An Introduction to Practical Biochemistry, Tata Mc-Graw-Hill Publishing Company Ltd., New Delhi.
3. Prescott L and Harley J Klein D (2005) Microbiology (6^{th} Ed) Mc Graw-Hill.
4. Ranade R and Deshmukh S (2013) Handbook of Techniques in Biotechnology, Studium Press (India) Pvt. Ltd. New Delhi.
5. Sawhney SK and *Singh R (2000)* Introductory *Practical Biochemistry (Ed.),* Narosa Publishing House Pvt. Ltd., New Delhi.
6. Wilson K and Walker J (2010) Principles and Techniques of Biochemistry and Molecular Biology (7^{th} Ed.), Cambridge University Press, New Delhi.

Paper – BOT-306 – Biodiversity and its conservation Credit -2 MM-50

Objectives: This paper is meant for students to gain in-depth knowledge of different levels, threats and distribution of Biodiversity and focus on the different approaches for biodiversity conservation.

Outcome: The student will be able to appreciate the value of biodiversity. They will also develop the skills necessary to work efficiently in areas of *in-situ* and *ex-situ* conservation.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. Biodiversity: importance, levels of biodiversity- species, genetic and ecosystem diversity, threats to biodiversity- habitat loss and fragmentation, exotic species, pollution, overexploitation, IUCN categories of threat
2. Distribution and global patterns of biodiversity
3. Biodiversity and ecosystem services
4. Terrestrial and marine hotspots of biodiversity; hotspots of biodiversity in India.

Unit-II

5. Principles and importance of conservation biology; In- situ conservation of biodiversity- Sanctuaries, national parks, biosphere reserves.
6. Ex-situ conservation of biodiversity: Principles and practices, field gene banks, seed banks and cryopreservation
7. Approaches for biodiversity conservation: tropical forests, wetlands and aquatic ecosystems
8. Major approaches to Management, Indian case studies on conservation/management strategy (Project tiger, biosphere reserves)

Suggested Readings :

Chape, S., Fish, L., Fox, P. and Spalding, M. 2003. United Nations list of protected areas. IUCN/UNEP/World Conservation Monitoring Centre, Gland, Switzerland/Cambridge

Gopal, B. (ed.) 1987. Ecology and Management of Aquatic Vegetation of the Indian Subcontinent. W. Junk bv. The Hague.

Heywood, V.(Ed.) (1995). Global Biodiversity Assessment. United Nations Environment Programme, Cambridge University Press, Cambridge, U.K.

Hunter (Jr.) M.L. (1996); Fundamentals of Conservation Biology, Blackwell Science. Meffe G.K. and C. Ronals Corroll (1994) Principles of Conservation Biology, Sinaur Associates, Inc., Sunderland. Massachusetts.

Peter H. Raven, P.H. and Berg , L. R. Berg. 2005. Environment, 5th Edition. John Wiley & Sons Inc., New York.

Singh,J.S., Singh,S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.

Soule, M.E. (ed.) (1986) : Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.

SEMESTER – IV

Paper – BOT-401 PHYSIOLOGY OF PLANT GROWTH AND DEVELOPMENT Credit-4 MM- 80

Objective: The course would deal with different aspects of plant growth and development especially germination and dormancy of seeds, plant growth regulators, senescence and abscission, photomorphogenesis and response of plant to different abiotic stresses.

Outcome: The students will be able to understand the basic concepts of plant growth and development.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Plant Growth: Growth concepts, Growth curves, Growth analysis.

Germination and Dormancy of seeds ; factors affecting dormancy and its regulation by plant growth regulators and environmental factors.

Stress Physiology: Response of plants to abiotic stresses: abiotic stress affecting plant productivity. Basic principles of crop improvement programme under stress.

Unit-II

Plant Growth Regulators: Discovery, biosynthetic pathways, transport, influence on plant growth and mechanism of action of: Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid.

Unit-III

Senescence and Abscission:

Physiological and biochemical changes associated with senescence and 661itrogenis .

Tropism: Phototropism, nature of receptors, role of hormones, Geotropism and nastism.

Unit-IV

Sensory Photobiology:

Phytochromes: mechanism of phytochrome action, photomorphogenesis and cryptochromes .

The Flowering Process:

Photoperiodism and its significance, importance of dark periods, role of vernalization.

Nature and events during flowering, florigen concept, chemical control of flowering.

Suggested Readings:

Audus, L.J. (1972). Plant Growth Substances. Vol.I Chemistry and Physiology. Leonard Hill, London.

Bonner, J. And Varner, J.E. (1976). Plant Biochemistry,IIIrd Edition, Academic Press, New York and London.

Buchanan, B.B., Gruissem, W. And Jones, R.L. (2000). Biochemstry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

Davies, Peter J. (1995). Plant Hormones: Physiology, Biochemistry and Molecular Biology. 2nd Edition. Kluwer Academic Publishers, The Netherlands.

Dey, P.M. and Harborne, J.B. (1997), First Indian Edition, Plant Biochemistry. Academic Press, Harcourt Asia Pvt.Ltd.

Garrett, R.H. and Grisham, C.M. (1999). Biochemistry. Second edition. Saunders College Publishing, Philadelphia.

Hopkins, W.G. 1995 Introduction to Plant Physiology, John Wiley and Sons.

Krishnamoorthy, H.N. (1993). Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.

Kumar, H.D. and Singh, H.N. (1993). Plant Metabolism. Second edition, Affiliated East- West Press Pvt Ltd. New Delhi.

Lehninger, A.L. (1978). Biochemistry. Kalyani Publishers, Ludhiana, India

Lehninger, A.L, Nelson, D.L. and Co MM 1993 Principles of Biochemistry Second edition, CBS Publishers.
Moore, Thomas. C. (1989). Biochemistry and Physiology of Plant Hormones. Second edition (Reprint 1994), Narosa Publishing House, New Delhi..
Noggle, G.R. and Fritz, G.J. (1983). Introductory Plant Physiology, Prentice-Hall of India Pvt. Ltd., New Delhi, Second edition Seventh reprint, 1993.
Salisbury, F.B. and Ross, C.W. (1992). Plant Physiology. Fourth edition, Wadsworth Publishing Co. Belmont, California, USA.
Singhal, G.S. Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee (editors) (1999). Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
Srivastava, L.M. (2006). Plant Growth and Development : Hormones and Environment. Academic Press. Published by Elsevier India Pvt. Ltd., New Delhi.

Taiz, L and Zeiger, E. (1998). Plant Physiology. Second edition. Sinauer Associates, Inc., Publishers, Massachusetts, USA
Trehan, K. (1990). Biochemistry. Second edition, Wiley-Eastern Ltd., New Delhi.
Trivedi, P.C. (2005). Applied Botany. Aavishkar Publishers, Distributors, Jaipur.
Trivedi, P.C. (2006). Plant Molecular Physiology: Current Scenario and Future Projections. Aavishkar Publishers, Distributors, Jaipur.
Weil, J.H. (1990). General Biochemistry. Sixth edition. Wiley-Eastern, New Age International Publishers, New Delhi.
Wilkins, M.B. (1987). Advanced Plant Physiology, ELBS, Longman, England.
Zubay, Geoffrey. (1989). Biochemistry. Mc.Millan Publishing Co. New York.

Paper – BOT-402 Biology of Reproduction and Anatomy Credit -4 MM-80

Objective: The course would deal with history of Embryology. It also describe the technique and applications of *in vitro* culture of reproductive organs.

Outcome: The students will be able to describe the structure and development of reproductive structures and the process of reproduction in plants.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit I

History of plant embryology

Male gametophyte: structure of anther, microsporogenesis, role of tapetum,

Pollen development, male sterility;

Pollen germination, pollen tube growth and guidance; pollen allergy

Unit II

Female gametophyte; ovule development, megasporogenesis;

Organization of the embryosac, structure of the embryo sac cells.

Pollination, Pollination mechanisms and vectors,

Unit III

Pollen pistil interaction and fertilization; structure of pistils; pollen-stigma interaction sporophytic and gametophytic incompatibility, double fertilization

Endosperm development, polyembryony; 663itrogen

Experimental Embryology: in vitro fertilization Anther, Pollen and embryo culture,

Unit IV

Anatomy in relation to taxonomy.

Anomalous secondary Structure: Anomalous secondary growth, anomalous position of cambium, abnormal behaviour of normal cambium, accessory cambium formation and its activity, extrastelar cambium, Interxylary and intraxylary phloe, presence of medullary bundles, cortical bundles, presence of exclusive phloem and xylem bundles, secondary growth in monocots.

Suggested Readings:

Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, New Delhi.

Shivanna, K.R. and Johri, B.M. 1985. The Angiopsrem Pollen: Structure and Function. Wiley Eastern Ltd., New Delhi.

Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge Univ. Press, Cambridge.

Johri, B.M. (ed.) Embryology of Angiosperms. Springer-Verlag, Heidelberg, Berlin,

Esau, K. 1965. Plant Anatomy. John Wiley & Sons New York.

Fahn, A. 1967.Plant Anatomy. Pergamon Press, London, New York.

Eames , A.J. and MacDaniels, L.H. 1947. An Introduction to the Plant Anatomy (2nd Ed.), McGraw Book Comp., New York.

Eames, A. J. 1961. Morphology of Angiosperms. McGraw Hill Book Company, New York

Paper – BOT-403 **Plant Tissue Culture** **Credit -4** **MM-80**

Objective: This course seeks to impart detailed knowledge of micropropagation, somatic embryogenesis, haploid production, somatic hybridization, cryopreservation and secondary metabolite production.

Outcome: The students will gain in-depth knowledge of plant cell and tissue culture techniques, *In vitro* haploid production, plant breeding, synthetic seeds and secondary metabolite production.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit I

1. History of Plant Tissue Culture, Basic concept, principles and scope of plant cell and tissue culture, concepts of cellular differentiation; Totipotency; basic techniques of plant tissue culture; callus formation, organogenesis and embryogenesis.
2. Protoplast isolation, fusion and culture, somatic hybridization, hybrid selection and regeneration. Cybrids and their application.

Unit-II

3. *In vitro* haploid production and its significance, Anther/Pollen culture and ovary culture; Embryo and ovule culture Production of triploids through endosperm culture.
4. Micropropagation: meristem culture and virus-free plants; Cryopreservation of plant cell and tissue cultures and establishment of gene banks.

Unit-III

5. Somaclonal variations and isolation of useful mutants; mechanisms and applications in genotype improvement.
6. Role of plant cell cultures in Bioreactor types and application in cell culture and secondary metabolite production.

Unit-IV

7. Somatic embryogenesis, production of synthetic seeds, importance, limitation and their utilization.
8. Application of tissue culture in forestry and agriculture; status of tissue and cell culture technology in India edible vaccines, and their prospects

Suggested Readings

1. Ammirato, P.V., D.A. Evans, N.D. Sharp and Y.P.S. Bajaj (1990). Hand Book of Plant Cell Culture, Vols. 1-5. McGraw Hill Publishing Company, New York.
2. Bhojwani, S.S. and Razadan, M.K. 1996. Plant Tissue Culture: Theory and Practice (A revised Edition), Elsevier Science Pub., New York, USA
3. Collins, H.A. and Edwards, S. 1998, Plant Cell Culture, Bios Scientific Pub., Oxford, U.K.
4. Kartha, K.K. 1985. Cryopreservation of Plant Cells and Organs, CRC Press, Boca Raton, Florida, U.S.A.
5. Razadan, M.K. 1993. An introduction to Plant Culture. Oxford & IBH Pub., Co., New Delhi, India

Paper – BOT-404(a) ADVANCED PHYCOLOGY (ELECTIVE) Credit -4 MM-80

Objectives: To impart knowledge about the wider perspectives of the ***'Nitrogen economy builders of the nation'*** in the context of fast changing industrializing Haryana as well as which has been traditionally an agricultural economy.

Outcome: To nurture and develop the trained human resources/ professionals to identify research problems, formulate testable objectives, develop appropriate methods & experimental designs, implement research projects in wider perspective of alagalization.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1) Photosynthesis and Chromatic adaptations in algae: pigments, photosynthetic membrane organization, oxygenic & anoxygenic photosynthesis.
2) Relationship of CO_2-assimilation with nitrogen assimilation: source of energy & reductants.
3. Nutrient uptake kinetics in algae.

Unit-II

4) Importance of N_2-fixing genera in Indian paddy fields for the improvement of soil fertility.
5) Heterocyst, its differentiation and role in N2-fixation.
6) Mechanism N_2-fixing fixation: 665itrogenise and its *in vivo* activity.
7) Uptake kinetics of nitrogenous compounds, their transport and assimilation.

Unit-III

8) Algal immobilization: methods and applications.
9) Technologies for the reclamation, restoration & maintenance of ***usar*** soils and its fertility.
10) Restoration of degraded ecosystems through algae. Importance of algal flora for the treatment of wastewaters (activated sludge system) for the production of useful biomass & energy-rich fuel.

Unit-IV

11) Concept of algalization and biofertilizers.
12) Strain improvement for the production of nitrogenous compounds. Biological & technical aspects of outdoor mass culture of algae.
13) A brief account of commercial potentials of algae, algal products & their uses.

Suggested Readings:

1. Ahluwalia, A.S. (Ed.). *Phycology: Principles, Processes and Applications.* Daya Publishing House, New Delhi. 2003.
2. Becker, E.W. (1994): Microalgae – Biotechnology & Microbiology, Cambridge University Press, Cambridge, U.K.
3. Carr, N.G. & Whitton , B.A. (1982): The biology of Cyanobacteria Blackwell Scientific Publ., Oxford, U.K.
4. Dubey, R.C. (2006): Introduction to Biotechnology, Delhi Book Trust, New Delhi.
5. Dubey, R.C. (2014): Advanced Biotechnology, S Chand & Cmpany Pvt. Ltd., New Delhi.
6. Fatma, T. (2005): Cyanobacterial and Algal Metabolism and Environmental Biotechnology, Narosa Publihers.
7.Fay, P & C van Baalen (1987): The cyanobacteria, Elsevier Science Publishers, B.V. Amsterdam, Netherlands.
8.Graham, L.E. & Wilcox, L.W. (1999): Algae, Benjamin Cummings, USA.

Paper – BOT-404(b) PRINCIPLES OF PLANT PATHOLOGY (ELECTIVE) Credit -4 MM-80

Objectives: The course has been conceived to equip the students with mechanism of infection of fungi, various defence mechanism employed by the plants to protect themselves against plant pathogens. Besides, the course deals with epidemiology, role of environmental factors for disease development, disease forecasting, applications of biotechnology in plant pathology and methods adopted for disease management.

Outcome: The students will understand various mechanisms involved during pathogenesis and disease epidemiology, plant disease forecasting and transmission and spread of plant pathogens. The students will learn the applications of biotechnological techniques in plant pathology after completing the course.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

How pathogens attack plants : chemical weapons of pathogens (enzymes and toxins)
How plants defend themselves against pathogens: structural defense and biochemical defense.

Unit-II

Plant disease epidemiology and plant disease forecasting: Importance of disease forecasting services, methods used in plant disease forecasting.
Management of plant pathogens: cultural, chemical and biological methods.

Unit-III

Applications of biotechnology in Plant Pathology: The use of tissue culture techniques (callus culture, apical meristem culture and protoplast fusion), Recombinant DNA technology, use of monoclonal antibodies in plant pathology.
Effect of environmental factors on disease development.

Unit-IV

Mycotoxin producing fungi during storage and major mycotoxins produced by them.
Host-pathogen interaction of population level: transmission and spread of plant pathogens.

Suggested Readings:

Agrios, G.N. (2005): Plant Pathology, Acad. Press, Inc. California.
Alexopoulos, C.J. Mins, C.W. & Blackwell, M. (1995): Introductory Mycology, John Willy and Sons. Inc.
Biswas, S.P. & Biswas, A. (1984): An Introduction to Viruses, Vani Education Books, New Delhi.
Clifton, A. (1958): Introduction to the Bacteria. McGraw Hill Books Co. New York.
Mehrotra, R.S. & Aneja, K.R. (1990): An introduction of Mycology, New Age International Press, New Delhi.
Mehrotra, R.S. and Ashok Aggarwal (2003): Plant Pathology, Tata Mc Graw Hill Publ. Ltd., New Delhi.
Michael J. Pelezar, E.C.S. Shan & N.R. Krieg (1993): Microbiology. Tata Mc Graw Hill Publ. New Delhi.
Ronald M. Atlas (1995): Principles of Microbiology. Mosby-Year Book, Inc. St. Louis, Missouri, USA.
Singh, R.S. (1990): Plant Disease, 6th Edition, Oxford, IBH Publ., New Delhi.
Sumbali, G. (2005): The Fungi, Narosa Publ. House, New Delhi.
Webster, J. (1985): Introduction of Fungi. Cambridge University, Press.

Paper – BOT-404(c) CONSERVATION BIOLOGY (ELECTIVE) Credi-4 MM-80

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Objectives: The student will be able to appreciate the value of Biodiversity and focus on the relationship between living organisms and the terrestrial, freshwater and marine environments, coupled with the interactions that results from natural and anthropogenic processes.

Outcomes: Student will develop the skills necessary to work efficiently in areas like conservation, EIA, environment management, monitoring and education and also gets an objective, scientific and realistic approach to conservation science.

Unit-1

1) Principles, characteristics and importance of conservation biology
2) Conservation values and ethics, Role of species in conservation

Unit-II

3) Global biodiversity I: Patterns and Processes
4) Global biodiversity II: Losses, Pattern of species vulnerability, Habitat fragmentation and degradation, Synergistic interactions
5) Biodiversity and ecosystem services

Unit-III

6) Biodiversity of wetlands, mangroves and coral reefs- A general account
7) Biosphere reserves and RAMSAR sites in India, The Design of Conservation Reserves
8) Major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere Reserves)

Unit-IV

9) Importance of genetic resources and conservation of crop genetic resources
10) International and National efforts to conserve biodiversity: Convention on biological diversity, CITES, Ramsar convention; National Biodiversity strategy
11) Role of remote sensing and GIS and biodiversity conservation

Suggested Readings :

Chape, S., Fish, L., Fox, P. And Spalding, M. 2003. United Nations list of protected areas. IUCN/UNEP/World Conservation Monitoring Centre, Gland, Switzerland/Cambridge

Gopal, B. (ed.) 1987. Ecology and Management of Aquatic Vegetation of the Indian Subcontinent. W. Junk bv. The Hague.

Heywood, V.(Ed.) (1995). Global Biodiversity Assessment. United Nations Environment Programme, Cambridge University Press, Cambridge, U.K.

Hunter (Jr.) M.L. (1996); Fundamentals of Conservation Biology, Blackwell Science. Meffe G.K. and C. Ronals Corroll (1994) Principles of Conservation Biology, Sinaur Associates, Inc., Sunderland. Massachusetts.

Huston, M.A. 1994. Biological Diversity: The Coexistence of Species on Changing Landscapes. Cambridge University Press, Cambridge.

Peter H. Raven, P.H. and Berg , L. R. Berg. 2005. Environment, 5th Edition. John Wiley & Sons Inc., New York.

Singh,J.S., Singh,S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.

Soule, M.E. (ed.) (1986) : Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.

Turner, M.G., Gadner,R.H. and O,Neill, R.V. 2001. Landscape Ecology: In theory and Practice, Pattern and Processes. Spinger Verlag, New York.

Paper – BOT-404(d) PLANT GROWTH REGULATORS (ELECTIVE) Credit -4 MM-80

Objective: The course would deal with the study of regulation of different growth regulators to fruit and seed physiology. The advances in senescence, abscission and mechanism of action of various phytohormones will also be studied.

Outcome: The students will be able to understand the recent advances in phytohormones, fruit and seed physiology. They will also be acquinted with advances in senescence and abscission also.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

Phytohormones
Recent advances in the biosynthesis and regulation of cytokinins and ethylene
Current scenario in the mechanism of action of gibberellins, abscisic acid, salicylic acid, jasmonic acid and brassinosteroids.

Unit-II

Seed Physiology
Seed viability and seed dormancy
Metabolism of germinating seeds.
Environmental and hormonal control of seed dormancy and germination.

Unit-III

Senescence and Abscission
Process of induction
Metabolic changes.
Role of plant growth regulators

Unit-IV

Fruit Physiology
Climacteric and non-climacteric fruits, fruit ripening.
Post-harvest storage of fruits – quality maintenance, physiological and biochemical studies under different kinds of storage conditions.

Suggested Readings:

Krishnamoorthy, H.N. (1993). Physiology of Plant Growth and Development. Atma Ram and Sons, Delhi.
Khan, A.A (1977). The Physiology and Biochemistry of Seed Dormancy and germination. North-Holland Publishing Co., Amsterdam, New Oxford.
Moore. T.C. (1989). Biochemistry and Physiology of Plant Hormones. Second edition (Reprint 1994), Narosa Publishing House, New Delhi.
Saymour, G.B., Taylor, J.E. and Tucker, G.A. (1993). Biochemistry of Fruit Ripening. Chapman and Hall, London.
Stahl, E. (1965). Thin Layer Chromatography, a laboratory handbook. Academic Press, London.
Taiz, L. And Zeiger, E. (1998). Plant Physiology. Second edition, Sinauer Associates, Inc., Publishers, Massachusetts, USA.
Wilkins, M.B. (1987). Advanced Plant Physiology. ELBS-Longman, England.
Srivastava, L.M. (2006). Plant Growth and Development : Hormones and Environment. Academic Press. Published by Elsevier India Pvt. Ltd., New Delhi.
Trivedi, P.C. (2005). Applied Botany. Aavishkar Publishers, Distributors, Jaipur.

Paper – BOT-404(e) GENOMICS (ELECTIVE) Credit -4 MM-80

Objective: This course seeks to impart detailed knowledge of basic methods involved in genome studies, their organization and function.

Outcomes: This paper would provide students an understanding about how the genetic information is stored in the genome and the mechanisms by which this information is used by the organism. They are also expected to know about the various databases used for storage and analysis of genome information.

Note: Nine questions will be set in all. Question No.1 will be compulsory covering the entire syllabus. The remaining eight questions will be set with two questions from each Unit. The candidate will be required to attempt one question from each unit. All questions will be of equal marks.

Unit-I

1. **Genome**: Completely sequenced prokaryotic (T_4, and λ phages; *E. coli*) and eukaryotic genomes (*Saccharomyces cerevisiae, Caenorhabditis elegans, Drosophila melanogaster, Arabidopsis thaliana, Oryza sativa, Mus musculus* and *Homo sapiens*); Mitochondrial and Chloroplast genomes.
2. **Mapping of Genome**: Genetic mapping- using DNA markers and Linkage analysis; Physical mapping- restriction mapping, Fluorescent *in-situ* hybridization and Sequence Tagged Sites (STSs) mapping.

Unit-II

3. **Genome sequencing**: Chain termination and chemical degradation methods; Next generation sequencing (NGS)- Pyrosequencing, SOLiD sequencing, Bridge amplification sequencing, Assembly of a contiguous DNA sequence- shotgun and clone contig methods, Human Genome Project.
4. **Understanding a Genome Sequence**: Gene location using 1.) ORF scanning, Automatic annotation, Homology searches and comparative genomics. 2.) Experimental techniques- northern hybridization, cDNA sequencing and RACE.

Unit-III

5. **Identification of a Gene Function**: Using computer analysis; Experimental analysis- gene inactivation and overexpression; Directed mutagenePsis; Reporter genes and Immunocytochemistry.
6. **Analysis of the Transcriptome**: Expressed Sequence Tags (ESTs); Serial analysis of gene expression (SAGE); Differential Display (DD); Representational Difference Analysis (RDA) and DNA Microarrays.
7. **Proteome Analysis:** Using 2-D; Protein identification; Protein-DNA and Protein- Protein interactions and Biochips.

Unit-IV

8. **Biological Databases**: Introduction; Primary and Specialized Databases; Database Scheme; Database Annotation; Retrieval System; Nucleotide Databases; Protein Databases; Genomic Databases and Resources; Gene Databases and Resources; Transcriptome Databases; Mutation Databases; Mitochondrial Databases and Resources.
9. **Computational Methods for Analysis of Genome Sequence Data**: Introduction; Dot-Plot Matrix; Sequence pairwise alignment; Database searching; Multiple alignment; Alignment profiles to recognize distantly related protein or protein modules; Methods for sequence assembly; Linguistic analysis of biosequences; Prediction of RNA secondary structures; Protein sequence analysis; Evolutionary and phylogenetic analysis.

Suggested Readings:

1. Birren B, Green ED, Klapholz S, Myers RM and Roskams J (1997) Genome Analysis, CSHL Press.
2. Brown TA (1999) Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.
3. Brown TA (2002) Genomes 2, Wiley-Liss, New York
4. Brown TA (2007) Genomes 3, Garland Science Publishing New York, London.
5. Chawla HS (2009) Introduction to Plant Biotechnology (3rd Ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Dale JW, Schantz MV and Plant N (2012) From Genes to Genomes (3rd Ed.), John Wiley and Sons, Ltd. UK.
7. Dawson, MT, Powell R and L Gannon F (1996) Gene Technology, BIOS Sci. Pub. Ltd., Oxford, UK. DNA Amplification, Stockton Press, New York, USA.
8. Glick B and Pasternak JJ (2003), Molecular Biotechnology (^{3rd} Ed), ASM Press, Washington.
9. Hartl DL and Ruvolo M (2011) Genetics- Analysis of Genes and Genomes (8th Ed.), Jones and Bartlett Publishers, Inc., USA.
10. Hunt SP and Livesey FJ (2000) Functional Genomics, Oxford University Press, New York. London.

11. Lewin B (2005) Genes VIII, Oxford University Press, Oxford, UK
12. Li WH (1997) Molecular Evolution, Sinauer Associates, Inc., USA.
13. Saccone C and Pesole G (2003), Handbook of Comparative Genomics, John Wiley and Sons, Inc., Hoboken, New Jersey.
14. Sambamurty AVSS (2007) Molecular Genetics, Narosa Publishing House Pvt. Ltd., New Delhi.
15. Singer M and Berg P (1991) Genes and Genomes: A Changing Perspective; University Science Books, CA, USA.

DEPARTMENT OF GEOPHYSICS KURUKSHETRA UNIVERSITY KURUKSHETRA

SCHEME OF EXAMINATION, TEACHING LOAD AND SYLLABUS OF
M.Sc. (Tech) Applied Geophysics.

FIRST SEMESTER EFFECTIVE FROM THE SESSION 2019-20:

S.No.	Course no.& Course	Teaching Load (hrs/week/group) L	T	P	Marks Distribution Th/P	CW	Total	Credit
1.	GP-101: Mathematical Methods in Geophysics	4	½	0	60	40	100	4
2.	GP-102: Solid Earth Geophysics	4	½	0	60	40	100	4
3.	GP-103: Numerical Methods & Computer Programming	4	½	0	60	40	100	4
4.	GP-104: Basic Geology	4	½	0	60	40	100	4
5.	GP-105: Geology Lab	0	0	12	90	60	150	6
6.	GP-106: Computer Lab	0	0	12	90	60	150	6
	Semester Total	16	2	24			700	28

SECOND SEMESTER EFFECTIVE FROM THE SESSION 2019-20:

S.No.	Course no.& Course	Teaching Load (hrs/week/group) L	T	P	Marks Distribution Th/P	CW	Total	Credit
1.	GP-201: Remote Sensing & GIS	4	½	0	60	40	100	4
2.	GP-202: Stratigraphy, Himalayan, Economic & Petroleum Geology	4	½	0	60	40	100	4
3.	GP-203: Geophysical Signal Processing	4	½	0	60	40	100	4
4.	GP-204: Geophysical Fields & Waves	4	½	0	60	40	100	4
5.	GP-205: Geophysical Lab - I	0	0	12	90	60	150	6
6.	GP-206: Geophysical Lab - II	0	0	12	90	60	150	6
7.	GP-207: Geological Field Training			4 hrs/week*			100	4
8.	OEL-I Open Elective paper/MOOC	2	0	0			50	2
	Semester Total	18	2	24			850	34

THIRD SEMESTER EFFECTIVE FROM THE SESSION 2019-20:

S.No.	Course no.& Course	Teaching Load (hrs/week/group)			Marks Distribution			
		L	T	P	Th/P	CW	Total	Credit
1.	GP-301: Seismology	4	½	0	60	40	100	4
2.	GP-302: Gravity & Magnetic Prospecting	4	½	0	60	40	100	4
3.	GP-303: Groundwater Geophysics	4	½	0	60	40	100	4
4.	GP-304: Electrical Prospecting	4	½	0	60	40	100	4
5.	GP-305: Geophysical Lab-III	0	0	12	90	60	150	6
6.	GP-306: Geophysical Lab-IV	0	0	12	90	60	150	6
7.	OEL-II: Open Elective paper/MOOC	2					50	2
	Semester Total	18	2	24			750	30

FOURTH SEMESTER EFFECTIVE FROM THE SESSION 2019-20:

S.No.	Course no.& Course	Teaching Load (hrs/week/group)			Marks Distribution			
		L	T	P	Th/P	CW	Total	Credit
1.	GP-401: Petrophysics & Well Logging	4	½	0	60	40	100	4
2.	GP-402: Physical Oceanography & Marine Geophysics	4	½	0	60	40	100	4
3.	GP-403: Seismic Prospecting	4	½	0	60	40	100	4
4.	GP-404: Geophysical Inversion	4	½	0	60	40	100	4
5.	GP-405: Geophysical Lab – V	0	0	12	90	60	150	6
6.	GP-406: Geophysical Lab - VI	0	0	12	90	60	150	6
7.	GP-407: Geophysical Field Training-I	4 hrs/week*					100	4
	Semester Total	16	2	24			800	32

FIFTH SEMESTER EFFECTIVE FROM THE SESSION 2019-20:

S.No.	Course no.& Course	Teaching Load (hrs/week/group) L	T	P	Marks Distribution Th/P	CW	Total	Credit
1.	GP-501: Near Surface Geophysics	4	½	0	60	40	100	4
2.	GP-502: Electromagnetic and Magenotelluric Methods	4	½	0	60	40	100	4
3.	GP-503: Geophysical Lab-VII	0	0	12	90	60	150	6
4.	GP-504: Geophysical Lab-VIII	0	0	12	90	60	150	6
5.	GP- Elective – I	4	½	0	60	40	100	4
6.	GP- Elective – II	4	½	0	60	40	100	4
	Semester Total	16	2	24			700	28

SIXTH SEMESTER EFFECTIVE FROM THE SESSION 2019-20:

S.No.	Course no.& Course		Marks Distribution Th/P	CW	Total	Credit
1.	GP-601: Dissertation	4 hrs/week*			400	16
2.	GP- 602: Comprehensive Viva-Voce				100	4
3.	GP- 603: Seminar	4 hr/week			100	4
4.	GP- 604: Geophysical Field Training-II	4 hrs/week*			100	4
	Semester Total				700	28

*Credited to the teacher(s) associated with Field training/dissertation work/seminar of the students

Elective – I   Solid Earth

GP-506 : Computational Seismology
GP-507: Geomagnetism
GP-508: Whole Earth Dynamics
GP-509: Solid Mechanics
GP-510: Numerical Simulation of Earth System
GP-511: Non-linear Geophysics

Elective – II

GP-512: Geotomography
GP-513: Seismic Data Analysis & Reservoir Geophysics
GP-514: Reservoir Modelling
GP-515: Radiometric Exploration
GP-516: Advanced Remote Sensing & Image Processing
GP-517: Artificial Intelligence and Machine Learning in Geophysics

GP-101: Mathematical Methods in Geophysics

Max. Marks: 60
Credits: 4 Time: 3 hours

Objective: The main objective of this course is acquiring information on different mathematical concepts applied to solve the geophysical problems.

Output: The course will enhance the knowledge of students on different mathematical tools that will useful in their further studies in geophysics.

Special Notes:
Nine questions will be set and students will attempt five questions. Question no. 1 will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. 1, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT-I: Special Functions
Power series method to solve partial differential equations Legendre Function: Legendre differential equation and its solution, recurrence relation, Legendre functions, Rodrigue's formula, Associated Legendre functions and its recurrence relations and orthogonality property Bessel Functions: Bessel differential equation and its first and second solutions, Bessel functions, Recurrence relations, Orthogonality, Modified Bessel function, Spherical Bessel functions Applications of Legendre and Bessel functions in Geophysics

UNIT-II: Complex Variables
Complex variable, limit, continuity and differentiability of function of complex variables, analytic functions, Cauchy Reimann's equations, Cauchy's integral theorem, Morera's theorem, Cauchy integral formula, Expansion by Taylors and Laurents series, singularities, Residue theorem, contour integration Applications in Geophysics

Unit-III: Integral Transforms
Fourier series, evaluation of coefficients of Fourier series, sine and cosine series, complex form of Fourier series, Dirichlet condition, integration and differentiation of Fourier series, Parseval theorem for Fourier series, Fourier sine and cosine integral Concept of integral transform, Laplace Transform (L.T): definition, properties, L.T. of periodic function, multiplication and division with L.T., L.T. of error function, L.T. of Bessel function, Inverse Laplace Transform. Fourier transform (F.T.): Definition, properties, Parseval theorem for F.T., Modulation, Conjugate and Convolution Theorem, Derivative of F.T., Inverse Fourier transform, application of Fourier transform in solving differential equations. Applications in Geophysics

Unit-IV: Partial Differential Equations (P.D.E.)
Solution by separation of variables of
(a) Wave equation: Transverse vibrations of a stretched string; Oscillations of a hanging chain, vibrations of rectangular and circular membrances, tidal waves in a canal.
(b) Laplace's equation: Laplace equation in Cartesian, Cylindrical and spherical coordinate systems, two dimensional steady flow of heat, General cylindrical and spherical harmonics.
(c) Diffusion equation: Variable linear heat flow, periodic heat flow in one dimension, two dimensional heat conduction.

RECOMMENDED BOOKS
(1) Applied Mathematics for Engineers and Physicists by L .Pipes & L.R. Horwell
(2) Mathematical Methods for Physicists by G. Arfken
(3) Mathematical Physics by B.S. Rajput
(4)Elementary Applied Partial Differential Equations: With Fourier series and Boundary Value Problems by Richard Haberman
(5) Integral Transforms by I. Sneddon
(6) Elements of Partial Differential Equations by I. Sneddon

GP-102: Solid Earth Geophysics

Credits: 4

Max. Marks: 60
Time: 3 hours

Objective: To provide basic knowledge about the origin & evolution of the Earth, its internal & external dynamics and study of potential fields developed in the earth.

Output: The course will develop concepts to analyze scientific and societal problems from a geoscientific perspective. The course provides a strong background in geoscience for further studies.

Special Notes:
Nine questions will be set and students will attempt five questions. Question no. 1 will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. 1, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT-I
A brief history of the development of Earth Sciences and of Geophysics in particular, an overview of Geophysical methods and their essential features, Problems of inversion and non-uniqueness in Geophysics, Origin & evolution of Solar system, Earth and Moon structure, Kepler's law of planetary motion, A review of the Earth's structure and composition

UNIT-II
Chemical composition of Earth, Rheological behaviour of crust and upper mantle, viscoelasticity and rock failure criteria, Geochronology: Radiometric dating and their advantages, meaning of radiometric ages, Major features of the Earth's gravitational field and relationship with tectonic processes in the crust and upper mantle, concept of isostasy, mathematical concept of Airy and Pratt hypotheses of isostasy.

UNIT-III
Origin of geomagnetic field, polar wandering, secular variations and westward drift, reversals of geomagnetic field, sun spot, solar flares, geomagnetic storms, sea-floor spreading, Paleomagnetism and its uses, Thermal history of the Earth, sources of heat generation and temperature distribution inside the earth, convection in the mantle.

UNIT-IV
Earthquake seismology, Earthquakes and its classifications, Global seismicity and tectonics, Earth's internal structure derived from seismology, Earthquake mechanism and Anderson's theory of faulting, Continental drift and plate tectonics: its historical perspective and essential features, present day plate motions, Triple junctions, oceanic ridges, Benioff zones, trenches and island arcs, hot spots, Mantle Plume, Mountain building, origin of Himalaya, Geodynamics of Indian subcontinent.

RECOMMENDED BOOKS:
(1) The Solid Earth by C.M.R. Fowler
(2) Understanding the Earth by I.G. Guass, P.S. Smith and R.G.L. Wilson
(3) The dynamic Earth by P.J. Wyllie
(4) Introduction to Geophysics by B.F. Howell
(5) Physics and Geology by J.J. Jacobs, R.D. Russel and J.T. Klilson
(6) Fundamental of Geodynamics by A.E. Schieddeggar
(7) Fundamentals of Geophysics by W. Lowrie

GP-103: NUMERICAL METHODS AND COMPUTER PROGRAMMING

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the basics and concepts of FORTRAN, C and C++, Learn how to build computer programs.
Outcome: The students are expected to get acquainted with the computer based problems and will be able to make computer codes to solve a problem.

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT-I
Introduction- Computer organization, Functional Units, basic I/O devices and storage media, computer software, computer languages, Problem Solving Approaches: Notion of an algorithm, stepwise methodology of developing algorithm, flowchart and computer program, introduction to computer operating systems: DOS, WINDOWS, UNIX/LINUX, brief introduction about MATLAB.

UNIT-II
Introduction to FORTRAN, constants, variables, data types, operations and intrinsic function, expression and assignments statements, Logical operators and Logical expressions, iterative statements, input/output statements, subroutine and functions, data sharing among subprograms/programs, Arrays, operations with files, programming examples to handle problems of numerical and statistical type.

UNIT-III
Programming language C: constants, variables, data types, expressions, operators, conditional statements, iterative statements, array, function, simple programming examples.
C^{++} An object oriented language: Concepts of class, object, constructors, destructors, operator overloading, inheritance, pointers, virtual functions, simple programming examples

UNIT-IV
Numerical integration by Simpson's method, Trapezoidal method, Numerical differentiation, solution of algebraic equation, Netwon Raphson method, solution of simultaneous linear equations, Gauss method, Gauss-Jordon method, Gauss-Seidel method, matrix inversion, least square curve fitting, straight line and polynomial fits, solution of ordinary differential equations.
A brief introduction of Binomial, Poisson and normal distributions, concept of mathematical expectations

RECOMMENDED BOOKS
(1) Fundamentals of computers by V. Rajaraman
(2) FORTRAN 77 and Numerical methods by C. Xavier
(3) FORTRAN Programming and Numerical methods by R.C. Desai
(4) Let us C by Yashwant Kanetkar
(5) Object Oriented programming with C^{++} by E. Balagurusamy
(6) Advanced UNIX- A Programmers guide by Stephen Prata

GP-104: BASIC GEOLOGY

Objective: To give a concise knowledge of mineralogy, petrology, processes on the surface of the earth, landforms and structural geology.

Output: 1. Proficiency in geology
2. Can understand and apply basic principles of geology to understand Earth Science

Max. Marks: 60
Credits : 4 Time: 3 hours

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT – I: INTRODUCTION
Introduction to geology, scope, sub-disciplines and relationships with other branches of science, Geomorphological Processes: Exogenic processes (weathering, erosive and tectonic denudation), Geologic time and age of the Earth, Geological processes by river, wind, glacier and waves and tides. Orogeny, volcanism, earthquakes and land slides

UNIT – II: MINERALOGY
Mineral – its definition and mode of occurrence, physical properties of minerals like form, colour, lustre, streak, cleavage, fracture, hardness and specific gravity, radioactivity, isotopes and ions, Physical characters and chemical composition of the rock forming minerals, mode of occurrence and economic uses of some important rock forming minerals.

UNIT – III: PETROLOGY
Rock- its definition, classification and distinguishing characteristics of Igneous, Sedimentary and Metamorphic rocks. Igneous rocks: Magma and lava, extrusive and intrusive forms, textures; Classification and description of some common igneous rocks (Granite, Dolerite, Basalt, Rhyolite, Pegmatite). Sedimentary rocks: Sedimentation processes; Classification and description of some common sedimentary rocks (Conglomerate, Sandstone, Shale, Limestone). Metamorphic rocks: Processes of metamorphism, textures and structures of metamorphic rocks; Classification and description of some common metamorphic rocks (Slate, Schist, Gneiss, Quartzite, Marble). Indian distribution of major rock types.

UNIT – IV: STRUCTURAL GEOLOGY
Primary and secondary structures of rock, Dip, strike, bearing and azimuth, Outcrops, outliers and inliers, Folds: definition and classification scheme, mechanism of folding, recognisation of folds in the field. Fault: definition and different terminology of fault, mechanism of faulting, recognisation of fault in the field, shear zone, lineament. Joints: definition, types of joint. Unconformity: concepts, types, recognisation and significance of unconformities. Clinometer compass and its use.

RECOMMENDED BOOKS:
(1) Rutley's Elements of Mineralogy By H.H. Read
(2) Structural Geology by M.P. Billings
(3) Principles of Physical Geology by A.H. Holmes
(4) A Text Book of Geology by P.K. Mukherjee
(5) The Principles of Petrology by G.W. Tyrrell
(6) Manual of Field Geology by R.R Compton

GP-105: GEOLOGY LAB

Credits : 6

Max. Marks: 60
Time: 4 hours

Objective: 1. To develop practical knowledge of minerals, rocks, landforms,
2.To know the use of toposheet, bruntone/clinometer in geology
3. To construct cross section across of area of different geological and structural setting.

Output: The lab work will develop field knowledge to geological problems.

1. Continental scale land forms of India
2. Physical properties of important rock forming minerals
3. Megascopic study and identification of important igneous, sedimentary and metamorphic rocks
4. Study of Toposheets
5. Uses of bruntone/clinometer and measurement of dip and strike of beds
6. Study of geological map and construction of cross section of area comprising of horizontal, unconformable, inclined, folded and faulted rocks.

GP-106: COMPUTER LAB

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To develop programming skiils.
Outcome: The students will learn to make computer programs of various methods.

(1) Exposure to computer operating system : DOS, WINDOWS, UNIX/LINUX

(2) Simple exercises based on available computer softwares

(3) Programming exercises on computational problems and their solution on computers. These include the following:

(i) Matrix operations

(ii) Matrix inversion

(iii) Numerical integration

(iv) Solution of simultaneous equations

(v) Linear curve fitting

(vi) Correlation coefficient, standard deviation etc.

(vii) Numerical differentiation

(viii) Solution of differential equation

(ix) Solution of transcendental and algebraic equation using Newton Raphson method

GP-201: Remote Sensing and GIS

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the basic concepts of remote sensing & GIS, mainly the applications of remote sensing & GIS inground water assessment.

Outcomes: The students are expected to get knowledge about the different tools of remote sensing and GIS.

Special Notes:
(i) Nine questions will be set and the students will attempt five questions. Question No.1 will be compulsory and based on the conceptual aspects of the whole syllabus. It can have five to ten parts. Answers should not be in yes/no. In addition to question No. 1, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit I
Definition, Principle and Physical basis of Remote Sensing, Electromagnetic (EM) Spectrum, Interaction of EM radiations with earth's surface and atmosphere, Atmospheric Windows, spectral signatures, remote sensing platforms, Concept of Photogrammetry, aerial photographs, types of aerial photographs, Information recorded on aerial photographs, stereoscopy, stereoscopic parallax, measurement of height difference, vertical exaggeration, elements of photo-interpretation, geotechnical elements, photo-characteristics of different rock types, photo-mosaic, image distortion and rectification.

Unit II
Remote Sensing Sensors: active and passive sensors, Satellite Imagery: Imagery vis a vis aerial photograph, MSS, LISS, CCD, Infrared and thermal scanners, IRS, SPOT and LANDSAT satellite programmes, microwave remote sensing: RADAR, LIDAR etc, remote sensing data products, resolutions in remote sensing, multispectral, super-spectral and hyper-spectral remote sensing, fundamentals of image interpretations and analysis, visual interpretation of remote sensing data; colour composites, concept of digital image and pixels, image restoration, image enhancement and information extraction, supervised and unsupervised classification; accuracy assessment in remote sensing

Unit III
Introduction to Geographical Information System (GIS), components of GIS, functions of GIS, data structures, Concept of raster and vector data, digitization, editing, attribute attachment etc, creation of thematic layers, Data Integration, vector to raster conversion and vice–versa. Introduction to Global Position System (GPS), various segments of GPS, Uses of GPS, GNSS.

Unit IV
Applications of Remote Sensing and GIS: image interpretation for identification of different rock types, structures, lineaments and preparation of geological map; recognition of landforms and preparation of geomorphological map; drainage pattern and its significance; ground water prospects mapping, integrated ground water resources (IGWR) mapping, landslide hazard zonation, route alignment for road/ canal, Hydrocarbon and minerals exploration, Disaster management (flood and cyclones)

Recommended Books:

1. Remote Sensing Geology (Springer Verlag). R.P. Gupta
2. Remote Sensing in Geology (John Wiley & sons). B.S. Siegel and A.R. Gillespie
3. Remote Sensing and image interpretation (John Wiley & sons). T.M. Lillesand and R.W. Kiefer
4. Remote Sensing Principles and interpretation (WH Freeman Company. F.F. Reeds
5. Remote Sensing fro Earth Resources (AEG publication), D.P. Rao
6. Principles of Remote sensing (ELBS London). P. J. Kuran
7. Advances in Geophysics Vol. 1 and 13 (Academic press) H.E. Landesberg
8. Handbook of Information issued by GSI (Airborne Mineral surveys and exploration wing), AEC (Atomic Minerals Divisions) and NGRI.
9. Principles of GIS, P. A. Burrough
10. Indian Society of GeomaticsNews letters 2004-2005
11. GPS: Theory and Practice (Springer Verlag). B. Hofman-wellenhof, H.lichtenegger and J.Collins

GP-202 STRATIGRAPHY, HIMALAYAN, ECONOMIC AND PETROLEUM GEOLOGY

Max. Marks: 60
Credits : 4 Time: 3 hours

Objective: To give a concise knowledge of stratigraphy, economic geology and fuel geology.

Output: 1. Proficiency in geology
2. Can understand and apply basic principles of geology to understand Earth Science

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit-1 Stratigraphy: Principles of stratigraphy, elements of stratigraphic classification, physical and structural sub-disciplines of Indian subcontinent and their characteristics, An outline of the geology of India with respect to distribution, classification, lithology and economic importance of the following: Archean, Dharwar, Cuddapah, Vindhyan, Gondawana.

Unit-2: Himalayan Tectonics and Exhumation: Tectonic divisions of the Himalaya and its evolution based on plate tectonics, Topographic growth: uplift, Isostasy and flexure, Tectonic-climate interactions, Principle and application of thermochronology to orogenic belt, Mountain belt exhumation with special reference to the Himalaya.

Unit-3. Economic Geology: Definition of ore, Ore and gangue mineral, Classification of ore deposits, Elementary ideas of the following processes of formation of ore deposits: Magmatic concentration, Pegmatitic, Sedimentation, Evaporation, Residual concentration, Mechanical concentration and Metamorphism, Chemical composition, Diagnostic characters, Occurrences, Uses and Distribution in India of important metallic and non-metallic mineral deposits.

Unit-4 Petroleum Geology
Petroleum; Origin of petroleum; Sedimentary environments and facies; The sources; Migration; The reservoir rocks; Traps and Seals; Classfication of Indian basins and petroleum geology of Assam, Krishna-Godavari, Cambay and Bombay offshore basins. Unconventional Source of energy: Shale gas; Coal Bed Methane; Gas hydrates.

Suggested Books
1. Economic Geology: Bateman
2. India's Mineral Resources: Krishna Swami
3. Introduction to India's Economic Minerals
4. Geology of India and Burma: Krishnan
5. Geology of India: Wadia
6. Geology of Petroleum: Leverson, A.I.
7. Petroleum Geology: Chapman, R.E.
8. Aspects of Tectonics: K.S. Valdiya
9. Dynamic Himalaya: K.S. Valdiya

GP-203: Geophysical Signal Processing

Credits : 4 Max. Marks 60
Time 3 Hrs

Objective: To impart the knowledge about the various tools used the processing of geophysical data.
Output: The students are expected to get acquainted with the tools of signal processing used for geo exploration.
Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT I: Signal and System
Signals: Various special signal and classification of signals, orthogonal function, band limited signals, sampling theorem, aliasing effect of sampling on reconstruction of continuous signal from their samples, extrapolation of band limited signals
Systems: Classification of Systems, Linear time invariant causal and stable system with continuous and discrete input, minimum phase signals, Hilbert transform

UNIT II: Discrete Transform
Z transform, properties of Z transform, and the region of convergence, Z transform of causal and non causal sequence, inverse Z transform, Transfer function, Solutions of difference equation using Z-transform, Relation between S-plane and Z-plane
Review of Fourier Transform, Introduction to wavelet transform and Walsh transform and their application in geophysics
Discrete Fourier transform (DFT), relation between DFT and Z transform, Fast Fourier Transform (FFT), Decimation in time(DIT) and Decimation in frequency (DIF) algorithms, applications of FFT in geophysics, deconvolution, circular convolution, Importance of Windowing, Commonly used windows, cepstral analysis

UNIT III: Time series analysis
Introduction of stochastic process, autocorrelation and cross correlation, Stationarity, Wide sense stationarity, ergodicity, power spectral density function, Wiener Khinchine theorem, White Gaussian Noise, Wiener Filtering, Matched Filtering

UNIT IV: Filters and System Realization
Recursive and non-resursive filters, ideal and realizable low pass, band pass and high pass filters, Gibbs phenomenon, IIR filters: design if IIR filter by Bilinear transformation method, Design of Butterworth filters, Characteristics of Chebyshev and elliptic filters, Design of FIR filters using windows.
direct and canonical realization scheme, Cascade and paraellel realization scheme.

Reccomended Books

1. Signal and Systems, M.L. Meade and C.R.Dillon , Chapman and Hall London
2. Digital Signal Processing, 1975, Oppenheim, A.V. and R.W. Schafer, Prentice Hall, Englewood Cliffs, New Jersey
3. An Introduction to Statistical Communication Theory, J. B. Thomas, John Wiley, New York
4. Spectral Analysis in Geophysics, 1974, Markus Bath, Elsevier, Amsterdam
5. Signal Analysis, 1977, A. Popoulis, McGraw Hill New York

6. The Fourier Integral and its applications, A. Popoullis, , McGraw Hill New York
7. Time Sequence Analysis in Geophysics, 1975, E.R. Kanscwich
8. Digital Signal Processing, A Anand Kumar PHI Learning, New Delhi

GP-204: Geophysical Fields and Waves

Credits : 4

Max. Marks 60
Time 3 Hrs

Objective: To teach the various laws related to different geophysical fields and to impart the basic knowledge of wave theory and oceanography.

Outcome: The students are expected to learn about different geophysical fields, wave theory and basics of oceanography.

Special Notes:

Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT – I: Potential Field Theory:

Introduction to Geophysical fields; Inverse square law of field: Gravity, Magnetostatic and electrostatic, Green's theorem and Green's functions, Potential due to an arbitrary source distribution, continuation of potential fields, Dirichlet and Neumann problems.

UNIT-II: Thermal Conduction in Earth

Heat conduction equation; effect of advection; time scale of conductive heat flow;calculation of simple geotherms in continents; Geological applications of heat conduction in semi-infinite half space: (i) penetration of external heat into the earth due to periodic variation of surface temperature, (ii) instantaneous heating or cooling of semi-infinite half space and its application to cooling of oceanic lithosphere and (iii) thermal and subsidence history of sedimentary basins, Age of Earth on the basis of cooling.

UNIT-III: Wave Theory

Introductory remarks about seismic and electromagnetic waves, Elastic Waves: Analysis of stress and strain, properties of equilibrium and motion in terms of stresses/displacements for infinitesimal and finite deformation, Generlised Hook's Law, Isotropy, Aelotropy and Anelasticity.

Electromagnetic Waves: Maxwell's equations, constitutive relations, Plane electromagnetic waves in dielectric and conductor.

Kirchoff's integral theorem and Kirchoff's solution of diffraction at a slit.

UNIT-IV: Oceanography

Tidal Waves, driven tidal waves, seiches, geostrophic effect on tidal waves, internal tidal waves, surface waves, permanent waves, waves due to local disturbances, equilibrium theory of tides, dynamic theory of tides.

Books Reccomended

(1) Geodynamics applications of continuum Physics to geological problems : Turcotte & Schubert
(2) Interpretation theory in Applied Geophysics: F.S. Grant & G.F. West
(3) Electromagnetic theory: J. Stratton
(4) Heat conduction: I.R. Ingersoll
(5) Solid Earth: C.F. Fowler
(6) Fundamentals of Geophysics: W. Lowrie
(7) Introduction to theoretical Geophysics: C.B. Officer

GP-205: Geophysical Lab-I

Credits : 6

Max. Marks: 60
Time: 3 hours

Section – A

Objective: To develop practical knowledge of ores, oil reserve of India and structure contour map. To impart the practical knowledge about use of satellite image, digital image processing, preparation of different types of maps including land cover map, hydrogeomorphology map etc.

Output: The lab work will develop field knowledge about the different types of maps.

1. Study of rocks from different stratigraphic horizons of peninsular India
2. Study of rocks of different tectonic divisions of the Himalaya
3. Exercise based upon thermochronological data
4. Megascopic study of major ore minerals
5. Calculation of Oil reserves
6. Study of Geological maps and sections of important oil fields of India
7. Exercises on structure contour map

Section – B

1. Preparation of base maps
2. Use of satellite image for identification of linear features.
3. Preparation of land use land cover map
4. Preparation of drainage map
5. Preparation of Geomorphology map
6. Preparation Hydrogeomorphology map
7. Simple exercises on digital image processing

GP-206: Geophysical Lab-II

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To give practical exposure to the students about the various tools of digital signal processing.
Output : The students are expected to get acquainted with the practical applications of tools of DSP used in the interpretation of geophysical data.

Exercises based on

(i) Convolution model in the time & frequency domain

(ii) Computation of FFT

(iii) Autocorrelation & Cross correlation

(iv) Inverse filtering

(v) Deconvolution using Z-transform

(vi) Predictive Deconvolution filter

(vii) Exposure to basic signal processing softwares like PITSA & MATLAB

GP-301: Seismology

Credits : 4 Max. Marks 60
Time 3 Hrs

Objective: To impart the knowledge about the basic components of seismology including wave propagation, earthquake source process, source parameters, seismic zoning etc.
Output: The students are expected to get the knowledge of different aspects of seismology.

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT – I: SEISMIC WAVE PROPAGATION
Review of basic concepts and relations in elasticity theory, Hook's Law, reflection and transmission of elastic waves at a plane boundary, plane waves, laws of simple reflection and refraction, head waves, total internal reflection, spherical waves, surface and interface waves, Rayleigh waves, Stoneley waves, love waves, dispersion curves, Free oscillations of the earth, toroidal and spheroidal oscillations, normal modes of a homogeneous sphere.

UNIT – II: EARTH STRUCTURE AND LOCATION
Travel time table: the ray parameter and seismic rays, time distance curves for local and teleseismic events, Inversion of travel times for earth's structure, the method of Herglotz and Wichert, Preliminary location of earthquakes, refining the locations, review of various types of field observations, salient features of seismograms with description of different seismic phases.

UNIT-III: EARTHQUAKE SOURCE PROCESS
Uniqueness and reciprocal theorems, Green's tensor for a uniform medium, mathematical models of earthquake source, radiation pattern for P & S waves from a shear fault, the fault plane solutions.

UNIT – IV: EARTHQUAKE PARAMETERS AND SEISMIC ZONING
Earthquake parameters: Intensity and magnitude scales, seismic moment, relation between parameters, scaling laws, seismic zoning, seismicity, induced seismicity, earthquake prediction, discrimination between earthquakes and explosions. Earthquake Early Warning System.

Recommended Books:
(1) Elementary Seismology: C.F. Richter
(2) Introduction to theory of seismology : K.E. Bullen
(3) Seismology and Plate Tectonics: David Gubbins
(4) Seismic waves and Sources: A. Ben-Menham & S.J. Singh
(5) Modern Global Seismology: Lay & Wallace
(6) Seismology: Shearer

GP-302: Gravity & Magnetic Prospecting

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the basic concepts of gravity & magnetic, instruments used, importance and applications of gravity and magnetic methods in geophysical exploration.
Outcome: The students are expected to get acquainted with the tools of gravity and magnetic including instruments used for geo exploration

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit – I: Basic Principles
Principles of Gravity and Magnetic methods, concept of Geoid, Spheriod, a review of magnetic field of the Earth, relation between gravity and magnetic potential, variation of gravity with elevation and depth, determination of density, isostasy and gravity, Magnetization of rocks-Dia, Para- and Ferromagnetism, Magnetic susceptibility of rocks and their ranges, Artificial versus natural source Methods.

Unit-II : Instrumentation
Gravity Prospecting Instruments: Absolute versus Relative measurements of Gravity, Pendulum apparatus, stable and unstable gravimeters, calibration of gravimeters, LaCoste-Romberg gravimeter, Worden gravimeter.
Magnetic Prospecting Instruments: Fluxgate magnetometers, Proton precession magnetometers, optical pumping instruments, Schmidt's horizontal and vertical magnetometrs.

UNIT-III: Gravity and Magnetic Surveys:
Gravity survey on land: setting up of a base station, tide and drift corrections, the reduction of gravity data: the latitude adjustment, the elevation adjustment, the excess mass adjustment, terrain correction, Gravity anomalies, Plan of conducting ground magnetic surveys, corrections applied to magnetic data, Airborne magnetic surveys and magnetic gradient surveys.

UNIT-IV: Interpretation
Separation of residual and regional anomalies: Graphical method, direct computation, second derivative method, polynomial fitting method, depth rules, gravitational and magnetic attraction of structures with various simple shapes, estimation of anomalous mass, ambiguity in gravity interpretation, model analysis, step model, ribbon model, Applications of gravity and magnetic methods in oil and mineral exploration.

Recommended Books:
(1) Basic Exploration Geophysics: Robinson
(2) Applied Geophysics: Telford et al.
(3) Introduction to Geophysical Prospecting: Dobrin & Saviet
(4) Geophysical prospecting for oil: Nettleton
(5) Introduction to Geophysical Exploration: Keary & Brooks
(6) Gravity and Magnetic methods of prospecting: B.S. Rama Rao & IVR Murthy

GP-303: Groundwater Geophysics

Max. Marks: 60

Credits : 4 Time: 3 hours

Objective: is to understand the origin, occurrence, monitoring of ground water. Mainly the rocks associated with ground water, the groundwater exploration, watershed management and management of ground water in respect to domestic, irrigation and industrial use.

Outcome: The students are expected to get acquainted with the groundwater terminology and management of groundwater.

Special notes:

Nine questions will be set and the students will attempt five questions. Question No.1 will be compulsory and based on the conceptual aspects of the whole syllabus. It can have five to ten parts. Answers should not be in yes/no. In addition to question No. 1, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit I

Concept of geohydrology and hydrogeophysics, hydrology in relation to other sciences, hydrosphere, hydrologic cycle, surface and subsurface distribution of water, origin of ground water, springs, hydrometeorology, precipitation, evaporation, evapotranspiration, seepage, infiltration and runoff and methods of measurement

Unit II

Hydrological properties of water bearing materials: porosity, void ratio, permeability, transmissivity, storativity, specific yield, specific retention, diffusivity, field and laboratory method for determining permeability, movement of ground water and aquifer performance tests, Darcy's Law and its range of validity, theory of groundwater flow under steady and unsteady conditions, determination of transmissivity and storativity by discharge methods.

Unit III

Mode of occurrence of ground water, classification of rocks with respect to their water bearing characteristics, aquifers, Aquiclude, aquitards, classification of aquifers, remote sensing studies for water resources evaluation. groundwater exploration and management, water balance studies, hydrograph analysis, conjunctive and consumptive use of ground water, water well drilling, development of wells, concept of artificial recharge, Watershed characterization and management,

Unit IV

Monitoring the health of groundwater reservoir, Use of IP for groundwater contamination, Groundwater exploration: surface geological and geophysical methods of exploration and subsurface geophysical methods; Hydro-geochemistry: Physical and Chemical characteristics of groundwater, classification of groundwater in respect to domestic, irrigation and industrial use, pollution of groundwater.

Recommended Books:

1. Groundwater hydrology (John Wiley and Sons), David K. Todd
2. Principles of Hydrology, Ward
3. Handbook of Applied Hydrology, V.T. Chow
4. Introduction to groundwater Hydrology, Heath & Trainer
5. Hydrology. O. Meinzer
6. Hydrogeology (John Wiley and Sons). Davis, S.N., Dewiest, J.R.N.
7. Groundwater (Tata McGraw Hill), Tolman, C.F.
8. Groundwater (Wiley Eastern Ltd.) H.M. Raghunath
9. Basic Exploration Geophysics. Robinson
10. Hydrogeophysics (Kluwer Publishers), Y.Rubin and S. Hubbard
11. Karanth: Development, Assessment and Management of Water Resources

GP 304: Electrical Prospecting

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: is to teach the various electrical method and basic of acquisition processing and interpretation electrical D.C. resistivity methods.

Outcome: The students are expected to learn the various electrical methods.

Special Notes:
Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit I Introduction to electrical methods
A rapid review of the method and techniques of electrical prospecting and their classifications. Electrical properties of rocks, electrical properties of rock and their measurement, anisotrophy and its effect on electrical fields. The geoelectric section and geological section. Basic concept on natural electric field.

Unit II Induced Polarization and Self Potential method
Electrode configuration, the choice of method and choice of site measurement, presentation of measured data.
S.P. Method: Origin of self potential, theoretical and experimental basis of S.P. method, field of polarized conducter, sphere and cylinder, determination of ore body parameter, downward continuation of S.P. data
I.P method: Sources of I.P, Membrane and electrode potential, time domain and frequency domain measurement of IP, chargeability, percent frequency effect and metal factor, dipole theory of I.P., transformation of time domain to frequency domain data

Unit III Resistivity Methods
D.C. resistivity method, fundamental laws, the potential distribution at the surface of horizontally stratified earth, Stefanescu's expression: Kernel function and its relation to subsurface parameters, Flathe and Pekeris recurrence relation: principle of equivalence, principle of superposition and principle of suppression. Apparent resistivity function, computation of apparent resistivity model curves, vertical electrical sounding
Resistivity Transform, Method of determination of resistivity transform, Asymptotic method, Complete curve matching, auxillary point method, equivalent curve matching using maxima and minima, Dar Zurruck curve, Direct interpretation method, application of linear filter theory for resistivity interpretation.

Unit IV: Interpretation of Electrical resistivity Data
Apparent resistivity function, computation of apparent resistivity model curves, vertical electrical sounding and horizontal profiling techniques, Interpretation of resistivity sounding data, Asymptotic method, Complete curve matching, auxillary point method, equivalent curve matching using maxima and minima, Dar Zurruck curve, Direct interpretation method, electrical profiling near a vertical contact, dyke, sphere, application of linear filter theory for resistivity interpretation.

Recommended Books :

1. Electrical method of geophysical prospecting: Keller, G.V. and Frish Knecht,
2. Geosounding principles: Koefoed, O.
3. The application of Kernel functions in neterpretating geoelectrical measurements, Geoexploration monograph series no. 2Gebruder, Brorntraegr, Berlin : Koefoed, O.
4. Direct current geoelectric sounding: Bhattacharya, B.K. and Patra, H.P.
5. Principles of direct current prospecting Gebruder: Kunetz, G.
6. Interpretation theory in applied geophysics, Mg Graw Hill Co. N.York
7. Kaufman and Keller, The Magnetic Sounding Methods: Grant, F.S. and West, G.B.,
8. Geoelectromagnetism: Wait, J.R.,
9. Time varying geoelectric sounding: Patra and Mallick, K.

GP-305: Geophysical Lab-III

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To impart the practical knowledge about the seismological problems including location of earthquake, fault plane solutions, estimation of earthquake magnitude, b-value, preparation of intensity maps etc.

Output: The students will get the practical exposure and learn to handle the seismological data.

1. Exposure to earthquake instruments available in the department
2. Identification of seismic phases on seismograms
3. Location of epicenters
4. Fault plane Solutions
5. Frequency magnitude analysis of earthquake data
6. Estimation of decay constant (p-value) from aftershocks data
7. Estimation of b-value from earthquake data.
8. Estimation of source parameters of earthquakes.
9. Estimation of magnitudes of earthquake
10. Estimation of Poisson probability for earthquake occurrences
11. Draw isoseismal lines and prepare intensity map from given data.
12. Exposure to seismological soft wares like PITSA, SEISAN etc.

GP-306: Geophysical Lab-IV

Max. Marks: 60

Credits : 6 Time: 3 hours

Objective: To impart the practical knowledge about the geophysical problems based on Gravity, Magnetic and electrical methods.

Output: The students will learn about the acquisition, processing and interpretation of gravity, magnetic and electrical data.

1. Exposure to the electrical, magnetic and gravity instruments available in the department
2. Interpretation of VES data using partial curve matching, computer programs and filtering techniques
3. Preparing electrical sections and correlation with lithological logs
4. Reduction of gravity data, Applications of drift correction, Free air correction, Bouguer correction.
5. Calculation of Free Air Anomalies & Bouguer anomalies and their interpretation
6. Estimation of Bouguer density using Nettleton mrthod
7. Calculation of Gravity and Magnetic effects due to simple shapes bodies.
8. Reduction of magnetic data
9. Interpretation of magnetic data using various techniques

GP-401: PETROPHYSICS AND WELL LOGGING

Credits: 4

Max. Marks: 60
Time: 3 hours

Objectives: The main objective of this course is acquiring information on physical properties of rocks that are exposed during drilling of an oil well. The key purpose of well logging is to obtain petrophysical properties of reservoirs such as Porosity, Permeability, hydrocarbon saturation etc., for hydrocarbon exploration.

Outputs: The course will enhance the knowledge of students in petrophysics and interpretation of well logging data. It will help to build carrier in academics industries.

Special Notes:
Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

UNIT-I: Basics of Petrophysics and Formation Evaluation
Well logging - objectives and its place in geoexploration Formation evaluation: Hydrocarbon volume calculation; Porosity: controls on porosity, porosity determination from core; Permeability: controls on permeability and ranges, determination of permeability, permeability porosity relationship; Coring: Preservation and Handling; Electrical properties of rocks: Formation resistivity factor (FR); correlations of FR with porosity, cementation, water saturation and permeability. Wire-line logging: representation of log, tools characteristics; borehole environment, invasion and drilling mud

UNIT-II: Spontaneous Potential (SP) and Natural Gamma Ray Logs
Introduction about SP logging, Principle, measurement tool, log presentation, factors affecting amplitude of SP, calculation of shale volume and other uses Fundamentals of radioactivity, scattering and attenuation, Gamma ray logging: principle, tool calibration, log representation, depth of investigation, bed resolution, calculation of shale volume, lithology identification and other uses

UNIT-III: Porosity Logs
Acoustic Log: Principles; acoustic logging tools; log representation, depth of investigation and vertical resolution, logging problems, uses of acoustic logging, Formation Density Log: principle; measurement tools and operation; calibration of tool, log characteristics- depth of investigation and bed resolution; uses of formation density logging; Neutron Log: Theory: neutron emission, scattering and absorption, Hydrogen Index, neutron logging tools, Log representation, Calibration, depth of investigation and vertical resolution; Uses of Neutron logging

UNIT-IV: Electrical Resistivity Logs and other logs
Concept of resistivity, resistivity of rocks, variation of formation fluid resistivity with temperature, Archie's first and second law, Hingle and Pickett plots, Saturation of Moveable Hydrocarbons. Resistivity logging: response of tool, resistivity tools: old and modern, spherically focused log, micro-resistivity logs, proximity log, induction log, depth of investigation and bed resolution, log representation, uses of resistivity log Nuclear Magnetic Resonance (NMR) Logging: background, need of NMR logging, log representation and interpretation; Caliper logging, temperature logging, dipmeter logging, LWD

Recommended Books:
1. Standard Methods of Geophysical Formation Evaluation: James K. Hallenburg
2. Practical Formation Evaluation: Robert C. Ransom
3. The geological Interpretation of Well Logs : Malcolm Rider
4. Well Logging for Earth Scientists: Darwin V. Ellis

5. Petrophysics- Theory and Practice of Measuring Reservoir Rock and fluid Transport Properties: Djebbar Tiab and Erle C. Donaldson

GP-402 Physical Oceanography and Marine Geophysics

Credits: 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the basic concept of physical and dynamical oceanography and different terminology related to marine geophysics.

Outcome: The students are expected to get knowledge of different terminology related to oceanography and marine geophysics.

Special Notes:
Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit

Unit I Physical Oceanography
Physical properties of seawater and methods of determination, distribution of salinity in the oceans, factors affecting salinity, water masses and water type, TS Diagram, Circulation of currents in major ocean waves. Tides: Dynamical and equilibrium theory of tides. Marine pollution, steps to control marine pollution, Laws of seas, Coastal zone management

Unit II Dynamical Oceanography
Equation of motion in a rotating and translating coordinate system, Coriollis force term and other terms, Nonlinear term in equation of motion, Brunt Viasala frequency, Geopotential surface and isobaric surface, wind driven ocean circulation, Ekman Solution, Sverdrup's Solution, Vorticity.

Unit III Marine exploration
Resource potential for offshore areas, Geophysical continental margins, type of continental margins, geophysical evidences for evolution of Atlantic type continental margins, Characteristic geophysical signatures for transitional crust, isostatic 2D gravity anomalies, sea floor magnetic anomalies and their interpretation.

Unit IV
Geophysical studies for active continental margins, Seismicity, volcanism, heat flow studies, seismic surveys along island arc-trench areas, seismic expression for subduction and crustal deformation, paired gravity anomalies over island arc trench areas and their interpretation. Geophysical exploration for continental Margins of India and Andman shelves, brief review on the hydrocarbon exploration for the Indian continental margin.

Reccomended Books:
1. The Earth, Tarbuck and Lutgens
2. Descriptive Physical oceanography, Pickard Lmerv
3. Estuaries- Introduction, Dyer
4. Oceanography, Ross
5. Dynamical Ocenography, Pond and Pickard

6. The Sea, Hill
7. Nettleton, Gravity and Magnetics in Oil prospecting
8. McQuillin and Ardus, Exploring the geology of shelf area

GP-403: SEISMIC PROSPECTING

Credits : 4

Max. Marks:60
Time: 3 hours

Objective: To impart the knowledge about the fundamentals, data acquisition, data processing and data interpretation of seismic prospecting method.

Output: The students will learn about the different aspects of seismic method.

Special Notes:

Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit

UNIT-I: FUNDAMENTAL OF PROSPECTING

Motivation for Seismic Prospecting, Oil Exploration, Mining and Engineering Application, Principles and Physical Basis of Seismic prospecting: Types of Elastic Waves, Reflection, Refraction and Transmission Coefficients, Expression for wave velocities, Factors affecting wave velocities in Rocks.

UNIT-II: DATA ACQUISITION

Seismic Sources: Explosive and Non-Explosive Sources, Seismic Refraction Method: Travel Time Equation for Simple one layer case and for variable velocity case. Expressions for dipping layer and faulted bed cases. Gardener delay time method. Hidden layer problems. Field techniques for refraction survey, fan shooting.

Seismic Reflection Method: The travel time equations for horizontally layered medium, Expression for dipping interfaces, Field techniques for reflection survey: Split Spread, End on Spread, Broad side configurations. 2D/3D configurations, Common depth point technique, Presentation formats for Seismograms, Selection of field survey parameters.

UNIT-III: SEISMIC DATA PROCESSING

Data processing sequence, Static and Dynamic Correction, weathering and datum corrections, CDP stacking, Migration and depth section preparation.

Velocity depth determination: Velocity-depth relation for measurements in boreholes, velocity depth relation from surface observations, the T^2-X^2 method, the T-ΔT method, the hyperbola method.

Noise Elimination method: The structure of noise and its classification using frequency and spatial filters(arrays), Multiples identification, Suppression of multiples, VSP.

UNIT-IV: SEISMIC DATA INTERPRETATION

Mapping of Hydrocarbon bearing and water bearing structures, geological interpretation, Structural and Stratigraphic traps, direct detection of hydrocarbons, pattern recognition, Seismic attribute analysis.

Recommended Books:

1. Dobrin, M.B Introduction to Geophysical Prospecting
2. W.M.Telford et al Applied eophysics
3. Keary and Brooks Introduction to Geophysical Exploration
4. Waters, R.H.. Reflection Seismology
5. Robinson Basic Exploration Geophysics

6. Sheriff, R.E Seismic Stratigraphy
7. Nelson, H.R New technologies in Exploration Geophysics
8. Lavergne, M. Seismic Methods

GP-404: Geophysical Inversion

Max. Marks: 60

Credits : 4 Time: 3 hours

Special Notes:

(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit-I:

Forward problems versus Inverse problems, continuous inverse problem, discrete inverse problem, formulation of inverse problems and their reduction to a matrix problem, linear inverse problems, classification of inverse problems, L1 norm inversion, least squares solution and minimum norm solution, concept of norms, concept of 'a priori' information, constrained linear least squares inversion, review of matrix theory.

Unit-II

Introduction to finite difference method, forward, backward and central difference method, Application of finite difference method for solving Helmholtz equation.

Introduction to finite element method, various steps, simple examples showing application of finite element method.

Unit-III

Model and Data spaces, householder transformation, data resolution matrix, model resolution matrix, checkerboard resolution test, eigen values and eigen vectors, singular value decomposition (SVD), generalised inverses, Non-linear inverse problems, Gauss Newton method,, steepest descent (gradient) method, Marquardt-Levenberg method, Earthquake location problem, tomography problem.

Unit-IV

Probabilistic approach of inverse problems, maximum likelihood and stochastic inverse methods, Backus-Gilbert method, Global optimization techniques: genetic algorithm, simulated annealing methods, neighbourhood algorithm, examples of inverting geophysical data.

Recommended Books:

(1) Geophysical data analysis: Discrete inverse theory: William Menke
(2) Deconvolution & Inversion: V.P. Dimri
(3) Geophysical Data analysis: Understanding Inverse problem theory & Practice: Max A. Meju
(4) Time series analysis and inverse theory for Geophysicists: David Gubbins
(5) Inverse problem theory methods for data fitting and model parameter estimation : I. Tarantola

GP-405: Geophysical Lab-V

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To impart the practical knowledge about the various techniques used in the seismic method.
Output: The students will get the exposure to the processing and interpretation techniques of seismic method.

1. Seismic Survey using engineering seismograph
2. Two layer and three layer problems of seismic refraction method for horizontal and dipping interface
3. Identification of faults on seismic refraction data
4. Static and Dynamic corrections to seismic data
5. NMO stretching effect
6. Interpretation of reflection data using $T^2 – X^2$ method, T-ΔT method etc.
7. Estimation of different types of velocities in Seismic method
8. Exposure to seismic data processing

GP-406: Geophysical Lab-VI

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To impart the practical knowledge about the different tools to invert the geophysical data.

Output: The students will learn applying the inversion tools to geophysical data.

Exercises based on:

(1) Eigen values and Eigen vectors

(2) Formulation & Solution of inverse problems

(3) Linear estimation of parameters

(4) Constrained and Unconstrained least square inversion

(5) SVD analysis

(6) Different techniques of Geophysical Inversion

GP-501: Near Surface Geophysics

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the near surface applications of geophysical methods alongwith the GPR and GIS applications.
Outcome: The students will get acquainted with the geophysical techniques including GPR and GIS applications for near surface studies.

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit-I: Introduction
Man and Environment, Near Surface Geophysics: Introduction, Practitioners and Users, Traditional and Emerging views of Near Surface- Geophysics, Concepts and Fundamentals, Special Challenges associated with near Surface Geophysics. Rock Physics Principles for Near-Surface Geophysics: Description of the Geological Material, Conditions in the Near Surface of the Earth, Density, Electrical Properties, Elastic Wave Velocities.

Unit-II: Geophysical Techniques in Near Surface studies
Review of Seismic, Gravity, Magnetic and Electrical methods, Applications of these methods to Environmental and Engineering studies: Delineation of structural trends, contacts and faults, microgragravity detection of subsurface voids and cavities, detection of Archaeological objects, Mapping of fracture zones, reflection profiling in ground water studies, dam site investigations, evaluation of acquifer potentional, Investigation of waste dump sites.

Unit-III: Ground-Penetrating Radar
Introduction, Electromagnetic Theory, Physical properties, EM wave properties, GPR Instrumentation, Modeling of GPR Responses, Survey Design, Data processing, Interpretation, Case Studies and Pit falls.

Unit-IV:GIS Applications in Near surface Geophysics
Concept of Digital Image in Remote Sensing, Image preprocessing, rectification, enhancements and analysis, Digital Image processing procedures, Band ratioing and NDVI, GIS applications in integrated ground water resources mapping, site suitability studies and utilities management, GIS applications for engineering, environmental problems, landfill sites and solid waste management,

Recommended Books:
1.Near-Surface Geophysics Edited by Dwain K. Butler
2.Applied Geophysics by W. M. Telford et al.
3.Experiments in Engineering Geology by KVGK Gokhale and D M Rao
4. Geotechnical and Environmental Geophysics Edited by Stanley H.Ward
5. Environmental and Engineering Geophysics, P.V.Sharma

GP-502: Electromagnetic and Magnetotelluric Methods

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the basic concepts of acquisition, processing and interpretation of different electromagnetic methods.

Outcomes: The students are expected to learn various electromagnetic methods.

Special Notes:
Nine questions will be set and students will attempt five questions in all. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit-I
EM Principle: Maxwell's equations, electromagnetic potential and wave equations, attenuation of EM field, depth of penetration, dip and tilt angles, electromagnetic field due to straight wire, rectangular and circular loops, elliptical polarizations, amplitude and phase relations, real and imaginary (quadrature) components.
Transient electromagnetic methods (TEM), transient emf and magnetic field behaviour due to various conductors; current density in half space by rectangular loop with time, toroidal and poloidal induction in a conductive zone, various time domain systems frequency sounding and geometric sounding, advantage of time domain methods over frequency domain methods.
Electromagnetic properties of rocks and minerals

Unit-II
EM Prospecting and Interpretation: various EM methods: Dip angle methods-fixed vertical loop transmitter, two frame method, Turam method, Moving source-receiver methods- horizontal loop (Slingram) method, AFMAG and VLF methods, Airborne EM systems- rotary field method, EM profiling and sounding. Marine Electromagnetic Methods, EM modelling.

Unit-III
MT Principle: Origin and sources of MT signal, interaction with the earth -uniform earth, horizontal layers, anisotropy, inhomogeneity, impedance tensor and tipper, topographic and regional effects, static shift. Data processing and analysis: auto and cross spectra, solution to the impedance and tipper equations, local and remote references, errors and noise. Robust and hybrid processing.

Unit-IV
MT Interpretation and uses: interpretation of MT data over a two layered earth, strike, rotation swift strike, polar diagram, tipper, skew, ellipticity, TE and TM modes, 1D and 2D interpretation, imaging continental lower crust, MT study over cratons. Mapping structures for petroleum exploration, geothermal mapping, exploration for sulphides, gold, uranium. Detecting water and subsurface structures.

Recommended Books:

1. Nabighian, M. N., 1988, Electromagnetic Methods in Geophysics, Volume 1, SEG Publication.
2. Nabighian, M. N., 1991, Electromagnetic Methods in Geophysics, Volume 2, Parts A and B, SEG Publication.

3. MICHAEL S. ZHDANOV, Geophysical Electromagnetic Theory and Methods
4. Grant, F. S., and West, G. F., Interpretation Theory in Applied Geophysics
5. Telford et. al: Applied Geophysics
6. Patra & Mallick: Geosounding Principles Vol.II
7. Geoelectromagnetism: Wait, J.R.,

GP-503: Geophysical Lab-VII

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To give practical exposure to the processing and interpretation of different types of logs and designing of filters.

Output: The students will learn the processing and interpretation of different types of logs, and filter designing.

(A) Exercises based upon:

(i) SP log

(ii) Natural Gamma Log

(iii) Caliper and Temperature Log

(iv) Resistivity Log

(a) Micro log

(b) latero log

(c) induction log

(v) Porosity Logs:

(a) Neutron log

(b) Acoustic log

(c) Density log

(vi) Computation of formation factor and water saturation.

(B) Exercises based on

(i) Design of optimum wiener filter

(ii) Exercises on Seismic Signal Processing softwares like PITSA, GEODEPTH, FOCUS etc

GP-504: Geophysical Lab-VIII

Credits : 6

Max. Marks: 60
Time: 3 hours

Objective: To train the students in small groups to solve the geophysical problems, presents the results in the form of a report.
Output: The students will learn to handle geophysical data and also learn to write a scientific report.

Problems/Case studies based on Geophysical Methods including:

(i) Seismology

(ii) Exploration Seismology

(iii) Seismic Signal Processing

(iv) Gravity & Magnetic Methods

(v) Electrical Methods

(vi) Geophysical Well logging

(vii) Remote Sensing & GIS

GP-506: Computational Seismology

Max. Marks: 60

Credits : 4 Time: 3 hours

Objective: To impart the knowledge about the basic concepts of strong motion seismology, simulation techniques, attenuation techniques, seismic hazard and engineering seismoplogy.
Outcome: The students are expected to learn the various techniques of computational seismology.

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit I Strong motion seismology
Concept of strong motion: Characteristics of earthquake strong ground motion, time domain and frequency domain parameters of strong ground motion, strong motion array and recorder, dynamics of vibration, vibration of a single degree of freedom system, earthquake response spectra, Strong motion networks in India
Modelling of strong ground motion: Stochastic modelling technique, concept of dynamic corner frequency, Empirical Greens function technique, Semi empirical technique and Composite source modelling technique, hybrid technique.

Unit II Attenuation Studies
Wave attenuation: geometrical spreading, scattering and intrinsic attenuation, Quality factor Q and its estimation using frequency domain methods, origin of coda waves, coda-Q and its estimation, estimation of frequency independent and frequency dependent Q using strong ground motion, simultaneous estimation of source parameters and Q, concept of 3-D Q and its estimation.

Unit III Engineering seismology
Concept of earthquake hazard, vulnerability and risk, probabilistic versus deterministic approach of estimating earthquake hazard, seismic quiescence/gaps, Regression analysis for estimating peak ground motion, microzonation, site amplification, concept of earthquake resistant design, Indian earthquake hazard scenario.

Unit IV: Selected Topics
Seismic tomography – Methods, regional and local tomography, 3-D velocity analysis, Receiver functions, Seismicity based studies- b-value, fractal and multifractal analysis, Dq-q analysis, self similarity, Ray tracing, Anisotropy, Time predictable model, GPS based studies in seismology.

RECOMMENDED BOOKS

(1) Quantity Seismology: Aki and Richards
(2) Introduction to seismology: Peter M. shearer

(3) Modern Global Seismology: Lay & Wallace
(4) Earthquake Hazard Analysis: L. Reiter
(5) An introduction to seismology, earthquakes and Earth structure: Stein & Wysession

GP-513: Seismic Data Analysis and Reservoir Geophysics

Credits : 4

Max. Marks: 60
Time: 3 hours

Objective: To impart the knowledge about the seismic data analysis including seismic modelling and about the reservoir Geophysics.
Output: The students will learn the different techniques of seismic data analysis including the seismic deconvolution, seismic migration and reservoir Geophysics.

Special Notes:
(i) Nine questions will be set and students will attempt five questions. Question no. I will be compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answers should not be in yes/no. In addition to question no. I, there will be four units in the question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit.

Unit-I: Introduction
Objectives of Seismic Signal Processing, Seismic Resolution, Basic data processing sequence: CMP sorting, Velocity analysis, residual statics corrections, Normal-Moveout Correction, Moveout stretch, Noise and Multiple Attenuation, f-k filtering, τ-p filtering, Dip-Moveout correction, CMP stacking, post stack processing.

Unit-II: Seismic Deconvolution and Seismic Migration
The convolutional Model, Inverse Filtering, Optimum Wiener filters, Predictive deconvolution in practice, The problem of nonstationarity: Time-Variant deconvolution, gated Wiener deconvolution, Homomorphic deconvolution, Minimum and Maximum Entropy Deconvolution, Inverse Q Filtering, Fresnel Zone, Seismic Migration: Mathematical foundation of migration, Migration using wave equation, Kirchhoff's theory , Pre and Post stack time and depth migration

Unit-III: Seismic Modeling
The role of Seismic Modeling, Concept and example of Physical Models, Seismic Modeling Approaches, Forward Seismic Modeling, Inverse Seismic Modeling, Application of GLI technique, Modeling pitfalls, Ray Tracing using Snell's Law, and Ray-bending.

Unit-IV: Reservoir Geophysics
Reservoir Management, Geophysical Method for Reservoir Surveillance, Analysis of AVO, Acoustic Impedance Estimation, 4-D Seismic Method, Interpretation with SH-wave, 4-C Seismic Method.

Recommended Books:

1. Seismic Data Analysis, Vol. I&II, ÖZYILMAZ.
2. Reservoir Geophysics, Robert E.Sheriff.
3. Seismic Modeling of Geologic Structures, Stuart W.Fagin.
4. Introduction to Seismic Inversion Method, Brian H.Russell

GP-517: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING IN GEOPHYSICS

Max. Marks: 60

Credits : 4 Time: 3 hours

Objective: To impart the knowledge about the fundamentals, concepts, data processing and data interpretation of machine learning.

Output: The students will learn about the different aspects of seismic interpretation using machine learning.

Special Notes:

Nine questions will be set and students will attempt five questions. Question No.1 is compulsory and based on the conceptual aspects of the whole syllabus. It can have 5 to 10 parts. The answer should not be in yes and no. In addition to Question 1, there will be four unit question paper each containing two questions belonging to four units in the syllabus. Students will select one question from each unit

UNIT-I: FUNDAMENTAL OF MACHINE LEARNING

Introduction to Artificial Intelligence and Machine Learning: Machine Learning concepts, algorithms, and its applications. Techniques of Machine Learning: Supervised, Unsupervised, Overview of Linear Algebra, Eigenvalues, Eigenvectors, and Eigen-decomposition, Calculus, Probability and Statistics. Regression: Linear Regression.

UNIT-II: NEURAL NETWORKS

Neural Networks. Multi-layer Perceptions, Activation function. Restricted Boltzman Machines, Support Vector Machine, Deep Belief Networks, Deep Recurrent Neural Network, Convolution DBN, Max Pooling CDBN. Data Preprocessing: Comprehend the meaning, process, and importance of data preparation, feature engineering and scaling, datasets, dimensionality reduction.

UNIT-III: MACHINE LEARNING WITH PYTHON

Introduction to Python. Control flow tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Standard Library, Virtual environment and packages. Machine Learning with Python.

UNIT-IV: APPLICATION IN GEOPHYSICS

Machine Learning Applications: First Break Picking, Sesimic Deconvolution, NMO correction in T-p domain. Reservoir characterization: Pattern recognition. Principle Component Analysis. Earthquake Prediction.

Recommended Books:

1. Anthony Croft et al. Engineering Mathematics
2. Martin C. Brown Python the compelete reference
3. R. Nageshwara Rao Core Python Programming

GP-601: Dissertation

Max. Marks: 400

Credits:16

Objective and Output:

Every student is required to undertake a project in the last semester. The project may be an experimental investigation, field work and laboratory studies, a theoretical investigation accompanied by computation work, data processing and analysis or combination of these. The exact nature of the project and the problem is decided by the chairperson of the department in consultation with faculty members and students. After the project is completed the students will submit two copies of dissertation based on the results obtained in the investigation. Finally the student is expected to defend his findings as embodied in his dissertation before a board of examinations and take an oral examination.

This will inculcate the research aptitude in the students.

GP- 602: Comprehensive Viva-Voce

Credits:4 **Max. Marks: 100**

Objective and Output:

In order to prepare the students for the various competitive examinations held by various organizations including ONGC, GSI, GATE, CSIR-JRF-NET, Ground water boards etc. the comprehensive viva-voce has been included in this semester. Every student shall be required to appear for comprehensive viva-voce examination based on complete M.Tech. (Applied Geophysics) course before a committee of teachers of the department.

GP-603: Seminar

Credits: 4 **Max. Marks: 100**

Objective and Output:

In order to inculcate sense of confidence and self reliance and with a view to train the student in the art of public speaking and self expression, each student is required to deliver a talk on a particular topic during sixth semester. The topic of the seminar is selected by the students under the advice of a teacher of the department. This is accompanied by a write up. Besides delivering a seminar talk a student is expected to attend all other seminars delivered by other students. The seminar shall be evaluated by a committee of the teachers of the department.

M.Sc. (Graphic Animation and Multimedia)

Scheme of Examination & Syllabus

w.e.f. academic session 2019-2020

First Semester

Paper Code	Subject Name	T	P	I	**Time**	**Credits**
MGM-101	Visual Arts and Creativity	-	75	25	4 Hours	4
MGM-102	Graphic Designing and Publishing	50	25	25	4 Hours	4
MGM-103	Multimedia and Technologies	75	-	25	4 Hours	4
MGM-104	Story, Script and Storyboarding	50	25	25	4 Hours	4
MGM-105	Techniques of 2D Animation	50	25	25	4 Hours	4
	Total Marks=500					**20**

Second Semester

Paper Code	Subject Name	T	P	I	**Time**	**Credits**
MGM-201	Film Appreciation and Cinematography	75	-	25	4 Hours	4
MGM-202	Digital Video Production and VFX	50	25	25	4 Hours	4
MGM-203	Multimedia Programming	50	25	25	4 Hours	4
MGM-204	3D Modeling and Texturing	50	25	25	4 Hours	4
MGM-205	Cyber Laws and Intellectual Property Rights	75	-	25	4 Hours	4
Open Elective Paper (for any student of university)	Photography	-	50	-	2 Hours	2
	Total Marks=500					**22**

Third Semester

Paper Code	Subject Name	T	P	I	**Time**	**Credits**
MGM-301	Motion Graphics	-	75	25	4 Hours	4
MGM-302	3D Rigging	50	25	25	4 Hours	4
MGM-303	3D Animation and Rendering Techniques	50	25	25	4 Hours	4
MGM-304	Sound and Video Design	50	25	25	4 Hours	4
MGM-305	Web Media Production	75	-	25	4 Hours	4
Open Elective Paper (for any student of university)	Videography	-	50	-	2 Hours	2
	Total Marks=500					**22**

Fourth Semester

Paper Code	Subject Name	T	P	I	**Time**	**Credits**
MGM-401	Portfolio Development	75	-	25	4 Hours	4
MGM-402	Instructional Material Design	75	-	25	4 Hours	4
MGM-403	Multimedia Marketing and Research	75	-	25	4 Hours	4
MGM-404 Elective Paper	(i) Television Production	50	25	25	4 Hours	4
	(ii) 2D Production	50	25	25	4 Hours	4
	(iii) 3D Production	50	25	25	4 Hours	4
	(iv) Sound Production	50	25	25	4 Hours	4
	(v) Web Production	50	25	25	4 Hours	4
	(vi) Android Application Development	50	25	25	4 Hours	4
	(vii) Graphic Designing	50	25	25	4 Hours	4
MGM-405	Training / Internship	-	75	25	-	4
	Total Marks=500					**20**

MGM 101
Visual Arts & Creativity

Total Marks: 100,
Practical Marks: 75
Internal Assessment: 25
Time: 3 Hrs.

There will be a practical based paper and there will be only a practical examination in this paper. External examiner will evaluate the skills of students in this field of visual art & creativity. Examiner will give on-the-sport assignment/task to the students. Beside this viva voice (Oral Examination) will be conducted by the examiner for testing the knowledge of the student of the field. During semester student have to prepare a portfolio and will submit it to the examiner duly signed by the subject teacher at least 20 days before the commencement of the theory examination

UNIT-I

Development of Art & Ideas

- Origin of Art**:**
  - Study of Prehistoric Indian Art
  - Visual Arts & Its Forms & Creative Pedagogies
- Drawing Concepts
- Perception of Color
- Pictorial Composition

UNIT-II

Drawing & 3D Design

- Perspectives on the Creative Process
- Living & Non-Living objects
- Basic Elements & Principles of 3D Design
- Calligraphy & Typography

UNIT-III

Development of Character Design

- Anatomy & Proportions
- Body Types, Poses, Facial Expression
- Model sheet of Character
- Character Line-up

UNIT-IV

Clay Modeling

- Introduction to different kind of clay
  - Natural clay & Synthetic clay
- Create various shapes through clay
  - Volume, space & dimensions of objects
  - 2D & 3D geometrical
- To Study Human & Animal body
  - Eyes, Nose, Lips, Cat, Dog, Penguin etc.

References:

1. Drawing Human Anatomy: Giovanni Civardi
2. Keys to Drawing (Paperback) byBert Dodson
3. Fundamentals of Drawing: A Complete Professional Course for Artists, Barrington Barber, Paperback

MGM-102
GRAPHIC DESIGNING AND PUBLISHING

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT-I

Introduction to graphics

- Introduction to graphics, tools of graphics, uses & types of graphics
- Meaning and definition of graphics design
- Elements and principles of graphic design
- Graphics Overview: Raster graphics, Vector graphics

UNIT-II

Corel draw

- Tools and menus, Effects and masking
- social advertising
- Cartoon character design, Product design

Photoshop

- Introduction to Photoshop, workspace and photo editing tools
- Filters and Adjustments
- Digital matte painting

Unit-III

Illustrator

- Introduction to Illustrator, Applications and features, Illustrator interface
- Aligning objects, working with groups, arrange object, distributing objects. Templates
- Transforming objects: Scaling, Reflection, Distorting and Shearing objects
- Coloring and painting
- Using effects, appearance attributes and graphics styles

Unit – IV

Publishing

- Authoring and process of publishing
- Publishing types, newspaper and magazine publishing
- Research papers and publications
- Packaging and its types, Functions of Packaging

MGM 103
Multimedia and Technologies

Total Marks: 100,
Theory Marks: 75,
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit I

Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Multimedia Databases; Types of Compression, Binary Image Compression Schemes, Color, gray scale, still-video image compression, video Image compression, audio compression; Data and File format standards- RTF, TIFF, RIFF, MIDI, JPEG, AVI, JPEG

Unit II

Key Technology Issues, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video; Magnetic Media Technology, Optical Media, WORM optical drives, Hierarchical Storage Management, Cache Management for storage systems.

Unit III

Types of Multimedia systems, Virtual Reality Design, Components of Multimedia system, Distributed Application Design Issues, Multimedia Authoring and User Interface, Hypermedia Messaging, Distributed Multimedia Systems

Unit IV

Secured Multimedia, Digital Rights Management Systems, Technical Trends, Multimedia encryption, Digital Watermarking, Security Attacks; Multimedia Authentication, Pattern, Speaker and Behavior Recognition, Speaker Recognition, Face Recognition

Reference Material:

- Weixel, Fulton, Barksdale.Morse, “Multimedia Basics”, Easwar Press 2004.
- Andleigh PK and Thakrar K, “Multimedia Systems”, Addison Wesley Longman, 1999.
- Fred Halsall, “Multimedia Communications”, Addison Wesley, 2000.
- Ralf Steinmetz, KlaraNahrstedt, “Multimedia, computing, communications and applications”, Prentice Hall, 1995.
- Tay Vaughan, “Multimedia making It work”, TMH 5th Edition 2001.

MGM-104
Story, Script and Storyboarding

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit I

Story

Elements of story, Resources and ideas from life, Story Genres, Characters and the story, character driven stories, Event driven stories.

Story structures and styles

Narrative, non-narrative, abstract, absurd with reference to stories for animated film Basic writing for Animation, Story Structure, Plot, Dramatic structure, Conflict, Setting mood, Rising action, Falling Action, Dénouement, Resolution

Unit II

Script

Anatomy of a Script, Script Elements and Scene Heading, Action, Characters, Dialogue, Parenthetical, Extension, Transition, Shots, Page Breaking, Finer Points, Dual Dialogue, and Adlibs, Abbreviations and Montages, A Series of Shots and Short Lines/Poetry/Lyrics, transitions, continuity etc.

Titles or Opening Credits, and Superimpose or Title, Title Page, Production Drafts, Top Continued and Bottom Continued, Locking Script Pages and Locking Scenes, Header, Do's and Don'ts, Other Script Formats, radio scripts, TV scripts, animation film scripts.

Unit III

Storyboarding

Introduction to Storyboard, Importance of StoryBoard, difference between storyboard and Graphic Comic, Difference between Story, Script and Storyboard.Advantages of Storyboard in Animation and Anatomy of a Storyboard.

Unit IV

Shots

Introduction to various shots, Camera angles and Camera Movements used in Storyboard panels.continuity and Timing, Building a sequence of shots. Use of Perspective, Composition, Light & Shadow in Storyboarding.

Script to Storyboard

Designing a storyboard based on a short script, Use of Thumbnails and Quick story sketches, Creating visual narrative using Animatics.

Reference Material:

- Animation history and production by aparna vats; new delhi publishers; First edition 2017
- Story: Substance, Structure, Style and the Principles of Screenwriting by Robert McKee
- The Way of the Storyteller by Ruth Sawyer
- Comic Book Design: The Essential Guide to Creating Great Comics and Graphic Novels Gary Spencer Millidge
- Facial Expressions: A Visual Reference for Artists, Mark Simon, Publisher: Watson-Guptill,

- The Animation Book: A Complete Guide to Animated Filmmaking--From Flip-Books to Sound Cartoons to 3- D Animation, Three Rivers Press
- The Illusion of Life: Disney Animation, Ollie Johnston and Frank Thomas, Publisher: Disney Editions;
- Making Comics: Storytelling Secrets of Comics, M... by Scott McCloud
- The Art of story board by John Hart
- 'How to Write for Animation' by Jeffrey Scott's book
- Animation Art: From Pencil to Pixel, the world of Cartoon Anime and CGI- Jerry Beck
- The Animation Bible: A Practical Guide to the Art of Animating from Flipbooks to Flash [Paperback], Maureen Furnis

MGM-105
Techniques of 2D Animation

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit I

- Interface of Adobe Flash/ Animator
- Flash workspace , Timeline, Using Tools to create character for animation
- Shape tween and motion tween,Symbols and Keyframes
- Character Model Sheet, Character Line Up in Software such as Photoshop and Flash.

Unit II

- Introduction to Layout and importance of layout in Animation.
- Cinematic Camera Angles, Aspect Ratio, Preparing/Posing Layouts, Camera Movements – tracking, zoom, panorama, Camera movement calculation to animation – matching speeds.
- Principles of animation; Creating object animation (Different weighted ball with different properties, Book fall from book self, moving object interaction with other moving objects, pendulum and Tail animation) using all principles of animation.

Unit III

- Character Animation; Creating walk cycle for male and female characters, creating run and jump for biped and quartered characters
- Acting for Animation
    - Basics of Facial Expressions with different Emotions, Understanding the Gestures and Postures. Understanding the importance of acting in animation, Body Language, Pulling , pushing and lifting objects.

Unit IV

- Facial Animation
    - Adding life to characters using expressions. Classical approaches to depict various expressions and emotions. The mechanics of eye movements, blinking, talking, and making various gestures, Lip sync with dialog
- Rendering and Output
    - Fundamentals of rendering and exporting, Exporting still images and sequences. Learning output formats, terminologies related to rendering.

Reference Material:

- Animator's Survival kit – Richard Williams, Pub.-Focal Press.
- Timing for Animation – Harold Whitaker, Pub.-Focal Press.
- Cartoon Animation – Preston Blair, Pub.-Walter Foster.
- The Animator's Survival Kit - Richard Williams
- Basics Animation: Digital Animation - Andrew Chong

MGM 201
Film Appreciation and Cinematography

Total Marks: 100,
Theory Marks: 75,
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Introduction to Indian Cinema

- History of Indian Cinema: Realism, Neo-realism
- Other arts and cinema - theater, painting
- Cinema and Literature, Language in Indian Cinema
- Foreign Cinema

UNIT II

Film Genres

- What are Movie Genres?
- Westerns and Gangster Films, Mysteries and Film Noir, Horror, Fantasy and Science Fiction(Scifi), Thrillers
- Romantic Comedy Musicals and Documentaries, Drama

UNIT III

Cinematography

- What is Cinematography?
- Lighting Color Saturation and Desaturation
- The Camera, Lens and Their Uses Framing Special Effects
- Cinematography Editing - Time and Space, Narrative, Shot, Set and Design, Lighting, Sound/Music

UNIT IV

Hollywood, Short Films and Animation

- Criticism and Analysis
- Famous Animated Movies
- Best Movie Oscar Winners
- Award winning short films and Web Series

Reference Material:

- Allen, Robert & Douglas Gomery. Film History: Theory and Practice. New York: McGraw- Hill, Inc., 1987.
- Carroll, Noel. Mystifying Movies: Fads and Fallacies in Contemporary Film Theory. New York: Columbia University Press, 1988.
- Gledhill, Christine & Linda Williams. Eds. Reinventing Film Studies. London: Arnold, 2000.
- Stam, Robert & Toby Miller. Eds. Film and Theory: An Anthology. London: Blackwell Publishers, 2000.
- Stam, Robert & Toby Miller. Eds. A Companion to Film Theory. London: Blackwell Publishers,1999

MGM-202
Digital Video Production and VFX

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs.

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit I

Video Editing

Introduction and history of evolution of the specialized stream called Editing. Deciding an edit. Develop an understanding of the digital video production process: pre-production, shooting, editing, and post-production. Understanding importance of editing in the flow of a narrative.Pace and Rhythm in editing. Linear and Non Linear Film Editing.

Editing Tool

Working with interface. Importing supported files and saving project. Understanding tools and palettes, timeline and project panel.Previewing footages.Managing footages.

Unit II

Working with footages

Setting up project, removing frames, naming, finding and deleting footages, learning file size limitations, Using markers, In-out points, Scaling clips, adding transitions. Changing and replacing transitions. Adding Key, Time remapping, video formats and resolutions.Editing mode, changing Frame size, Exporting, Aspect Ratio, Pixel Aspect Ratio, Audio sample rate, Color Correction and Grading.

Unit III

Introduction to AfterEffects

Working with interface. Importing supported files and saving project. Understanding tools and palettes, timeline and project panel.Previewing footages. Managing footages, Introduction to Layers System(2D, 3D layers), Working with different types of Tools, Key Frame Animation

Working with footages

Rotoscope Techniques(Overview on Roto paint, Animating Roto Shape, Paint Techniques), Wire Removal Techniques, Green/Blue screen, Understanding of Pre-composing/Nesting, 3D Render Pass Comping, Color Correction & Grading.

Unit IV

Creating Masks

Key, Matte, Alpha, and Mask, Creating a Luma-Key, Creating a Chroma-Key, Creating a Mask(The Difference Mask, The Color Difference Mask, Geometric Primitives, Drawing Shapes, Painting a Mask, Combo Masks).

Compositing

Introduction to Compositing, Compositing CGI(Multipass Compositing, Depth Compositing, Multiplane Compositing, Working with Premultiplied CGI), Blue Screen Compositing (The Blue Screen Composite, About Keyers, Compositing Outside the Keyer, Shooting Blue Screens and Green Screens).

References:

- Editing Digital Video : The Complete Creative and Technical Guide by Robert Goodman (McGraw-Hill), Pub.- McGraw-Hill/TAB Electronics.
- Adobe premiere pro Bible by Adele Droblas, Pub.-Wiley.
- The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics (The Morgan Kaufmann Series in Computer Graphics) by Ron Brinkmann
- Video editing: a post-production by S.E. Browne
- The technique of film editing by Reisz and Miller
- Grammar of editing by Roy. Thompson
- Rotoscoping: Techniques and Tools for the Aspiring Artist

MGM 203
Multimedia Programming

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT-I

Fundamental Of Computer Programming

- Programming Environment, Basic Syntax, Data Types, Variables, Keywords, Basic Operators, Decision Making, Control Statements, Numbers, Characters, Arrays, Strings Functions

UNIT-II

Web Essentials, HTML, CSS

- Basic Structure of a Web Page
- Basic Tags: Links, Images, Fonts, Colour and Character entities
- Images, Forms, Lists, Tables
- Block and Text level Elements

UNIT-III

JavaScript & PHP

- JavaScript Introduction, Variables and Data types, Control Structures, JavaScript Objects.
- PHP, PHP language Basics , Files and directories, Data Retrieval

UNIT-IV

SQL and Database Management

- Introduction to Sql: Creating Databases and Tables
- Sql Queries: Inserting, Deleting, Updating Data, Joins
- Sorting and Filtering Data
- Querying Sql Database in PHP

Reference Material:

- Paul Wilton and Jeremy McPeak, “Beginning JavaScript, 3rd Edition”, Wrox Press Inc., 2007.
- Mercer, Kent, Nowicki, Squier and Choi, “Beginning PHP5”, John Wiley & Sons, Inc., 2004.
- Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Pearson Education, 2006.
- Chris Bates, “Web Programming – Building Intranet applications”, Wiley Publications, 3rd Edition, 2009.
- Deitel, Deitel& Nieto, “Internet and World Wide Web - How to Program”, Prentice Hall, 4th Edition, 2008.
- www.w3schools.com

MGM 204
3D Modeling and Texturing

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT-I

Modeling Basics

- Polygon Modeling Basics
- Using CV/EP Curves
- NURBS/Surface Modeling
- Sculpting Tools
- Hard Surface Modeling: Interiors/Exteriors, Props etc.
- Organic Modeling: Character Modeling

UNIT-II

Introduction to Zbrush

- Zbrush Interface, ZTools: Primitives, Subtools, Geometry, Deformations
- Basic Brush: Type, Size, Intensity, Color, Alpha, Stroke
- Symmetry, Masking, Slicing, Clipping
- Working with DynaMesh
- Transpose: Move, Scale, Rotate
- Retopology Workflow for Animation (Zbrush to Maya)

UNIT-III

UV Mapping

- UV Projections: Planar Maps, Cylindrical Maps, Spherical Maps, Automatic Mapping, Camera based Mapping
- 3D Cut and Sew UV Tool
- UV Editor and UV Toolkit: Unfold, Normalize, Distribute, Layout, Optimize
- UV Sets Editor
- Exporting UV Maps: UV Snapshot

UNIT-IV

Texturing and Shading

- Hypershade Editor
- Using Images as Textures
- Normal Maps, Bump Maps, Displacement Maps
- Multi-Layered Texture and Alpha Maps
- Texturing with Substance Painter

Reference Material:

- Prof. Sham, PixologicZBrush 2018: A Comprehensive Guide, CADCIM Technologies, 2019, ISBN: 978-1640570481
- Beginner's Guide to ZBrush, 3DTotal Publishing, 2017, ISBN: 978-1909414501
- Kurt Papstein, ZBrush Characters and Creatures, 3DTotal Publishing, 2015, ISBN: 978-1909414136
- Chris Legaspi, Anatomy for 3D Artists: The Essential Guide for CG Professionals, 3dtotal Publishing, 2015, ISBN: 978-1909414242
- Lee Lanier, Advanced Maya Texturing and Lighting, Sybex, 2015, ISBN: 978-1118983522

MGM 205
Cyber Laws and Intellectual Property Rights

Total Marks: 100,
Theory Marks: 75
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT-I

Cyber Threats

Cyber Crimes, vulnerabilities, risks, theft, Hacking, Virus/Worm attacks, DOS attack, Trojan , Spoofing, Spamming, E-commerce/ Investment Frauds, Defamations, Privacy, Confidentiality, Cyber Stacking

UNIT-II

Cyber Law & Information Technology Act 2000

Cyber Jurisprudence, Cyber Ethics, Cyber- Jurisdiction, Hierarchy of Courts, Civil and Criminal Jurisdictions, Overview of IT Act, 2000, Section 66a of IT Act, Amendments and Limitations of IT Act, Digital Signatures, Cryptography.

UNIT-III

Patent Law

Patents – International Law, Patents Law- Emerging Trends, Social Implication of Patents, Infringement of Patents.
Introduction to Copyrights as forms of Intellectual Property, Copyright Law in India (Copyright Act of 1957), Copyright infringement.
Right conferred by Registration and use of Trademarks, Infringement of Trademarks and passing off, Offences, remedies and enforcement, Trademarks, International Law.

UNIT-IV

Intellectual Property Rights

Introduction to Intellectual Property Rights, Evolution of Intellectual Property Laws
Standards and Concepts in Intellectual Property, IPRs and Information Technology IPRs, Management of Intellectual Property Rights, Law of Intellectual Property and Ethical Issues, Intellectual Property Rights in India and abroad.

Reference Material:

- Law and practice of intellectual property in India by VikasVashishth
- Intellectual property by A.Kalank
- Intellectual property- patents, copyrights ,trademarks and allied rights by Cornish W R
- Patents, copyrights, trademarks and design by B L Wadhera
- Intellectual property law by P Narayana
- Patents, copyrights, trademarks and design by Rajeev Jain

Open Elective Paper- (2nd Semester)

Photography

Time: 3 Hrs.
Total Marks: 50

There will be two assignments and two class tests for the subject. The student have to submit at least 02 assignments and they should also have appear in each class tests. The entire syllabus will be practical based.

Unit-I

- Concept and definition of Photography
- Digital and analog photography
- Types of lenses and working
- Types of still camera

Unit-II

- Indoor and outdoor photography
- Working with still camera
- Compositions of photograph, frame, modes of photography
- Feature photography

Unit-III

- Editing of photographs
- Introduction to editing softwares
- Genre of photography, candid, wildlife, sports, fashion and glamour
- Importance of lighting and reflector in photography

Unit-IV

- Placement and selection of photographs in journalism
- Caption and outline writing in photography
- Camera basics:- aperture, shutter speed, film speed, exposure, color temperature
- Creative and aesthetic approaches of a photographer

MGM 301
Motion Graphics

Total Marks: 100,
Practical Marks: 75
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

There will be a practical based paper and there will be only a practical examination in this paper. External examiner will evaluate the skills of students in this field of Motion Graphics. Examiner will give on-the-sport assignment/task to the students. Beside this viva voice (Oral Examination) will be conducted by the examiner for testing the knowledge of the student of the field. During semester student have to prepare a portfolio and will submit it to the examiner duly signed by the subject teacher at least 20 days before the commencement of the theory examination

UNIT I

Introduction to Adobe After Effects

Understanding GUI and related terminologies, Managing and setting up workspace. Project panel, Footage, Composition, Timeline, Effects and Presets. Importing and Organizing footages and files, Using Ram preview for playback.

Compositions and Layers

Creating & saving projects. Understanding broadcasting fundaments, Pixel aspect ratios and frame rates, Trimming, Splitting and understanding concept of In and Out points. Understanding layer stacks, modes and switches. Shape layers and solid layers, Mask and transparent layers. Pre-composing, and pre-rendering, Using Layer effects. Color correction and color adjustment, Light Layer, Null Layer and Adjustment Layer.

UNIT II

Effects and Tools

Text effects Blur and Sharpen effects. Essentials of Chroma and keying. CC Snow, CC Rain, CC Blur effects etc. Learning Tracking fundamentals, Using trackers and stabilizing footages. Using four corner pins to track footage. Pen tool to draw custom shapes and masks. Text tool Puppet Pin and 3D camera tools.

UNIT III

Animation and Dynamics

Understanding Animation basics in after effects.Introduction to graph editor. Applying, selecting, editing, moving, copying and deleting key frames. Animating objects with Motion paths, motion blur and smoothing animation. Adding randomness to key values. Learning Interpolation types like Linear, Bezier and Auto Bezier, Continuous Bezier Interpolation and Hold Interpolation. Controlling speed of the animation.Using time remapping and frame blending.

UNIT IV

Audio and Transitions

Fundamentals of Audio: Technical terminologies related to Audio and Sound. Using Audio files, Synchronizing and editing audio, Controlling Pitch and Temp, Adding effects like Echo, Reverb.

Rendering

Fundamentals of rendering and exporting, Using Render Queue. Exporting still images and sequences. Learning output formats.

Reference Material:

- Broadcast Graphics On the Spot: Timesaving Techniques Using Photoshop and After Effects for Broadcast and Post Production - Richard Harrington
- Motion Graphics: Principles and Practices from the ground up- Ian Crook and Peter Beare
- Trish & Chris Meyer, Creating Motion Graphics, Focal Press
- Richard Harrington and Ian Robinson, Motion Graphics Studio Techniques, Adobe Press
- The After Effects Illusionist: All the Effects in One Complete Guide by Chad Perkins
- Creative Motion Graphic Titling for Film, Video, and the Web: Dynamic Motion Graphic Title Design - Yael Braha and Bill Byrne
- Motion Graphics with Adobe Creative Suite 5 Studio Techniques - Richard Harrington and Ian Robinson

MGM 302
3D Rigging

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Introduction To Rigging

- Basic Human Anatomical Structure
- Joints, Forward Kinematics, Inverse Kinematics
- Mirroring Joints, Reroot Skeleton, Connect/Disconnect Joints
- Joint Orientation

UNIT II

Basic Rigging

- Constraints
- Deformers
- Set Driven Key, Adding Custom Attributes
- Connection Editor, Expression Editor, Reference Editor

UNIT III

Character Rigging

- IK Handle Tool, IK Solvers(Rotate Plane, Single Chain, Spline), IK Controls, IK Preferred Angle, Pole Vector Constraint
- Mechanical Rig Setup: Props, Robots etc.
- Biped Rig Setup
- Quadruped Rig Setup
- IK/FK Switching in Arm Joints

UNIT IV

Skinning and Blend Shapes

- Skinning: Smooth Binding, Interactive Binding
- Editing Skin Weights: Weight Painting, Mirror Skin Weights, Copy Skin Weights, Hammer Skin Weights, Component Editor, Export/Import Skin Weights
- Blend Shapes and Shape Editor
- Editing Blend Shapes: Duplicate, Mirror, Flip
- Facial Controls: Eyelids, Eye brows, Mouth/Lips, Cheeks, Ears, Nose

Reference Material:

- Tina O'Hailey, Rig it Right! Maya Animation Rigging Concepts, Focal Press, 2013, ISBN: 978-0240820798
- Palamar T., Mastering Autodesk Maya 2016, Autodesk Official Press, 2015, ISBN: 978-1-119-05982-0
- Jason Patnode, Character Modeling with Maya and ZBrush, Focal Press, 2008, ISBN: 978-0-240-52034-6
- William Vaughan, Digital Modeling, 2012, ISBN: 978-0321700896

MGM 303
3D Animation and Rendering Techniques

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Animation Principles

- Principles of 2D & 3D Animation
- History of Animation
- Action Analysis

UNIT II

3D Animation Techniques

- Graph Editor
- Dope Sheet
- Walk Cycle, Run Cycle, Jumping
- Animation Parenting: Picking, Pushing, Lifting, throwing Objects
- Animation Layers

UNIT III

Basics of Rendering: Lights, Camera and Materials

- Basic Materials: Base Color, Diffuse, Specular, Reflection, Refraction, Transparency, Glow
- Lights: Point, Spot, Area, Directional, Volume, Ambient
- Camera: Camera Controls, Area Of View, Focal Length, Depth Of Field
- Hypershade Editor
- Rendering Settings: Image Format, Image/Animation extension, Frame Range, Renderable Cameras, Image Size
- Render: Render View, Render IPR View, Batch render, Render Sequence

UNIT IV

Rendering in Arnold

- Ray Tracing
- Renderers in Maya: Maya Software Renderer, Hardware Renderer, Solid Angle's Arnold Renderer
- Arnold Lights: Area, Skydome, Mesh, Photometric, Light Portal, Physical Sky
- Arnold Materials: aiStandard, aiFlat
- Arnold Settings: Sampling, Ray Depth, Motion Blur, AOVs

Reference Material:

- Les Pardew, Character Emotion in 2D and 3D Animation, Cengage Learning PTR, ISBN: 9781598633818
- Richard Williams, The Animator's Survival Kit, Farrar, Straus and Giroux, 2012, ISBN: 978-0865478978
- Ollie Johnston, Frank Thomas, The Illusion of Life: Disney Animation, Disney Editions, 1995, ISBN: 978-0786860708
- Jeremy Birn, Digital Lighting and Rendering, New Riders, 2013, ISBN: 978-0321928986
- Wes McDermott, The PBR Guide: A Handbook for Physically Based Rendering, Allegorithmic, 2018, ISBN: 978-2490071005
- Donna Betancourt, Arnold 5: First Lessons in Autodesk Maya 2018, Amazon Digital Services LLC, 2018

MGM 304
Sound and Video Design

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Introduction

- Introduction to Sound & its forms.
- Mono & Stereo techniques.
- Sound production equipments.

UNIT II

Recording

- Common Recording Techniques
- Recording & formats
- Microphone setup & recording.
- Introduction with Sound effects & their uses
- Assignment: - Recording of audio (commentary, dubbing, music).

UNIT III

Editing

- Basic Sound Editing techniques.
- Basic timeline Editing:- Trim ,add and separate .
- Sound Editing: dialogue editing- Cleaning up audio , noise reduction, etc.
- Assignment :- studio project (recording /Editing) and Field interview

UNIT IV

Mixing

- Understanding – How to mix?
- Levels
- Equalization Technique- Equalizers: History and Application, EQ Parameters, EQ Types
- Panning
- Time based Effects
- Assignment: - Music and effects (Techniques of recording music/effects and their creative use)

Reference Material:

- Audio book publishing, Power Publishers.
- Sound Design: The Expressive Power of Music, Voice and Sound Effects in Cinema, by David Sonnenschein (Author)
- A Thesis in Editing and Sound Design Paperback – 27 Jul 2011
- by Gabriel Lamb (Author)

MGM 305

Web Media Production

Total Marks: 100,
Theory Marks: 75
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit- I

Web Media: Concept, role and responsibilities in society

Web media and social media projects

Digital media components and their advantages

Web enabled media and applications

Unit- II

Web Project stages: Planning, designing, development, testing, maintenance and promotions

Web Team: role and functions

Web team members: Co-operation, Coordination, Collaboration

Web hosting and registration services

Unit- III

Content creation techniques for media projects

Search engine optimization (SEO) techniques

Content streaming strategies and challenges

Web Modules: Emails, logins, weblogs, online polling, comments and feedbacks

Smartphone enabled services

Unit- IV

Cloud applications and securities

Cloud based technologies

Online media apps and tools

Data backup and restoration

Open Elective Paper- (3rd Semester)

Videography

Time: 3 Hrs.
Total Marks: 50

There will be two assignments and two class tests for the subject. The student have to submit at least 02 assignments and they should also have appear in each class tests. The entire syllabus will be practical based.

Unit-I

- TV and Video Production:- Meaning and Scope
- Importance of Concept, Idea and treatment in Production
- Production personnel's, their duties and responsibilities

Unit-II

- Introduction to Video Camera
- Types of Video Camera and their major components
- Basics shots and their composition
- Camera movement and angles

Unit-III

- Video Production Stage and importance
- Video Editing importance and scope
- Editing Problems and ethics
- Lighting techniques, equipments and control

Unit-IV

- Introduction to news anchoring
- Radio Jocky, an introduction
- Social Media emerges as new media
- Story Board and Scripting for T.V. Production

MGM 401: Portfolio Development

Total Marks: 100,
Theory Marks: 75
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit-I

Introduction to portfolio management: objectives and importance

Types of portfolios, phases

Evolution and role of portfolio management

Unit-II

Introduction to electronic portfolio

Benefits of e-portfolio

Process of e-portfolio

e-portfolio formats

Unit-III

Portfolio revision

Need for portfolio revision

Strategies for portfolio constraints

Portfolio assessment

Unit-IV

Portfolio analysis,

Process of portfolio analysis

Types of portfolio evaluation analysis

Need for evaluation, portfolio evaluation tools

MGM 402: Instructional Material Design

Total Marks: 100,
Theory Marks: 75
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit-I

Information processing: meaning, concept and processing

Cognitive information processing of learning

Unit-II

Instructional design: meaning, concept and principles

Instructional material design process, system approach to instructional design

Unit-III

Component of instructional design: instructional problem, learner characteristics, task analysis, instructional objective, content sequencing ,instructional strategies, instructional delivery, Evaluation instruments, instructional resources

Writing of performance objectives/learning outcome

Unit-IV

Models of instructional design: use of instructional design, level of instructional design, Difference between theory and model of instructional design

An overview of Dick and Carey model, ASSURE model and ADDIE model

David Merrill's theory of integration

MGM 403

Multimedia Marketing and Research

Total Marks: 100,
Theory Marks:75
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

Unit I

Research: meaning, objective and types

Introduction to various research approaches

Significance of research

Elements of good research

Unit II

Research process: define research problem, research design,

Research methodologies: survey method, content analysis, case studies Methods of data collection, processing and analyzing the data

Uses of research in multimedia production

Unit III

Marketing: meaning and scope, concept of multimedia marketing,

Tools and elements of multimedia marketing,

Benefits of multimedia marketing,

Multimedia marketing environment, marketing ethics

Unit IV

New trends in marketing: globalization and consumerism, green marketing, direct marketing, network marketing, event marketing.

Product decisions: new product development, product mix, product life cycle, branding and packaging; pricing methods and strategies

Promotion decisions: promotion mix, advertising, sales promotion, publicity and personal selling

MGM 404
Elective – I: (Television Production)

Total Marks: 100,
Theory Marks:50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Introduction

- Introduction to Television Broadcast
- Understanding Media
- Video Basics: Scanning, Aspect Ratio, Formats (NTSC, PAL, VGA, HDTV), Component Interface
- Stages of TV Production: Pre Production, Production and Post Production
- TV Production Team: Writers, Directors, Producers, Actors, Camera Operators, Production Manager, Line Producer, Executive Producer

UNIT II

Still Camera

- Working Principal of Still Camera
- Components of Still Camera
- Types of Still Camera: Compact, SLR, DSLR
- Basic Shots and Composition

Video Camera

- Working Principal of Video Camera
- Components of Video Camera
- Concept of Looking Space, Head Room, and walking space
- Importance of Cut Away, and Cut in Shots
- Camera movements and angles

UNIT III

Lighting

- Importance of Lighting
- Types of Lights: Key, fill, rim, kick, bounce etc.
- Techniques of Lighting
- Lighting Equipment and Control

UNIT IV

Production Process

- TV Studio Production
- Single and Multi Camera Shooting
- Shooting Interview
- TV Production on Air

Reference Material:

- Brett Christophers , Envisioning Media Power: On Capital and Geographies of Television 2006
- Herbert Zettl, Television Production Handbook 2002
- Eve Light Honthaner, The Complete Film Production Handbook 2010

MGM 404
Elective – II: (2D Production)

Total Marks: 100,
Theory Marks:50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Story and Concept

- Story Development: Premise, Story Arc, Character Arc,, Plot, etc.
- Screenplay/Script
- Storyboard, Animatic
- Concept Designs: Composition of a scene, Color, Design, Value, FG, MG, BG elements
- Character Designs: Appeal, Reference, Personality, Visual Contrast

UNIT II

Asset Creation

- Vector graphics vs Raster Graphics
- Symbols: Types of Symbols, Creating and Using Symbols
- Character Development: Expression, Prop, Replacement Parts Library
- Background Development: BG, MG, FG Elements

UNIT III

Animation

- Principles of Animation
- Timing and Spacing in Animation
- Action Analysis
- Character animation: Expressions
- Lip Sync: Basic mouth expression A-E-I-O-U

UNIT IV

Adobe Animate (Flash)

- Timeline, Keyframing, InBetweening and Layering
- 2D Animation Techniques: Shape tween, Motion tween, Frame-By-Frame
- Masking
- Flash library
- Adding a sound in movie clip
- ActionScript
- Publishing & Exporting flash files

Reference Material:

- Fred Gerantabee, Adobe Flash Professional CS6 Digital Classroom, 2012
- Richard Williams, The Animator's Survival Kit, Farrar, Straus and Giroux, 2012, ISBN: 978-0865478978
- Ollie Johnston, Frank Thomas, The Illusion of Life: Disney Animation, Disney Editions, 1995, ISBN: 978-0786860708

MGM 404
Elective – III: (3D Production)

Total Marks: 100,
Theory Marks:50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Story and Concept

- Story Development: Premise, Story Arc, Character Arc,, Plot, etc.
- Screenplay/Script
- Storyboard, Animatic
- Concept Designs: Composition of a scene, Color, Design, Value, FG, MG, BG elements
- Character Designs: Appeal, Reference, Personality, Visual Contrast

UNIT II

Asset Creation

- Modeling: Polygon Modeling, NURBS/Surface Modeling, Sculpting (Zbrush)
- UV mapping and Texturing
- Environment Development
- Character Topology for Animation
- Character Rigging for Animation: Joints, FK/IK, Skinning, Constraints etc.

UNIT III

Animation

- Principles of Animation
- Timing and Spacing in Animation
- Action Analysis
- Character animation: Expressions
- Lip Sync: Basic mouth expression A-E-I-O-U

UNIT IV

3D Animation Techniques and Render

- 3D Animation Techniques: Motion Paths, Set Driven Key, Animation Layers, Animation Parenting
- Using Graph Editor, Dope Sheet
- Camera Animation: Camera Angles, Shots, and Movement in 3D
- Look Dev: Materials/Shading, Lighting, Fog/Atmosphere
- Rendering Settings, Render Layers(AOVs), Batch Render
- Compositing

Reference Material:

- Tina O'Hailey, Rig it Right! Maya Animation Rigging Concepts, Focal Press, 2013, ISBN: 978-0240820798
- Palamar T., Mastering Autodesk Maya 2016, Autodesk Official Press, 2015, ISBN: 978-1-119-05982-0
- Jason Patnode, Character Modeling with Maya and ZBrush, Focal Press, 2008, ISBN: 978-0-240-52034-6
- Richard Williams, The Animator's Survival Kit, Farrar, Straus and Giroux, 2012, ISBN: 978-0865478978
- Ollie Johnston, Frank Thomas, The Illusion of Life: Disney Animation, Disney Editions, 1995, ISBN: 978-0786860708

MGM 404
Elective – IV: (Sound Production)

Total Marks: 100,
Theory Marks:50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Introduction

- Sound: Physics, Importance and Use
- Properties of Sound: Pitch(Bass, Treble), Amplitude, Timbre, Duration, Envelope, Location
- Sound Aesthetics: Rhythm, Harmony, Contrast, Emotiveness, Resonance etc.
- Digital vs. Analogue Sound

UNIT II

Sound Modulation, Filters and Effects

- Voice Modulation
- Types of Sound Effects
- Noise, Echo, Reverb, Distortion
- Audio Filters: Meaning & Types
- Equalization: Meaning, Types & Process

UNIT III

Sound Recording and Equipments

- Sound Recording History
- Sound Recording Equipment
- Types of Sound: Mono, Stereo, Surround
- Types of Surround Sound: 5.1, 6.1 ,7.1
- Voice Over and Dubbing
- Using Logic Pro X for Creating and Recording Sound

UNIT IV

Sound Editing

- Adobe Audition Interface
- Sound Editing Techniques: Sound Bridge, Voice Over, Sonic Flashback, J-Cut, L-Cut
- Removing Noise from Samples
- Adding Effects: Delay, Echo, Reverb, Distortion, Equalization, Pitch Shift, Time Stretch, Modulation, Compression.

Reference Material:

- Talbot, Michael -Smith, Sound engineering explained, Focal Press, 2011
- Nisbett, Alec, The sound studio: audio techniques for radio, television, film and recording, Focal Press, 2003
- Mott, Robert L., Sound effects: radio, TV, and film, Focal Press, 1990
- Sonnenschein, David, Sound design: the expressive power of music, voice, and sound effects in cinema, Michael Wiese Productions, 2001
- Viers, Ric, The Sound Effects Bible: How to Create and Record Hollywood Style Sound Effects, Michael Wiese Productions, 2008
- Altman, Rick, Sound theory, sound practice, Routledge, 1992
- Alburger,James, The Art of Voice Acting, Focal Press, 2010, ISBN: 9780240812113
- Rumsey,Francis and TIM MCCORMICK, Sound and Recording,Focal Press 2009, ISBN: 9780240521633

MGM 404
Elective – V: (Web Production)

Total Marks: 100,
Theory Marks:50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct. .

UNIT I

Introduction

- Introduction to Web Designing
- Basic Elements of a Web Page
- Introduction to HTML
- Static and Dynamic Web Pages

UNIT II

Frontend: HTML, CSS, JS

- Basic Structure of a Web Page
- Basic Tags: Links, Images, Fonts, Colour and Character entities
- Lists and Tables
- Block and Text level Elements
- Introduction to CSS
- CSS Properties

UNIT III

Web Design

- Layout Design of a Web Page
- Interface between HTML and other coding languages
- Working with External Libraries: Bootstrap & jQuery
- Using Bootstrap Components
- Project: Frontend for a Blogging Website

UNIT IV

Backend: PHP, SQL

- PHP Basics
- Introduction to MySql: Creating Databases and Tables
- MySql Queries: Inserting, Deleting, Updating Data
- Querying MySql Database in PHP (PDO)
- PHP Form Handling using GET and POST Method
- Project: Building a Students Directory with working Login and Signup Pages

Reference Material:

- Deitel, Deiteland Nieto, Internet and World Wide Web : How to Program, Edition, 2012, Prentice Hall, ISBN: 978-0-13-215100-9
- Stephen Wynkoop, Running a perfect website, QUE, 2nd Edition, 2001. ISBN: 9780789709448
- Chris Bates, Web Programming: Building Intranet applications, 3rd Edition, 2009, Wiley Publications,. ISBN: 9780470017753

MGM 404
Elective – VI: (Android Application Development)

Total Marks: 100,
Theory Marks:50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT I

Introduction to Android

- What is Android?
- Basic Building Blocks of Android
- Application Structure
- Virtual Android Emulator and project setup
- Android API levels (versions & version names)

UNIT II

Java & SQL Basics

- OOP
- Inheritance
- Exception handling
- Packages & interfaces
- SQLite Programming

UNIT III

Android Programming Basics

- Views
- Intent
- Activities
- Storage and Content Providers
- Services
- Basic UX/UI: Form widgets, Text Fields, Layouts

UNIT IV

Advance Concepts

- Multimedia Services
- Maps, GPS and Location Based Services
- Animations and Graphics
- Publishing Apps to PlayStore

Reference Material:

- Dawn Griffiths, David Griffiths,"Head First: Android Development", OReilly 2015, ISBN: 9781449362188
- Greg Milette, Adam Stroud, "PROFESSIONAL Android™ Sensor Programming", John Wiley and Sons, Inc 2012, ISBN: 978111265055
- Paul Deital, Harvey Deital, Alexander Wald, "Android 6 for Programmers, App Driven approach", 2015, Prentice Hall, ISBN: 9780134289366
- http://developer.android.com/training/index.html

MGM 404
Elective – VII: (Graphic Designing)

Total Marks: 100,
Theory Marks: 50
Practical Marks: 25
Internal Assessment: 25
Time: 3 Hrs. *(For Theory Exam)*

Question paper for each theory paper will have two questions from each of the four units. Students will be required to answer any one Question from each unit. Unit V of the Question paper will have six questions out of which the student will require to answer any four Questions. Each unit will carry equal marks. Students have the option to attempt questions either in Hindi or English but within an answer to a question the language should be pure and correct.

UNIT-I

Introduction to graphics

- Introduction to graphics, tools of graphics, uses & types of graphics
- Meaning and definition of graphics design
- Elements and principles of graphic design
- Graphics Overview: Raster graphics, Vector graphics

UNIT-II

Corel draw

- Tools and menus, Effects and masking
- social advertising
- Cartoon character design, Product design

Photoshop

- Introduction to Photoshop, workspace and photo editing tools
- Filters and Adjustments
- Digital matte painting

Unit-III

Illustrator

- Introduction to Illustrator, Applications and features, Illustrator interface
- Aligning objects, working with groups, arrange object, distributing objects. Templates
- Transforming objects: Scaling, Reflection, Distorting and Shearing objects
- Coloring and painting
- Using effects, appearance attributes and graphics styles

Unit – IV

Publishing

- Authoring and process of publishing
- Publishing types, newspaper and magazine publishing
- Research papers and publications
- Packaging and its types, Functions of Packaging

Paper: MGM-405

Training / Internship

Total Marks: 100,
Training / Internship : 75
Internal Assessment: 25

The internship is compulsory for the students. Students have to go for internship for six weeks with an organization related to the field of specialization they opted. Marks awarded will be based on the report submitted by the student and assessment report given by the employer. The report will be evaluated by a panel of three examiners to be appointed by the Director of the Institute.

Introduction

Each student shall be supposed to prepare an internship/training report with CD/DVD (soft copy) content during the last semester of the course. The project work will be purely practical work. This report will be prepared in accordance with the format provided by the institute. Report should be printed both side with hard bound. Report should contain minimum 40-50 pages of text, graphics, visuals etc.

Each student will write his/her report according to the following format:

- Idea/concept of the project
- Treatment of the project
- Technical equipment used
- Workflow of the project
- Contribution of the student
- Main observations during the training
- Key points of learning

The students have to prepare a training project report under the supervision of the concerned teacher in the Institute. Students will submit a soft copy of the project to the concerned teacher.

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Dissertation/Project
Paper-405

Total Marks	:	100
Report Writing	:	40 Marks
Viva-Voce	:	40 Marks
Internal Assessment	:	20 Marks

Students should submit a dissertation report/project according to specialization opted/selected by him. This report/project should be submitted to the Institute before the commencement of 4^{th} semester theory examination.

Project/Report to be evaluated by a panel of three examiners to be appointed by the Director of the Institute.

Open Elective **Semester- II**

Paper code: **Credits: 2**

Creative and Critical Skills Enhancement

Course objective: The objective of this course is to acquaint students with the conceptual understanding of creativity and critical thinking and help them in using the same for better decision making.

Course contents:

Creativity: introduction, creative folk attributes, blocks to creativity, techniques for generating new ideas, creative designing; Critical Thinking and problem solving: Thinking out of the box, brainstorming sessions, group problem solving; Emotional Intelligence: Self awareness using Johari window, self management and self discipline, EQ self assessment; Personality Identification: Personality type using personality tests, choice of career according to personality type; Professional communication skills: Public speaking, interview skills, group discussion, presentation and writing skills

References:

Edwards, B. *Drawing on The Right Side of the Brain.* Souvenir Press. 4th edition

Goleman, D. *Emotional Intelligence.* Bloomsbury Publishing India Pvt. Ltd. 2017

Greenberg, J. *Behaviour in Organizaions.* Pearson Education. 10th edition

Murphy, H. A. *Effective Business Communication.* McGraw Hills. 7th edition

Robbins, S. P., Judge, T. A., & Vohra, N. *Organization Behaviour.* Pearson Educaion.13th edition

Sinha, K. K. *Business Communication.* Galgoia Publishing Co.

Semester- II

Open Elective

Rural Community Engagements-I :-

1. Rural Society, Transformation and PanchayatiRaj :- Dynamics of Rural Society, Panchayati Raj System:Social,Economics Political and Cultural Community Goal Setting: SAGY, MPLADS and UBA.

2. Participatory Learning, Social, Mapping Resource Mapping :- Approaches and Methods, Community Project Proposal and Project Management, Concept and Steps, Thematic Maps, Social Maps, Transect Walk, Seasonal Map, Natural and Human Resource Mapping and Management, Ethnographic Research.

3. Rural Resilience and Resource Efficiency :- Vulnerability, Rural Resilience- Risk Reduction, Role and Responsibilities Rehabilitation: Social, Physical and Psychological aspects increasing efficiency in Water, Energy, Sanitation and Waste (Solid and Liquid) Management.

4. Rural Institutions Close to Community :- Engagement with School of competency enhancement/Street Committee for resource efficiency/Health Centre/ Panchayat/ Gram Sabha/ SHGs Awareness: Rural Health Management, Indigenous or Folk Medicine & Hygiene/Sports/Rights/ Policies &Programmes/Transparency/Corruption /Social Benefits, addressing issues in inclusive development and inclusive identification of beneficiaries, improving implementation efficiency

while plugging leakages in benefit schemes, Direct Benefit Transfer.

OPEN ELECTIVEPAPER **Semester -III**

OE Competency Mapping

Maximum Marks: 50
Internal: 50
Credits: 02

Objectives: -The objective of the course is to provide both theoretical and application-oriented inputs on competency mapping and developing mapped competencies and understand the various approaches towards building a competency model

Note: For internal evaluation the students will be evaluated by the concerned teachers on the criteria such as – written test, class attendance, assignment writing, presentation, viva-voce etc.

Course Contents:

Competency: Concept and definition of competency, Characteristics of competency, Types of competencies – generic/specific, threshold/performance, and differentiating and technical, managerial and human, competency culture: Context and Relevance of competencies in modern organizations.**Competency mapping** :process of competency mapping, approaches of competency mapping,**competency modeling** : phases of competency model, classification of competency models ,iceberg's model of competency,**competency Assessment** : perquisites for competency assessment, process of competency assessment,Techniques used in assessment : MAP, MBTI, FIRO-B, SPIRO-M profile, 360 degree feedback.

Suggested Readings:

1. The Handbook of Competency Mapping: Understanding, Designing and Implementing Competency Models in Organizations, SanghiSeema. Sage Publications Pvt. Ltd - 2007
2. Competency based HRM Shermon, Ganesh. Tata Mc Graw Hill – 2004
3. 360 degree feedback, competency mapping &assessment centers ,Sharma, Radha R. , Tata Mc Graw Hill – 2003
4. Competency based Human resource management, Srinivas R. Kandula , PHI publications.

Semester- III

Social Media Analytics

Course Objective

The course aims at developing understanding of social media analytics & its various tools. It aims to introduce the necessary theories and the state-of-the art techniques in web mining, networks analysis and information retrieval to study emerging problems with social media. These problems include information diffusion, recommendations, behavior analysis, and event analytics in social media. The ultimate goal of this course is to sharpen problem solving skills of the students, and prepare them with this unique set of expertise for the increasing demands in IT industry and for in-depth advanced research.

Course Content

Introduction to Social Media Listening, role, structure and evaluation of social media conversation

Opinion Science and Dynamics: Evaluation and judgement of social media contributions, online social intelligence

Applying aspects of social media monitoring to business decisions

Key Social Media Metrics: Graph Essentials: Graph theory and Centrality Measures, Network Analysis: and Data Application Program Interface(API), Centralization and Social Theory, Network Statistical Models, Social Media Clusters: Natural Language Processing, Fake News, Influence, Subgroup Analysis, Sentiment Analysis,

Suggested Reading

"Social Network Analysis with Applications": Ian McCulloh, Helen Armstrong and Anthony Johnson, Wiley, 2013.

"Social Media Mining: An Introduction", Reza Zafarani, Mohammad Ali Abbasi, and Huan Liu, Cambridge University Press, 2014.

Mining the Social Web". 2nd Edition. Matthew A. Russell, O'Reilly Media. 2013.

Social media analytics: effective tools for building, interpreting & using metrics, Sponder, Marshall Mc Graw Hill education.

Social media Analytics, Techniques and Insights for extracting business value out of Social media, Gains,Matthew; Kohirkar,Avinash Pearson

Semester- III

Rural Community Engagement-II:-

5.Gram Panchayat Development and Village Disaster Management Plan:	Making of Gram Panchayat Development Plan including aspects and process of preparation of Village Disaster Management Plan, village livelihoods, rural tourism, entrepreneurship, appropriate technology access including digitized transactions.
6. Rural Field Engagement :-	Community Project and Participatory Rural Appraisal, Land and Human Resource Mapping and Action Research with Community Organization. On field Learning: Preparation of Gram Panchayat Development Plan Village Resource Planning, Participation in Agri/Craft Operations and Value addition in village, Working with SHGs and CBOs.

SYLLABUS FOR ONE YEAR CERTIFICATE COURSE IN COMMUNICATION SKILLS, Session 2019-20

SCHEME OF STUDY

	Name of the Paper	Periods/Week
1.	Oral Communication	4 Periods
2.	Written Communication	4 Periods
3.	Personality Development	4 Periods

SCHEME OF EXAMINATION

	Name of the Paper	No. of Paper	Marks	Time
1.	Oral Communication	I	60+15*	3 Hrs
2.	Written Communication	II	60+15*	3 Hrs
3.	Personality Development	III	60+15*	3 Hrs

* 60 marks for External Examination and 15 marks for Internal Assessment.

Paper-I - Oral Communication

Time: 3 Hours | **Max. Marks: 60**
Internal Assessment : 15

Note: - 1. Nine questions will be set in all by the examiner and the candidates are required to attempt five questions in all including one compulsory question.
2. Question No. 9 is compulsory consisting of short answer type questions and spread over the entire syllabus. Phonetic Transcription (10 Marks), other short answer type questions (10 Marks) (10+10 = 20 Marks)
3. The remaining eight questions are to be set from 4 units, at least two questions from each unit. The candidate is required to attempt four questions, selecting at least one question (10 marks each) from each unit. (10 * 4 = 40 Marks)

UNIT-I: Communication: Meaning, Nature, Importance and Purpose of Communication, Types of Communication, Process of Communication, Communication Network in an Organisation, Strategy for Effective Communication, Verbal and Non-Verbal Communication, Barriers to Communication.

UNIT-II: The Process of Listening, Barriers to Listening, Types of Listening, Benefits of Effective Listening, Note Taking ad Note Making.

UNIT-III: Spoken English in India, The Organs of Speech, Description and Articulation of English Speech Sounds, Syllables and Stress (Weak Forms, Intonation), Connected Speech, Spelling and Pronunciation, International Phonetic Alphabet Transcription of Received Pronunciation of Words as per the Oxford Advanced Learners Dictionary of H.S. Hornby.

UNIT-IV: Presentation Skills; Interview Skills- Preparing for an Interview, Interview Techniques, Public Speaking, Preparing the Speech, Organising the Speech, Delivering the Speech.

Classroom Practice:
- Greeting and introducing.
- Practising Short Dialogues.
- Group Discussions, Seminars/Paper-Presentations.
- Listening News/Conversations/Telephonic Conversation.

*** Internal assessment will be marked on the basis of Presentations in the class.**

Suggested Readings:

1. Sethi, J & et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
2. Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
3. Prasad, P. Communication Skills, S.K. Kataria & Sons.
4. Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
5. Roach Peter. English Phonetics and Phonology.
6. A.S. Hornby's. Oxford Advanced Learners Dictionary of Current English, 7th Edition.

Paper-II - Written Communication

Time: 3 Hours **Max. Marks: 60**
Internal Assessment : 15

Note:- 1. Nine questions will be set in all by the examiner and the candidates are required to attempt five questions in all including one compulsory question.

2. Question No. 9 is compulsory consisting of short answer type questions and spread over the entire syllabus. (20 marks)

3. The remaining eight questions are to be set from 4 units, at least two questions from each unit. The candidate is required to attempt four questions, selecting at least one question from each unit. (10 * 4 = 40 Marks)

UNIT-I: Reading Skills: Purpose, Process, Methodologies Strategy, Reading Comprehension.

UNIT-II: Effective Writing Skills: Elements of Effective Writing, Main Forms of Written Communication: Agenda, Minutes, Notices, Writing of CV, Memo, Drafting an E-mail, Press Release. Correspondence: Personal, Official and Business, Report Writing, Dialogue writing, Essay writing.

UNIT-III: Idioms and Phrases, Words Often Confused, One Word Substitutes, Prefixes, Bases and Suffixes (Derivational & Inflectional), Idioms and Phrases.

UNIT-IV: Remedial Grammar and Usage, Important Aspects of English Grammar and Usage, Phrases and Clauses.

Classroom Practical:

- Based on entire syllabus.

*** Internal assessment will be marked on the basis of writing tests in the class.**

Suggested Readings:

1. Prasad, P. The Functional Aspects of Communication Skills, Delhi.
2. Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
3. McCarthy, Michael. English Vocabulary in Use, Cambridge University Press.
4. Rajinder Pal and Prem Lata. English Grammar and Composition, Sultan Chand Publication.

Paper-III – Personality Development

Time: 3 Hours **Max. Marks: 60**
Internal Assessment : 15

Note:- 1. Nine questions will be set in all by the examiner and the candidates are required to attempt five questions in all including one compulsory question.

2. Question No. 9 is compulsory consisting of short answer type questions and spread over the entire syllabus. (20 marks)

3. The remaining eight questions are to be set from 4 units, at least two questions from each unit. The candidate is required to attempt four questions, selecting at least one question from each unit. (10 * 4 = 40 Marks)

UNIT-I: Soft Skills: Improving soft skills; Personality Development-Personality Analaysis, Vivekananda's Concept of Personality Development, Personality Traits; Personality Types.

UNIT-II: Career Planning- Benefits; Motivation and Achieving goals; SWOT Analysis, Team Building and Team work.

UNIT-III: Values-Power of Values, Personal Values, Cultural Values, Social Values, Etiquette; Classification of Etiquette, Significance of Self-discipline.

UNIT-IV: Time Management- Analysis of Time Matrix, Effective Scheduling; Stress Management-Effects of Stress; Kinds of Stress, Sources of Stress.

* Internal Assessment will be marked on the basis of Questions, Group Activity and Self-Assessment test.

Suggested Readings

1. Alex, K. (2010) Soft Skills, S. Chand Publishing, New Delhi.
2. Mitra, Barun K. 2011 Personality Development and Soft Skills, Oxford University Press.

Department of Social Work
Kurukshetra University Kurukshetra

Syllabus of Master of Social Work

(Choice Based Credit System)

W.E.F.2016-17

Time	:	03 Hours
Maximum Marks	:	100 Marks
Theory	:	80 Marks
Internal Assessment	:	20 Marks, Division of Marks as given below:-

One Test / Seminar: 50% (For Each Paper)
One class Test: 25% (One Period Duration)

Attendance: 25%, Marks of Attendance will be given as under:-

*	91% onwards	:	05 Marks
*	81% To 90%	:	04 Marks
*	75% To 80%	:	03 Marks
*	70% To 74%	:	03 Marks
*	65% To 69%	:	01 Marks

* For students engaged in co-curricular activities of the University only/ authenticated medical ground duly approved by the concerned Chairperson.

Scheme of Examination for Master of Social of Work

The MSW (Master of Social Work) Examination has been divided into four semesters spread over two years. Every student has to pass 132 Credit [**112 Compulsory + 16 Optional Credit and 4 Credit (2 in semester –II and 2 in semester –III) from Optional Elective Paper from Other Departments] out of 196 credit** is necessary to earn the degree under the new scheme i.e. **Choice Based Credit System.**

However, the choice of Optional credit is subjected to the availability of teaching faculty in the Department. The paper scheme detail semester – wise is as follow:-

Sr. No.	Name of the Subject /Paper	No. of credit	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)		
			L	T	P	(Sem. Theory exam)	Internal Assessment	Total
Master of Social Work (MSW) Semester-I								
MSW(C) -101	Society and Current Social Problems	4	4	-----	-----	80	20	100
MSW(C) -102	Human Growth and Development-I	4	4	-----	-----	80	20	100
MSW(C)- 103	Social Work Profession: Philosophy and Concepts	4	4	-----	-----	80	20	100
MSW(C)- 104	Social Case Work-I	4	4	-----	-----	80	20	100
MSW(C)- 105	Social Group Work-I	4	4	-----	-----	80	20	100
MSW(C)- 106	Community Organization and Social Action-I	4	4	-----	-----	80	20	100
MSW(C)- 107	*Field Work Practicum	8	-----	-----	8x2= 16	175	25	200
	Total (A)	**32**						**800**

*** Field Work (Detail of marks)**

- External Viva-Voce: 150
- Organizational Visits: 25
- Fieldwork Internal Assessment: 25

Master of Social Work (MSW) Semester-II								
MSW(C) -201	Social Justice and Social Legislation in the New Millennium (21st Century)	4	4	-----	-----	80	20	100
MSW(C) -202	Human Growth and Development-II	4	4	-----	-----	80	20	100
MSW(C) -203	Health Care, Needs and Services	4	4	-----	-----	80	20	100
MSW(C) -204	Social Case Work-II	4	4	-----	-----	80	20	100
MSW(C) -205	Social Group Work-II	4	4	-----	-----	80	20	100
MSW(C) -206	Community Organization and Social Action-II	4	4	-----	-----	80	20	100
MSW(C) -207	*Field Work Practicum	8	-----	-----	8x2= 16	175	25	200
	**Open Elective Paper	2	1	-----	-----	50	----	50
	Total (B)	**34**						**850**

*** Field Work (Detail of marks)**

- External Viva-Voce: 150
- Summer Placement: 25
- Fieldwork Internal Assessment: 25

****** Open Elective Paper (to be opted out of various subjects offered by faculty of Social Sciences.)

Master of Social Work (MSW) Semester-III								
MSW(C) -301	Social Policy and Planning: Current Issues and Strategies	4	4	-----	-----	80	20	100
MSW(C) -302	Administration of Social Welfare	4	4	-----	-----	80	20	100
MSW(C) -303	Social Work Research and Statistics-I	4	4	-----	-----	80	20	100
MSW(C) -304	Mental Health Care, Services and Counseling	4	4	-----	-----	80	20	100
Candidate has to choose any one Specialization out of Group I to V during 3rd and the same has to be continued in 4th semester.								
Group-I Human Resource Management, Industrial Relations and Labour Welfare								
MSW(E) -305	Human Resource Management and Industrial Relations-I	4	4	-----	-----	80	20	100
MSW(E) -306	Labour Welfare and Labour Legislations-I	4	4	-----	-----	80	20	100
Group-II Family and Child Welfare								
MSW(E) -307	Family Dynamics: Issues & Needs-I	4	4	-----	-----	80	20	100
MSW(E) -308	Developmental Services for Women and Children-I	4	4	-----	-----	80	20	100
Group-III Medical And Psychiatric Social Work								
MSW(E) -309	Policy and Development of Health Care-I	4	4	-----	-----	80	20	100
MSW(E) -310	Psycho-social Perspectives on Mental Health-I	4	4	-----	-----	80	20	100
Group-IV Community Development								
MSW(E) -311	Rural Community Development: Policies and Programmes-I	4	4	-----	-----	80	20	100
MSW(E) -312	Urban Community Development: Policies and Programmes-I	4	4	-----	-----	80	20	100
Group-V Criminology and Correctional Administration								
MSW(E) -313	Crime and Criminal Justice-I	4	4	-----	-----	80	20	100
MSW(E) -314	Institutional Services & Rehabilitation of Criminals-I	4	4	-----	-----	80	20	100
MSW(C)- 315	*Field Work Practicum	8	-----	-----	8x2= 16	175	25	200
	**Open Elective Paper	2	1	-----	-----	50	----	50
	Total (C)	**34**						**850**

*** Field Work (Detail of marks)**

- External Viva-Voce: 150
- Field Work Presentation: 25
- Fieldwork Internal Assessment: 25

****** Open Elective Paper (to be opted out of various subjects offered by faculty of Social Sciences.)

Master of Social Work (MSW) Semester-IV								
MSW(C) -401	Dynamics of Social Development in View of Globlization	4	4	-----	-----	80	20	100
MSW(C) -402	Population, Environment & Disaster Management	4	4	-----	-----	80	20	100
MSW(C) -403	Social Work Research and Statistics-II	4	4	-----	-----	80	20	100
MSW(C) -404	Emerging Areas of Social Work Practice	4	4	-----	-----	80	20	100
Group-I Human Resource Management, Industrial Relations and Labour Welfare								
MSW(E) -405	Human Resource Management and Industrial Relations-II	4	4	-----	-----	80	20	100
MSW(E) -406	Labour Welfare and Labour Legislations-II	4	4	-----	-----	80	20	100
Group-II Family and Child Welfare								
MSW(E) -407	Family Dynamics: Issues & Needs-II	4	4	-----	-----	80	20	100
MSW(E) -408	Developmental Services for Women and Children-II	4	4	-----	-----	80	20	100
Group-III Medical And Psychiatric Social Work								
MSW(E) -409	Policy and Development of Health Care-II	4	4	-----	-----	80	20	100
MSW(E) -410	Psycho-social Perspectives on Mental Health-II	4	4	-----	-----	80	20	100
Group-IV Community Development								
MSW(E) -411	Rural Community Development: Policies and Programmes-II	4	4	-----	-----	80	20	100
MSW(E) -412	Urban Community Development: Policies and Programmes-II	4	4	-----	-----	80	20	100
Group-V Criminology and Correctional Administration								
MSW(E) -413	Crime and Criminal Justice-II	4	4	-----	-----	80	20	100
MSW(E) -414	Institutional Services & Rehabilitation of Criminals-II	4	4	-----	-----	80	20	100
MSW(C)- 415	*Field Work Practicum	8	-----	-----	8x2= 16	175	25	200
	Total (D)	**32**						**800**
GRAND TOTAL (A+B+C+D)		**132**						**3300**

*** Field Work (Detail of marks)**

- External Viva-Voce: 150
- Block Placement: 25
- Fieldwork Internal Assessment: 25

Paper Code -MSW(C)-106

Community Organization & Social Action-I

Credits : 04

Max. Marks. : 100
Theory : 80
Internal Assessment : 20
Time 3 Hours

Objectives: To make the students

1. To understand the basic elements of community organization practice
2. To enhance analytical understanding of the approaches/models and strategies for community organization practice.
3. To understand the critical issues in community organization process.
4. To develop skills necessary to engage in community organization practice.

Unit-1

- Community and community engagement: concept, nature, types and approaches.
- Community Organization- concept, nature, objectives, values, scope, process and related concepts: community work, community development, community action.
- Community organization as a method of social work intervention.

Unit- II

- Principles of community organization
- Strategies in community organization such as bargaining, confronting, collaborating, problem-solving, educating, social advocacy, joint action, persuasion and campaign.
- Skills in and techniques of community organization practice.
- Participative learning and social mapping: concept, approaches and steps; thematic mapping, social mapping, transact walk, resource mapping - natural and human resource mapping.
- Roles of social worker in community organization.

Unit- III

- W. Biddle's enabling/encouraging approach and Saul Alinsky's dynamics of power approach to community organization/development.
- Models of community organization- locality development model, social planning model and social action model.
- Theory of community engagement; school, family and community partnership.

Unit- IV

- Problems in development of community work in India- such as problems of community welfare councils, community chests, public relations and community participation.
- Community based disasters; risk and risk reduction role and responsibilities.
- Practical records in community settings and their discussions.

Note.

- The examiner will set 9 questions in all.
- Candidate will be required to attempt five questions.
- Question No. 1 will be compulsory, consisting of 5 short answer type questions covering all the units of the whole syllabus, to be answered with in 100 words. Each question carry 4 marks (5X4=20 marks).
- Candidates are required to attempt other 4 long answer type questions, by selecting one from each of the four units. Each unit shall have two questions of 15 marks each. (4X15=60 Marks)

Refrences

1. Brager,G. and Specht,H.,1969	Community Organisation,New York: Columbia University Press.
2. Brown, M. J. (2006).	Building powerful community organizations: A personal guide to creating groups that can solve problems and change the world. Arlington, MA: Long Haul Press.
3. Chanan, G.2013	Rethinking Community Practice, Rawat Publications, Jaipur
4.Eric Mann**.** 2011	Playbook for Progressives: 16 Qualities of a Successful Organizer Beacon Press.
5. Gangrade, K. D. 1971.	Community Organization in India, Mumbai; Parkashan, 1971.
6. Gangrade, K. D. 2001.	Working with communities at grass root level: Strategies and Programmes, Radha Publications.
7. Gilchrist , A and Taylor,M. ,2012	The Short Guide to Community Development, Rawat Publication, New Delhi
8. Karamer, R.M. & Spech,H.1983	Reading in Community Organization Practice-Hall Inc.
9. Loretta Pyles, 2009	Progressive Community Organizing: A Critical Approach for a Globalizing World, Routledge.

10. Lakshmipathi Raju M 2012 — Community Organization and Social Action: Social Work Methods and Practices, Regal Publications, N. Delhi

11. M, Warren. and K, Mapp.2011 — A Match on Dry Grass: Community Organizing as a Catalyst for School Reform Oxford.

12. Mahatma Gandhi National Council of Rural Education, 2018 — Rural Immersion: A Manual for Rural Engagement. Ministry of Human Resource Development, Govt. of India

13. McMiller,W.1945 — Community Organisation for Social Welfare, Chicago: University of Chicago Press.

14. Murphy C. G.1954 — Community Organization Practice, Boston; Houghton Miffin Co.

15. Perlman, R. and Gurin, A.1972 — Community organization and social planning. New York: John Wiley

16. Popay J, Attree P, Hornby D, Milton B, Whitehead M, French B, et al. — Community engagement in initiatives addressing the wider social determinants of health: a rapid review of evidence on impact, experience and process. Lancaster: University of Lancaster; 2007.

17. Ross M.G.1955 — Community Organisation:Theory,Principles and Practice, New York: Harper and Brothers.

18. Rubin & Rubin 2008 — Community Organising and Development, Printice Hall. Inc

19. Samuel H. Taylor and Robert W. Roberts 2013 — Social Work Practice with Communities, Rawat Publications, New Delhi

20. Sengupta, P.K.1976 — Community Organization Process in India, Kiran Publishers.

21. Sheridan K, Tobi P. 2010 — Towards a community engagement strategy: some practical notes. Br J Healthcare Manag ;16:123–8.

22. Si Kahn. 2008 — Creative Community Organizing: A Guide for Rabble-Rousers, Activists, and Quiet Lovers of Justice, Berrett-Koehler.

23. Siddique, H.Y.1997 — Working with Communities: An Introduction to Community Work, New Dehli, Hira Publications.

24. Specht, H & Karmer: R.M.; 1969 — Reading in Community; Englewood Cliffs: Prentice Hall.

25. Weil,M (ed.) 1996 — Community Practice: Conceptual Models, New York; The Haworth Press.Inc.

26. Zastrow Charles: 1978. — Introduction to social Welfare Institution Social Problems, services & Current Issues (Social work Community Practices Part-3 Chapter-10) Ontario: The Dorsey Press. Delhi.

Paper Code-MSW(C)-206

Community Organization & Social Action - II

Credits : 04
Max. Marks. 100
Theory : 80
Internal Assessment : 20
Time 3 Hours

Objectives

1. To understand the basic elements of community development / social action and mass communication.
2. To enhance analytical understanding of the approaches/models and strategies for community development/social action practice.
3. To understand the critical issues of local self government and community power structure for effective community organization practice.
4. To develop skills necessary to engage in community organization/social action practice.

Unit-I

- Rural and Urban Development- meaning, concept, scope and Current Developmental programmes
- Slum Community: concept, characteristics, problems and current schemes and programmes for slum dwellers. Role of Social Worker in Slum Community.
- Study of rural institutions: Engagement with School, Street Committee, Health Centre, Panchayat and Self Help Groups.

Unit- II

- Community Project and Participatory Rural Appraisal: Features, Techniques and uses.
- Introduction to Local Self- Government (Rural &Urban)- meaning, attributes, organization and function.
- 73^{rd} & 74^{th} Amendments of India Constitution.
- Community Power Structure – concept, sources and its importance for community organization.

Unit- III

- Community Empowerment-concept, principles, process and barriers
- Different types of conflicts like communal, regional and caste conflicts.
- Social Action- concept, strategies, steps and models
- Social Movements - Narmada Bachao Andolan, Chipko Movement, J. P Movement in Bihar.

Unit- IV

- Mass communication-concept and methods
- Models of mass communication.
- Use of mass media for community organization/social action.
- Discussion on practical records in different community setting.

Group-III
Paper Code –MSW(E)-309

Policy and Development of Health Care-I

Credits :04
Max Marks. 100
Theory : 80
Internal Assessment : 20
Time: 3 Hours

Objectives:

1. To gain knowledge about the concept of Health and Mental Health as an important part of life and become familiar with the policy and programmes in health and mental health care.
2. To develop an understanding of minor and major health problems with a focus on psychiatric disorders.
3. To understand the relevance and types of social work interventions in the fields of health and mental health.
4. To develop skills to function as Medical and Psychiatric social workers in child & adult, school, family and psychiatric setups.

UNIT-I

- Concept of Health: individual and community health.
- Health and Social Work, medical social work: meaning, nature, scope.
- Health problems-economic considerations, social and cultural aspects.
- National Health Policy: national health programmes a critical analysis.
- Identification of needs of health and other related services in India.

UNIT-II

- Major health problems of the disadvantaged such as T.B., leprosy, malaria and other communicable diseases.
- Psycho-social effects of disabilities on growth and development.
- Specialized services-problems of the deaf, blind and orthopedically handicapped.

UNIT-III

- Review of mental health services, economic aspects and effectiveness of various models of treatment.
- Psycho-Social treatment & therapies i.e. RET, Client Centered therapy, Gestalt therapy, Cognitive behaviour therapy.
- Health work in the hospitals: work with patient, individual groups and community, family and collaterals.

UNIT-IV

- Rehabilitation services-concept, nature and services for psychiatric and the physically disabled.
- Prevention of mental health problems and promotion of mental health.
- Role and functions of Social Workers in hospital and in community health.
- Role of Social Workers, individually and as a part of a team of professionals.
- Role of international organizations in health care.

Group-III
Paper Code –MSW(E)-310

Psycho-Social Perspectives of Mental Health-I

Credits	**:04**
Max Marks.	**100**
Theory	**: 80**
Internal Assessment	**: 20**
Time: 3 Hours	

Objectives:

1. To gain knowledge and develop an understanding of minor & major psychiatric disorders, their causes, symptoms, diagnosis manifestations and management.
2. To develop appropriate skills and attitude required for the practice of mental health and psychiatric social work.
3. To develop a critical perspective of health care and mental health care services and programmes in India and in the world.

UNIT-I

- Concept of normality and abnormality.
- Concept of mental health, Epidemiology of mental illness: Extent and prevalence of mental disorders at National and International Levels.
- Classification of mental disorders: WHO approach (ICD-10) and American Psychiatric Association approach (DSM-IV & IV-TR).
- Scope of Psychiatric Social Work and role of Psychiatric Social Worker.

UNIT-II

- Psychoneurotic disorders: magnitude of the problem worldwide and analysis of the problem from different perspectives.
- Delirium and Dementia: Alzheimer's disorder: causes, symptoms & treatment.
- Psychoneurotic disorders: anxiety states, hysteria, obsessive compulsive reactions; Causes, symptoms and treatment
- Neurotic depression and neurasthenia: symptoms and treatment methods.
- Somatoform disorders: conversion disorder (Hysteria), Hypochondrias is, Pain disorders; causes, symptoms, types and treatment.

UNIT-III

- Psychotic reactions-Schizophrenia, Manic Depressive Psychosis (MDP) causes, types and treatment.
- Paranoid State: types, symptoms, treatment and rehabilitation
- Epilepsy-types and management
- Mental Retardation causes, types-management and rehabilitation, role of family and parents.
- Personality disorders: nature, causes and types; concept of gender identity.

UNIT- IV

- Practice of Psychiatric Social work in different settings: family services agencies, child welfare agencies, school setting, general hospitals, de-addiction centres.
- Mental Status Examination, case recording, case preparation and presentation.
- Major approaches in psychiatric social work, Community mental health, community psychiatry.

Group-III
Paper Code –MSW(E)-409

Policy and Development of Health Care-II **Credits :04**

Max Marks. 100
Theory : 80
Internal Assessment : 20
Time: 3 Hours

Objectives:

1. To develop a critical perspective of health care services in programmes in the context of health scenario in India.
2. To develop a holistic and integrated approach to social work practice in the field of health.
3. To develop a scientific attitude to the health conditions
4. Gain understanding of relevance, domains and nature of social work interventions in health and psychiatric settings.

UNIT-I

- Emotional aspects of illness, social perception of illness.
- Indicators of health status of people. Concept of patient and his role.
- Health Care Services in India: structure and functions, primary health care; concept, issues availability and problems. National Rural Health Mission (NRHM). Role of NGOs in providing health services.
- Polyclinic, nursing homes, quacks and rural health services
- Different systems of medicine and their role: Ayurveda, Homeopathy, Unani and Allopathy.

UNIT-II

- Medical conditions requiring intervention cancer, ulcers, Burns, Poisoning snake bite.
- Cancer: types, awareness and treatment.
- Cancers of reproductive organs, breast cancer, uterus.
- Role of Social Work in prevention.

UNIT-III

- Policy for specialized groups and diseases.
- Indian and western treatment and approaches to various psychiatric problems.
- Field instructions supervision, recording, documentation and evaluation in psychiatric social worker practice.

UNIT-IV

- Community Health and its progress: People's participation, school health services, health insurance systems.
- Role of Social Worker in policy development for health.
- Preparing family and community for the return of the affected individual.
- Follow up, Public health and its programmes.

Group-III
Paper Code –MSW(E)-410

Psycho-Social Perspectives of Mental Health-II

Credits :04
Max Marks. 100
Theory : 80
Internal Assessment : 20
Time: 3 Hours

Objectives:

1. To Understand and analyze mental health problems and services in Indian Context.
2. To develop non-judgmental attitudes to those experiencing problems of mental health.
3. To equip students for their role as Medical and Psychiatric Social Workers.

UNIT-I

- Concept of Psychiatry and Psychopathology.
- History of mental health care in India and in western countries.
- The field of Psychiatric social work: basic concept, historical development, value concepts understanding psychiatric social work practice.

UNIT-II

- Meaning of Sociology of mental illness
- Social concept of mental illness; mental illness as a social problem
- Patient and Society; Health, Medicine and Society
- Hospital as a social organization
- Child & Adolescent psychiatric disorders: Autism, ADHD, Temper tantruns Eating disorder, Sleep Disorder.

UNIT-III

- Concept of therapeutic community and open mental hospital.
- Development of mental health profession and man-power, private practice, problems and limitations of treatment.
- Property rights of certified mental patient, insanity as defense.
- Community consciousness of mental health.

UNIT-IV

- Government Policy on mental health care. Mental Health Act, 1987.
- Recent trends in mental health services: mental hospitals, psychiatric clinics, nursing homes, psychiatric emergency, team approach
- Community Mental Health and units in general hospital.
- Industrial mental health services.

Note.

- The examiner will set 9 questions in all.
- Candidate will be required to attempt five questions.
- Question No. 1 will be compulsory, consisting of 5 short answer type questions covering all the units of the whole syllabus, to be answered with in 100 words. Each question carry 4 marks (5X4=20 marks).

B.Tech Instrumentation Engineering

SCHEME OF EXAMINATIONS

B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-HSM-201	Project Planning Estimation and Management	2	2	--	--	2	40	60		100	3 Hrs
IN-ES-203	Basic Instrumentation Engineering	3	2	1		3	40	60		100	3 Hrs
IN-PC-205	Network Analysis	3	2	1		3	40	60		100	3 Hrs
IN-PC-207	Transducers and Applications	3	2	1		3	40	60		100	3 Hrs
IN-PC-209	Linear Integrated Circuits	3	2	1		3	40	60		100	3 Hrs
IN-PRIE-09	Instrumentation Lab	1	--	--	2	2	20		30	50	3 Hrs
IN-PRNA-11	Network Analysis Lab	1	--	--	2	2	20		30	50	3 Hrs
IN-PRTR-13	Transducer lab	1.5	--	--	3	3	30		45	75	3 Hrs
IN-PRLIC-15	Linear Integrated Circuits Lab	1.5	--	--	3	3	30		45	75	3 Hrs
	Total	19	10	4	10	24	300	300	150	750	

B.Tech. 2ND YEAR (SEMESTER–IV) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PC-202	Power Electronics-I	3	2	1	--	3	40	60		100	3 Hrs
IN-BS-204	Mathematics -III	3	2	1	--	3	40	60		100	3 Hrs
IN-PE-206	Control System Components	3	2	1	--	3	40	60		100	3 Hrs
IN-PC-208	Electrical Machines	3	2	1	--	3	40	60		100	3 Hrs
IN-PC-210	Digital Techniques	3	2	1	--	3	40	60		100	3 Hrs
IN-PRPE-10	Power Electronics Lab-I	1.5	--		3	3	30	--	45	75	3 Hrs
IN-PRCS-12	Control System Lab-1	1.5	--		3	3	30	--	45	75	3 Hrs
IN-PRDT-14	Digital Lab	1	--		2	2	20	--	30	50	3 Hrs
IN-PRSIM-16	Simulation Lab	1	--		2	2	20	--	30	50	3 Hrs
	Total	20	10	5	10	25	300	300	150	750	

B.Tech Instrumentation Engineering

SCHEME OF EXAMINATIONS

B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2019-20)

IN-HSM-201 Project Planning Estimation and Management

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-HSM-201	Project Planning Estimation and Management	2	2	--	--	2	40	60		100	3 Hrs

Course Outcomes

The objective of this course is to familiarize the prospective engineers with basics in economics and

Management. It aims to equip the students to deal with advanced aspects of project appraisals and management aspects.

The students will learn:

- The project proposal fundamentals
- The effective demand forecast analysis and tools for statistical analysis
- The basics of economics and management practices in project funding and control

PROGRAM OUTCOMES

1. Graduates will be able to apply fundamental knowledge in mathematics, science, electronics and instrumentation for solving engineering problems.
2. Graduates will be able to identify and analyze complex engineering problems in the areas of electronics, instrumentation and automation.
3. Graduates will be able to solve open-ended technical problems and be proficient in the design, test, and implementation of electronics, instrumentation and control systems.
4. Graduates will attain skills to conduct experiments/investigations and interpret data with reference to systems and standards related to electronics and instrumentation engineering.
5. Graduates will have proficiency in system design tools and software packages related to electronics and instrumentation.
6. Graduates will have knowledge in the area of instrumentation engineering to assess and address societal, health, safety, legal and cultural issues.
7. Graduates will have broad education necessary to understand the impact of engineering solutions and sustainable development in environmental and societal context in the field of Instrumentation.
8. Graduates will be able to understand and uphold professional, ethical, and social responsibilities in Instrumentation engineering.
9. Graduates will be able to function efficiently as an individual or in team in process and automation industries.
10. Graduates will have ability to communicate effectively in written, oral and instrumentation formats to put forth solutions and prepare detailed engineering report in the process and automation industries.
11. Graduates will be able to apply the knowledge, skill and attitude as a team player in initiating, executing and managing projects in the areas of design, manufacture, marketing and entrepreneurship in multi-disciplinary environments.
12. Graduates will be able to conduct information searching and processing and develop the ability for lifetime-learning in field of Instrumentation engineering.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1								**S**		**S**	**S**	**S**
CO2								**S**		**S**	**S**	**S**
CO3								**S**		**S**	**S**	**S**
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

IN-HSM-201 Project Planning Estimation and Management

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises

4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Module-1

Project Development Cycle: Pre-investment phase, implementation phase, operational phase. Aspects of Appraisal: Market Appraisal, Technical Appraisal, Financial Appraisal, Economic Appraisal. Objectives of investment decision making. Scouting for project ideas; Preliminary Screening, compatibility with the promoter, consistency with governmental prioritize, availability of inputs, Adequacy of the market, Reasonableness of cost, Acceptability of Risk Level.

Module--II

Market and Demand Analysis: Information required for Mauler and Demand Analysis, Secondary sources of information, Market Survey - Steps in sample survey, Demand Forecasting, Uncertainty in Demand forecasting, Method of Forecasting, Environmental Changes, coping with uncertainties.
Technical Analysis: Material and inputs; Product Technology; Choice of Technology, Acquiring Technology, Appropriateness, of Technology, Product Mix, Plant Capacity, Location of site.

Module--III

Financial Estimates: Cost of Project, Main Components, Means of financing, Planning the Capital structure of a new company, Norms of the Controller of Capital issue, Norms and requirements of All India Financial Institutions, Stock Exchange stipulation, Difficulty in raising External Finance, Designing the capital structure.

Module--IV

Project Planning & Control: Functions of Planning, Areas of planning, Project objectives and policies, life cycle of a project, Tools of Planning, Hierarchy of plans; Project Control- Reasons for ineffective control, variance Analysis Approach, Performance Analysis, Modern Approach to Control.

Reference Books:

1. Project Preparation, Appraisal, Budgeting Implementation by Parsanna Chandra, Tata Mc-Graw Hill.

B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2019-20)

IN-ES-203 Basic Instrumentation Engineering

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-ES-203	Basic Instrumentation Engineering	3	2	1		3	40	60		100	3 Hrs

Course Outcomes

- To understand basics of electrical and electronics measuring instruments
- To compute different types of errors that can occur during the measurement and to use the methods to correct the measurement errors.
- To learn the calibration of various electrical measuring instruments
- To learn the measurement of different Electrical Parameters

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak	
COs	Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt all questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Module- - I

Introduction: Block diagram of measuring instruments, characteristics of instruments, classification of instruments, classification of standards, error in measurement, relative, systematic, random error, and parabolic errors.

Basic instruments: Principle, Construction, Features, Analysis & Performance of moving coil instrument (D'Arsonval Galvanometer Vibration galvanometer, flux meter, ratio meter, Meggger), a) Moving iron instruments, b) Electrodynamic instruments, c) electrostatic instruments, d) Induction Instruments.

Module- II

Measurement of energy: Energy meters for Ac circuits, theory of induction type meters, single phase induction type Watt-meters, construction, theory, operation, Two element energy meter, average demand indicator.

Module-- III

Measurement of R,L, and C: Measurement of resistance (low, medium, high).Kalvin's double bridge, bridge controlled circuits, inductance bridge (Maxwell's), Capacitance bridge (Hay's), Wein, Anderson and Schearing bridges.

Module- - IV

DC potentiometers, Basic potentiometer circuit, Compton type & multiple range potentiometer, constructional details & precision type potentiometers & their applications, AC potentiometer, Power meter, field strength meter, phase meter, vector impedance meter, Q meter, LCR bridge.

Reference Books:

1. Electronic Instrumentation By H.S.Kalsi, TMH
2. Electronic Instrumentation Techniques By Cooper Halfrick, PHI

3. Electronic Instrumentation & Measurement By A.K.Sawhney, Dhanpat Rai & Sons
4. Electrical Measurements By Baldwin
5. Electronic Instruments and Measurement By Jones & Chin
6. Principles of measurement &Instrumentation by Alan S. Morris
7. Electrical, Electronics measurement & Instrumentation, by JB Gupta

IN-PRIE-09 Instrumentation Lab

IN-PRIE-09	Instrumentation Lab	1	--	--	2	2	20		30	50	3 Hrs

List of Experiments: (A minimum of 12 experiments are to be done)

1. Determination of B-H curve of an iron ring specimen
2. Measurement of resistance using Wheat stone's bridge
3. Measurement of self/mutual inductance and coupling coefficient of iron cored coil and air cored coil
4. Calibration of dynamometer type wattmeter, using precision type Vernier potentiometer
5. Extension of range of ammeter and calibration of the extended meters using standard ammeter
6. Extension of range of voltmeter and calibration of the extended meters using standard voltmeter
7. Extension of range of a dynamometer type wattmeter using CT/PT and calibration of the extended meter using a standard wattmeter
8. Calibration of single-phase energy meter by direct loading and phantom loading at UPF
9. Calibration of single phase energy meter using standard wattmeter
10. Measurement of capacitance using Schering bridge
11. Measurement of branch voltages in a series RLC circuit using A.C potentiometer
12. Calibration of static Single Phase Energy Meter
13. Calibration of static Three Phase Energy Meter
14. Measurement of unknown voltage using Vernier potentiometer and voltmeter calibration.
15. Draw the V - I characteristics of linear and non-linear resistance
16. Calibrate the given single phase energy meter by phantom loading at 0.5 and 0.866 PF lag
17. Calibrate the given single phase energy meter by phantom loading at 0.5 and 0.866 PF lead.
18. Measurement of resistance using Kelvin's double bridge

Expected outcome

At the end of this course, the student will be able to measure various electrical quantities, extent meter ranges and calibrate instruments.

Text Books

- E.W. Golding and F.C. Widdis, Electrical Measurements and Measuring Instruments, Reem Publishers
- A.K. Sawhney, A course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai and sons
- Joseph J Carr, Elements of electronic Instrumentation and Measurement, Pearson Education

B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2019-20)

IN-PC-205 Network Analysis

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PC-205	Network Analysis	3	2	1		3	40	60		100	3 Hrs

Course Outcomes

- To model linear circuits and systems using differential equations and Transfer Functions..
- To expose to the concept of poles and zeros.
- To develop equations for large linear circuits by using network laws, and analyse their responses to different types of signals in time domain.
- To familiarise with two port network parameters.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt all questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

IN-PC-205 Network Analysis

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Module-- I

Topology: Principles of Network Topology, graph matrices, network analysis using graph theory. Transient Response: Transient Response of RC, RLC, TL circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

Module-- II

Network Functions: Terminal pairs or ports, network functions for one-port and two-port networks, pole and zeros of network functions, restrictions on pole and zero locations for driving point functions and transfer functions, time domain behavior from pole-zero plots. Stability criteria of active networks

Module- - III

Characteristics and parameters of two port networks: Relationship of two port variables, short circuit admittance parameters, open circuit impedance, parameters, transmission parameters, hybrid parameters, relationship between parameter sets, interconnection of two port networks, T and π networks, lattice networks, terminated two port networks

Module-- IV

Fundamental of filters, filter networks, equation of filter network, classification and characteristic impedance of band low-pass, high-pass, band-pass & band-reject, constant K pass filters, m – derived. Network synthesis: Herwitz Polynomial, positive real functions, synthesis of one port and two port networks, elementary idea of active networks and frequency response.

Text Books:

1. Network Analysis A.Sudhakar&S.P.Shyammohan TMH
2. Introduction to Modern Network Synthesis Van Valkenburg, PHI
3. Network Analysis By Van Valkenburg, PHI
4. Network Analysis By G.K.Mithal, Khanna Publication
5. Networks and Systems by D.Roy Choudhury; New Age International

Reference Books:

1. Reza F. M. and Seely S., “Modern Network Analysis”, Mc.Graw Hill Book Company
2. Roy Choudhury D., “Networks and Systems”, New Age International Publishers.
3. Kuo F. F., “Network Analysis & Synthesis”, John Wiley & Sons.

IN-PRNA-11 Network Analysis Lab

IN-PRNA-11	Network Analysis Lab	1	--	--	2	2	20		30	50	3 Hrs

NETWORKS LAB

List of Experiments

2nd Year / 4th Semester

Subject: Network Analysis Lab (PR-2307)

S.No	Experiments
1.	To find out the cut-off frequency of RC Low pass filter.
2.	To find out the cut-off frequency of RC High pass filter.
3.	To find out the Impedance or z-parameters for two port network.
4.	To find out the Admittance or y-Parameters of two port network.
5.	To find out the hybrid or h-Parameters for two port network.
6.	To find out the transmission or ABCD- Parameters for two port network.
7.	To find out the impedance or Z-parameters for series connected two -two port network.
8.	To find out the admittance of Y –parameters for parallel connected two –two port network.
9.	To find out the transient response of series connected RC Network.
10.	To find out the transient response of parallel connected RC Network.

B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2019-20)

IN-PC-207 Transducers and Applications

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PCC-207	Transducers and Applications	3	2	1		3	40	60		100	3 Hrs

Course Outcomes

- To understand and analyze basicsof transducers/ sensors
- To study the principles and operation of various transducers
- To describe functional elements of any measurement system and to list static and dynamic characteristics of the measuring instruments.
- To use different types of transducers for various industrial purposes.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	**Course title**	**Credits**	**Teaching Schedule**				**Allotment of marks**				**Duration of Exams**
			L	**T**	**P**	**Total**	**Minor test + Curricular activities**	**Major test**	**Practical**	**Total**	
IN-PC-207	Transducers and Applications	3	2	1		3	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt all questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

IN-PC-207 Transducers and Applications

Module-I

Introduction of Transducer and its classifications, basic requirements of transducer/Sensors. Displacement Transducers: LVDT, RVDT, potentiometric, Variable Reluctance, Variable Capacitive displacement Transducers and Hall Effect Devices.

Tachometers: DC tachometers, AC tachometers, Bearing tachometers, magnetic speed sensors, impulse tachometers, stroboscopic tachometers, variable-reluctance tachometers, photoelectric tachometers, eddy current tachometers, hydraulic tachometers, vibration measurement. Accelerometers: Bonded strain gauge accelerometer, Piezoelectric accelerometer, seismic mass accelerometer, servo accelerometer and digital accelerometer.

Module-II

Strain Gauge Transducers: Basic principle of operation of Resistance strain gauge, type of Electrical strain gauges and their theories (wire gauges, unbounded strain gauges, foil gauges, semiconductor strain gauges and thin film gauges), Materials for strain gauges and strain gauge circuits (potentiometer and Wheatstone Bridge circuits). Force Transducers; load Cell, Hydraulic Load Cell Torque Transducers: Absorption type, transmission Type, Stress Type, Deflection type.

Module-III
Pressure transducers: Manometers, Elastic transducers, High Pressure transducers, Mcloed Gauge, Pirani-gauge, Ionization gauge, Knudsen Gauge, pressure smart transmitters. Temperature Transducers: Resistive transducers (Platinum Resistance Thermometer), Thermistor, Thermoelectric sensors, Solid-state Sensors & Pyrometers.

Module-IV
Flow Transducers: Classification of flow meter, Volume flow Sensors (orifice, Nozzle, Venture, Pitot type) Turbine type, Rotometers, Anemometers, Ultrasonic, Mass flow meters, Positive displacement type flow-meter, Open channel flow measurement, E.M. Flow-meter. Level Transducers: Thermal effect type, Electric methods (Resistive method, Conductance probe method, Inductive level gauging and capacitive method), Ultrasonic method. Acoustics sensors: ceramic microphones, capacitor microphones, electric microphones, magnetic microphone, Humidity sensors: Hair hygrometer, electrode hygrometer, moisture sensors.

Reference Books:

1. Principles of Industrial Instrumentation by D.Patranabis, TMH
2. Instrumentation measurement & Analysis by Nakra, Chaudry, TMH
3. Instrumentation Devices & Systems by Rangan Mani Sarma, TMH
4. Instrumentation for Engineers by J.D.Turner

IN-PRTR-13 Transducer lab

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
INE-PRTR-13	Transducer lab	1.5	--	--	3	3	30		45	75	3 Hrs

Course Outcomes

It aims to get the practical ability to the students with standard concepts and tools at an intermediate to advanced level to perform the experiments related to the theory paper IN-PC-207 Transducers and Applications.

Laboratory Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

- Identify various elements required for characterization of given transducers/sensors.
- Design and conduct experiments for measurement, characterization, and ability to analyze and interpret data.
- Communicate effectively in oral and written form while formulating experiments, reports and other related documents.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												

CO2												
CO3												
CO4												
CO5												

TRANSDUCER LAB

1. Local cell characteristics
2. Strain gauge characteristics
3. RTD and thermisters characteristics
4.Thermocouple calibration
5.Hall Effect sensor
6.Tachometer
7.Capacitive sensor characteristics
8.Inductive sensor characteristics- LVDT
9. Flapper – Nozzle characteristics
10. LDR and optocoupler characteristics
11.Synchro characteristics
12.Vibration sensor
13. Elastic transducers – characteristics

Program Education Objectives (PEOs):
The Undergraduate students will demonstrate..

I. To provide the students with solid foundation in mathematics, science andInstrumentation Engineering to solve real world problems appropriate to the discipline.
II. To able to apply current industry accepted practices, new and emerging technologies toanalyze, design, implement, and maintain state-of-art solutions.
III. To exhibit self- learning capabilities to assimilate and practice emerging theories andtechnologies. Exhibit teamwork and effective communication skills.
IV. To inculcate professional and ethical attitude and ability to relate automation issues tosociety at large.
V. To successfully employed or accepted into a graduate program / higher studies, anddemonstrate a pursuit of lifelong learning.

PROGRAM OUTCOMES

1. Graduates will be able to apply fundamental knowledge in mathematics, science, electronics and instrumentation for solving engineering problems.
2. Graduates will be able to identify and analyze complex engineering problems in the areas of electronics, instrumentation and automation.
3. Graduates will be able to solve open-ended technical problems and be proficient in the design, test, and implementation of electronics, instrumentation and control systems.
4. Graduates will attain skills to conduct experiments/investigations and interpret data with reference to systems and standards related to electronics and instrumentation engineering.
5. Graduates will have proficiency in system design tools and software packages related to electronics and instrumentation.
6. Graduates will have knowledge in the area of instrumentation engineering to assess and address societal, health, safety, legal and cultural issues.
7. Graduates will have broad education necessary to understand the impact of engineering solutions and sustainable development in environmental and societal context in the field of Instrumentation.
8. Graduates will be able to understand and uphold professional, ethical, and social responsibilities in Instrumentation engineering.
9. Graduates will be able to function efficiently as an individual or in team in process and automation industries.

10. Graduates will have ability to communicate effectively in written, oral and instrumentation formats to put forth solutions and prepare detailed engineering report in the process and automation industries.
11. Graduates will be able to apply the knowledge, skill and attitude as a team player in initiating, executing and managing projects in the areas of design, manufacture, marketing and entrepreneurship in multi-disciplinary environments.
12. Graduates will be able to conduct information searching and processing and develop the ability for lifetime-learning in field of Instrumentation engineering.

Program Outcomes (POs):

The Undergraduate Students will demonstrate.

a. An ability to apply knowledge of mathematics, Science and Engineering toInstrumentation and Control Discipline

b. An ability to design and conduct experiments for measurement, measurement devices /elements, Control System, variety of control algorithms paradigms, final controlelements, etc., and ability to analyze and interpret data.

c. Be able to apply the principles and practices for instrument / system / equipment /device design and development to real world problems adhering to safety andregulatory standards as applicable.

d. Be able to work effectively in a various team (may be multidisciplinary teams).

e. An ability to identify, formulate and solve a problem in Instrumentation and ControlEngineering

f. Understand the social impact of automation, safety aspects of automation, hazardsassociated with various processes, environmental issues, professional ethics, etc.

g. An ability to communicate effectively in oral and written form while formulating projectproposals, reports and other related documents.

h. Understand the impact of Instrumentation and Control solutions in a global, economic,environmental, and societal context.

i. Demonstrate the knowledge and capabilities necessary for pursuing a professionalcareer or graduate studies; recognize the need for continuing professionaldevelopment.

j. Understanding of contemporary and emerging technology for various processes and24systems.

k. Ability to select and use latest hardware and software tools for various processes andsystems.

l. Demonstrate an understanding of sensors / transducers, Control system, completeautomation system.

m. Demonstrate proficiency in using a high-level / low level programming languages andnetwork protocols for embedded system applications and networked systems.

IN-PC-209 LINEAR INTEGRATED CIRCUITS

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Acquire knowledge in identifying implementation areas of op-amps for specific purpose.

CO2: Design and construct circuit's depending upon applications.

CO3: Analyze the circuits using modern simulation software

CO4: Design electrical circuits, devices, and systems to meet application requirements.

CO5: Design a project as a team

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S									
CO2	S	S	S									
CO3				S	S							
CO4		S	S									
CO5								S	S	S	S	S

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PCC-209	Linear Integrated Circuits	3	2	1		3	40	60		100	3 Hrs
IN-PRLIC-15	Linear Integrated Circuits Lab	1.5	--	--	3	3	30		45	75	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions among the 4-modules, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the 4-modules, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

IN-PCC-209 Linear Integrated Circuits Details of the Course Contents

Module-1

The basic operational amplifier, the differential amplifier, the emitter coupled differential amplifier, transfer characteristics of differential amplifier, offset error voltages and currents, input bias current, input offset current, input offset current drift, input offset voltage, input offset voltage drift, output offset voltage, PSRR, slew rate and universal balancing techniques, measurement of Op-Amp parameters

Module -II

Op-Amp Circuit Stability, Frequency and Phase Response, Freq. compensating methods, Op-Amp Circuit Bandwidth. Op-Amp applications: Inverter, scale changer, adder, analog integration and differentiation(brief explanation with circuit diagram), wave form generator (square wave, pulse and triangle wave generator),

Module -III

Op-Amp Applications II: Instrumentation Amplifier, Precision Half Wave Rectifier, Precision Full Wave Rectifier, limiting Circuits, Clamping Circuits, Peak Detectors, Sample & Hold Circuits, logarithmic Amplifier, inverting Schmitt Trigger Circuit, Phase Shift Oscillator, Oscillator Amplitude Stabilization, Wien-Bridge Oscillator.

Module -V

Regulated Power Supplies: Regulator Action, Regulator Performance, Voltage follower Regulator (Design & performance), Adjustable Voltage Regulator (Design & performance),Stabilization, Output Current limiting (Short circuit Protection) (Fold-back Current limiting), I.C. Regulators (Basic Idea). The 555 I.C. Timer, and its applications, Voltage Time Base Generators, Step (Stair Case) Generators.

References:

1. Microelectronics by MillmanGrabel, TMH
2. Electronic Principles by Malvino, TMH
3. Integrated Electronics by MillmanHalkias, McGraw Hill
4. Op-Amps & Linear Integrated Circuits by R.A.Gayakwad, PHI

IN-PRLIC-15 Linear Integrated Circuits Lab

Course No.	Course title	Credits	Teaching Schedule	Allotment of marks	Duration

			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	of Exams
INE-PRLIC-15	Linear Integrated Circuits Lab	1.5	--	--	3	3	30		45	75	3 Hrs

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Design basic application circuits using op-amp.
CO2: Understand and implement the working of basic digital circuits
CO3: Design multivibrators and voltage regulators
CO4: Design Counters and Timers
CO5: Design and Fabricate small projects using simulation tools and hardware

LIST OF EXPERIMENTS : Experiments beyond the syllabus should be conducted

1. Op-Amp parameters.
2. Op-Amp Application 1: Inverting, non-inverting.
3. Op-Amp Application 2: square wave generator, differentiator, integrator, log amplifier .
4. Design of astable, monostable multivibrators
5. Application of IC voltage regulator.
6. Op-amplifier as Rectifiers.

B.Tech. 2ND YEAR (SEMESTER–IV) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PC-202	Power Electronics-I	3	2	1	--	3	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each**

Course Outcomes

After successful completion of this course, the students should be able to

1. Identify, formulate & solve engineering problems with simulation.
2. Simulate characteristics of SCR, MOSFET, IGBT, gate firing circuits.
3. Formulate Thyristor Analogy and Thyristor Protection.
4. Simulate Rectifiers and on hardware kits.
5. Simulate Cyclo-converter circuit.

PROGRAM OUTCOMES

1. Graduates will be able to apply fundamental knowledge in mathematics, science, electronics and instrumentation for solving engineering problems.
2. Graduates will be able to identify and analyze complex engineering problems in the areas of electronics, instrumentation and automation.

3. Graduates will be able to solve open-ended technical problems and be proficient in the design, test, and implementation of electronics, instrumentation and control systems.
4. Graduates will attain skills to conduct experiments/investigations and interpret data with reference to systems and standards related to electronics and instrumentation engineering.
5. Graduates will have proficiency in system design tools and software packages related to electronics and instrumentation.
6. Graduates will have knowledge in the area of instrumentation engineering to assess and address societal, health, safety, legal and cultural issues.
7. Graduates will have broad education necessary to understand the impact of engineering solutions and sustainable development in environmental and societal context in the field of Instrumentation.
8. Graduates will be able to understand and uphold professional, ethical, and social responsibilities in Instrumentation engineering.
9. Graduates will be able to function efficiently as an individual or in team in process and automation industries.
10. Graduates will have ability to communicate effectively in written, oral and instrumentation formats to put forth solutions and prepare detailed engineering report in the process and automation industries.
11. Graduates will be able to apply the knowledge, skill and attitude as a team player in initiating, executing and managing projects in the areas of design, manufacture, marketing and entrepreneurship in multi-disciplinary environments.
12. Graduates will be able to conduct information searching and processing and develop the ability for lifetime-learning in field of Instrumentation engineering.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		M								
CO2											M	
CO3									M			
CO4			M	S							S	
CO5		M	S			S			S		S	

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

POWER ELECTRONICS-I

Module-I

Introduction to power devices: Constructional features & characteristics of thyristors, MOSFET, IGBT, MCT. Triggering & switching: Various triggering devices used for thyristor.

Module -II

Thyristor Analogy: Two transistor analogy, series and parallel operation of thyristors.
Protection: Protection of SCR against over current, over voltage, high dv/dt, and high di/dt.

Module -III

Classification of Rectifiers, Phase Controlled Rectifiers: Single phase half wave controlled, Fully wave and half controlled rectifiers with Resistive, Inductive and e.m.f. loading and their performance parameters. Three phase half wave, full wave and half controlled rectifiers with resistive and inductive and emf loading and their performance.

Module -IV
Cycloconverter: Introduction & principle of working cycloconverter; types of cycloconverter; enveloped type & phase controlled type , features of cycloconverter; voltage wave form, circulating mode of operation, circulating current free modes, cycloconverter under discontinuous conduction, effect of source inductance on the performance of cycloconverter, network reaction, Advantages and disadvantages of cycloconverter .

References:

1. Modern Power Devices by B.JayantBalica, New Age Inter.
2. Power Electronics by P.C. Sen (TMH)
3. An Introduction to Thyristors and Their Applications by M. Ramamurthy (EWP)
4. Power electronics by Ned Mohan and Robins, John Wiley and Sons
5. Power Electronics by M. Rashid (PHI)
6. Thyristor Phase Controlled converters and Cyclo-converters by B.R.Pelly
7. Power Electronics by VendemSubrahmanyam, New Age International

B.Tech. 2ND YEAR (SEMESTER–IV) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PRPE-10	Power Electronics Lab-I	1.5	--		3	3	30	--	45	75	3 Hrs

LIST OF EXPERIMENTS STUDY EXPERIMENTS :
1.Study of characteristics of SCR,MOSFET,IGBT
2.Study of Gate firing circuits
3.Pulse Width Modulation techniques

SIMULATION EXPERIMENTS :
1. Single Phase Half wave controlled converter with R,RL&RLE Load (for firing angles 30,60,90)with/without FD
2. Single Phase Half controlled converter with R,RL&RLE Load (for firing angles 30,60,90)with/without FD
3. Single Phase Full controlled converter with R,RL&RLE Load (for firing angles 30,60,90)with/without FD
4. Three Phase semi controlled converter with R,RL&RLE Load
5. Three Phase full controlled converter with R,RL&RLE Load
6. Single phase AC Voltage Controller with R&RL Loads
7. Boost converter and buck converter with open loop and closed loop operations
8. Single Phase inverter
9. Single Phase cyclo converter

HARDWARE EXPERIMENTS :
1.Thyristorised drive for PMDC motor with speed measurement and Single Phase Half controlled rectifier and full controlled rectifier
2. Closed loop control of DC Motor using three face fed four quadrant chopper drive.
3.IGBT based 4 quadrant drive for PMDC Motor with speed measurement and closed loop control
4.Three Phase input Thyristorised drive for Dc Motor with closed loop control
5.Speed control of three Phase 3-Phase wound Induction Motor
6.DC Jones chopper
7.Single Phase Series Inverter
8.Single Phase Parallel Inverter

1.Characteristics of
a) SCR,
b) MOSFET,
c) IGBT
2. Gate firing circuits of SCR,
3. Single phase AC Voltage controller with R & RL loads
4. Single phase fully controlled bridge converter with R&RL loads
5. Forced competition circuit trainer (Class A,B,C,D& E)
6. DC jones chopper with R&RL loads
7. Single phase parallel inverter with R & RL loads

PROGRAM OBJECTIVES & OUTCOMES

PROGRAM OBJECTIVES:

1. To simulate and design various gate firing circuits.
2. To familiarize the students by introducing softwares like P- sim, Multisim, and help them to simulate and analyze different converters.
3. To enable the students to study & simulate circuits using Matlab software and on hardware kits.

PROGRAM OUTCOMES:

1. Ability to design and conduct simulation and experiments.
2. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
3. Ability to identify, formulate & solve engineering problems with simulation.
4. Ability to simulate characteristics of SCR, MOSFET, IGBT.
5. Ability to simulate gate firing circuits
6. Ability to simulate Rectifiers, AC voltage controller on hardware kits.

B.Tech. 2[ND] YEAR (SEMESTER–IV) (w.e.f.2019-20)

IN-BS-204 Mathematics -III

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-BS-204	Mathematics -III	4	3	1	--	4	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each**

B.Tech. 2[ND] YEAR (SEMESTER IV) (w.e.f.2019-20)

IN-BS-204 Mathematics -III

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in complex variables, Fourier series, statistics and probaility . It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The mathematical tools needed in evaluating contour integration.
- The effective mathematical tools for statistical analysis
- The tools of Bessel and series solution, Fourier series to analyze harmonics used in various techniques dealing engineeringproblems.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S									
CO2	S		S	S								
CO3	S		S									
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	**Course title**	**Credits**	**Teaching Schedule**				**Allotment of marks**				**Duration of Exams**
			L	**T**	**P**	**Total**	**Minor test + Curricular activities**	**Major test**	**Practical**	**Total**	
IN-BS-204	Mathematics -III	4	3	1	--	4	40	60		100	3 Hrs

IN-BS-204 **Mathematics –III** Detailed contents:

Module-I

Bessel functions: series solution of Bessel differential equation, Bessel function of first kind Jn(x), generating function for Jn(x), recurrence relations.

Legendre Polynomials: Legendre differential equation, Legedre polynomials Pn(x) as solution of legedre differential equation for (n>0), generating function for Pn(x), recurrence relations, Orthoganality of Pn(x).

Module -II

Fourier Series: Euler's formulae, conditions for Fourier expansions, Fourier expansion of functions having points of discontinuity, change of interval, odd & even functions, half range series. Fourier Transforms: Fourier Integrals, Fourier transforms, Fourier cosine and sine transforms, Properties of Fourier Transforms, convolution theorem, Parseval's identity, relation between Fourier and Laplace transforms

Module -III

Function of a complex variables: Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, harmonic functions, Taylor and Laurent series, singular points, residues, evaluation of residues at poles, and poles of mth order, Cauchy's residue theorem, the Cauchy's principle value, evaluation of definite integrals.

Module -IV

Probability Distributions: Probability, Baye theorem, Discrete & Continuous probability distributions, discrete random variable, probability function, distribution function, Mathematical expectation, expectation of a sum of random variables, expectation of product of independent variables.

Binomial distribution, the Poisson distribution, the normal distribution, relation between a normal and a binomial distribution, the mean deviation of a normal distribution, area under normal error curve, fitting of normal curve, the normal and Gaussian law of error, applicability of the normal law of error, normal error distributions, chi square test-definition, conditions, test of independence, goodness of fit, test of homogeneity, limitations.

Text / References:

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory" , Universal Book Stall,2003.
3. S. Ross, " AFirst Course in Probability", Pearson Education India, 2002.
4. W. Feller, " AnIntroduction to Probability Theory and its Applications" , Vol. 1, Wiley, 1968.
5. N.P.BaliandM.Goyal,"AtextbookofEngineeringMathematics", LaxmiPublications, 2010.
6. B.S.Grewal,"HigherEngineering Mathematics",Khanna Publishers,2000.
7. T.Veerarajan,"Engineering Mathematics",TataMcGraw-Hill,New Delhi,2010.
8. Theory of Errors By J.Topping
9. Probability and Statistics, Speigel, Schaum Series, 2016

References:

1. Complex variables and Applications by R.V.Churchil; McGraw Hill
2. Engineering Mathematics Vol-II by S.S.Sastry; PHI
3. Operation Research by H.A.Taha;
4. Probability and Statistics for Engineers by Johnson ; PHI

5. Higher Engineering Mathematics by B.S.Grewal
6. Advance Engineering Mathematics by E. Kreyzig

B.Tech. 2ND YEAR (SEMESTER–IV) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PE-206	Control System Components	3	2	1	--	3	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions among the 4-modules, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the 4-modules, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

IN-PE-206 Control System Components

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Design and conduct performance experiments, as well as to identify, formulate and solve machine related problems.

CO2: Analyze and describe aspects of the construction, principle of operation, applications and methods of speed control

CO3: Describe the construction, application and operation of single phase and three phase transformers

CO4: Understand the basic concepts and working of switches and relays.

CO5: Identify suitable motors for industrial applications

PROGRAM OUTCOMES

1. Graduates will be able to apply fundamental knowledge in mathematics, science, electronics and instrumentation for solving engineering problems.
2. Graduates will be able to identify and analyze complex engineering problems in the areas of electronics, instrumentation and automation.
3. Graduates will be able to solve open-ended technical problems and be proficient in the design, test, and implementation of electronics, instrumentation and control systems.
4. Graduates will attain skills to conduct experiments/investigations and interpret data with reference to systems and standards related to electronics and instrumentation engineering.
5. Graduates will have proficiency in system design tools and software packages related to electronics and instrumentation.
6. Graduates will have knowledge in the area of instrumentation engineering to assess and address societal, health, safety, legal and cultural issues.
7. Graduates will have broad education necessary to understand the impact of engineering solutions and sustainable development in environmental and societal context in the field of Instrumentation.
8. Graduates will be able to understand and uphold professional, ethical, and social responsibilities in Instrumentation engineering.
9. Graduates will be able to function efficiently as an individual or in team in process and automation industries.
10. Graduates will have ability to communicate effectively in written, oral and instrumentation formats to put forth solutions and prepare detailed engineering report in the process and automation industries.
11. Graduates will be able to apply the knowledge, skill and attitude as a team player in initiating, executing and managing projects in the areas of design, manufacture, marketing and entrepreneurship in multi-disciplinary environments.
12. Graduates will be able to conduct information searching and processing and develop the ability for lifetime-learning in field of Instrumentation engineering.

Module-1

Control System: Open loop & closed loop operation, Introduction to control system components, Representation of control components: Mechanical, Electrical, hydraulic and pneumatic. Transfer function of control system, Mathematical Modeling of Dynamic system: Mechanical, Electrical, Analogous system, Electromechanical system, hydraulic and pneumatic transfer function by block diagram, reduction technique, signal flow graphs techniques, Meson's gain formula for signal flow graph.

Module-2

Basic control action & Industrial automatic controller: On/Off or two position, proportional, integral, proportional-Integral, proportional-derivative and proportional-integral-derivative control action. Pneumatic controller, comparison between pneumatic and hydraulic systems, Pneumatic amplifiers, pneumatic proportional controller, pneumatic derivative and integral control action, PID controller, PI controller action. Hydraulic controller: Advantage and disadvantage of Hydraulic controllers, Hydraulic integral controller, proportional controller, Hydraulic PI controller, hydraulic PD controller.

Module-3

Electronic controller: On/Off or two position, proportional, integral, proportional-integral, proportional-derivative and proportional-integral-derivative, design and consideration. Programmable controller, characteristic function of PLC, block diagram of PLC, ladder diagram, ladder diagram elements, development of simple ladder diagram & applications.

Module-4

Control valve: Type and characteristics, control valve sizing, selection criteria concept. Calculation of control valve size, positioner, necessity type & effects on performance of control valve. Pneumatic control valve characteristics, Actuators: electrical actuators, pneumatic actuators, Hydraulic, Electro-hydraulic, Electro-pneumatic.

Auxiliary process components: Hydraulic pumps & power supply, Hydraulic servomotor, Hydraulic integrator, Amplidyne, Magnetic Amplifier.

Reference Books :

1. Process Control and Instrument Technology by C.D.Jhonson.
2. Instrumentation for Process Measurement and Control By N.A.Anderson
3. Automatic Control Engineering by Raven
4. Automatic Control System by C.Kuo
5. Modern Control Engineering by Katsuhiko& Ogata
6 Control System by Nagrath& Gopal

B.Tech. 2ND YEAR (SEMESTER–IV) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PRCS-12	Control System Lab-1	1.5	--		3	3	30	--	45	75	3 Hrs

Program Educational Objectives

Graduates of the program will,

PEO1	Have successful professional careers in Electrical Sciences, and IT enabled areas and be able to pursue higher education.
PEO2	Demonstrate ability to work in multidisciplinary teams and engage in lifelong learning.
PEO3	Exhibit concern for environment and sustainable development.

COURSE OUTCOMES:

After the successful completion of the course, the student will be able to

1. Execute time response analysis of a second order control system using MATLAB/ simulation software
2. Analyze and interpret stability of the system through Root Locus, Bode plot and Nyquist plot.
3. Design Lag, Lead, Lead-Lag compensators and verify experimental results using MATLAB.
4. Analyze toque- speed characteristics of DC and AC servomotors.
5. Analyze the effect of P, PI, PD and PID controllers on a control system.

List of Experiments **2nd Year / 4th Semester**

Subject: Control System Lab

S.No	Experiments
1.	Simulation Software for pneumatic components : An Introduction
2.	Simulation Software for hydraulic components : An Introduction
3.	Design a hydraulic circuit using a double acting cylinder and 4/2 hand operated valve to raise or lower the pressure.
4.	Design a hydraulic circuit by using a single acting cylinder to open or close the door. The operator can open or close the door at the time of loading or unloading the component.
5.	Design a hydraulic circuit to lift a movable object by using telescopic cylinder and 4/3 hand lever valve.
6.	Design a pneumatic circuit to open and close the door. By operating a push button valve, door should be open or close.
7.	Design a pneumatic circuit using a double acting cylinder and 5/2 air spring valve to open the door which can be controlled from other place.
8.	Design a pneumatic circuit for a piston of double acting cylinder is to extend when one or both of the two 3/2 push button valve is activated, if both the push button are released the cylinder has to retract.

IN-PC-208 ELECTRICAL MACHINES

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PC-208	Electrical Machines	3	2	1	--	3	40	60		100	3 Hrs

IN-PC-208 ELECTRICAL MACHINES

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Design and conduct performance experiments, as well as to identify, formulate and solve machine related problems.

CO2: Analyze and describe aspects of the construction, principle of operation, applications of various electrical machines.

CO3: Describe the construction, application and operation of single phase and three phase transformers

CO4: Understand the basic concepts and working of switches and relays.

CO5: Identify suitable motors for industrial applications

PROGRAM OUTCOMES

1. Graduates will be able to apply fundamental knowledge in mathematics, science, electronics and instrumentation for solving engineering problems.
2. Graduates will be able to identify and analyze complex engineering problems in the areas of Electrical, Instrumentation and Automation.
3. Graduates will be able to solve open-ended technical problems and be proficient in the design, test, and implementation of Electrical, Instrumentation and control systems.
4. Graduates will attain skills to conduct experiments/investigations and interpret data with reference to systems and standards related to electronics and instrumentation engineering.
5. Graduates will have proficiency in system design tools and software packages related to electronics and instrumentation.
6. Graduates will have knowledge in the area of instrumentation engineering to assess and address societal, health, safety, legal and cultural issues.
7. Graduates will have broad education necessary to understand the impact of engineering solutions and sustainable development in environmental and societal context in the field of Instrumentation.
8. Graduates will be able to understand and uphold professional, ethical, and social responsibilities in Instrumentation engineering.
9. Graduates will be able to function efficiently as an individual or in team in process and automation industries.
10. Graduates will have ability to communicate effectively in written, oral and instrumentation formats to put forth solutions and prepare detailed engineering report in the process and automation industries.
11. Graduates will be able to apply the knowledge, skill and attitude as a team player in initiating, executing and managing projects in the areas of design, manufacture, marketing and entrepreneurship in multi-disciplinary environments.
12. Graduates will be able to conduct information searching and processing and develop the ability for lifetime-learning in field of Instrumentation engineering.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1				S				S	S	S	S	S
CO2	S			S				S	S	S	S	S
CO3	S			S					S	S	S	S
CO4				S					S	S	S	S
CO5				S					S	S	S	S

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Module-1

MAGNETIC CIRCUITS AND INDUCTION: Magnetic Circuits, Magnetic Materials and their properties, static and dynamic e.m.f.s and force on current carrying conductor, AC operation of Magnetic Circuits, Hysteresis and Eddy current losses, frictional & copper losses. TRANSFORMERS: Basic theory, construction, operation at no-load, equivalent circuit, phasor diagram, O.C. and S.C. tests for parameters determination, efficiency and regulation, auto-transformer, introduction to three phase transformer; Scott connection, parallel operation of transformer.

Module-2

PRINCIPLES OF ELECTROMECHANICAL ENERGY CONVERSIONS: Force and torque in magnetic field system, energy balance, energy and force in singly excited magnetic field system, concept of co-energy, forces and torques is system with permanent magnets, dynamic equation. DC MACHINES: Basic theory of DC generator, brief idea of construction, emf equation, load characteristics, basic theory of DC motor, concept of back emf, torque and power equations, load characteristics, starting and speed control of DC motors, Types of DC generator & motors, Armature reaction, commutation characteristics of DC machines.

Module-3

Induction Motors: Three phase motors, principle of operation, slip-torque equation, torque-slip characteristic, relation between slip and rotor copper loss, equivalent circuit, different types of starters applications. Single phase induction motors, principle of working, types, applications, Special Purpose Machines: Principle, working, applications of stepper motor, servo motors and universal motors.

Module-4

Alternators: Constructional features, synchronous speed, e.m.f. equation, winding factor, regulation by synchronous impedance method. Motors - concept of rotating magnetic field, principle of working, effect of variation of load, Vee curves.

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions among the 4-modules, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the 4-modules, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Reference Books :

1. Electrical Machines by Magrath and Kothari, TMH
2. Electrical Machines by Mukharjee and Chakravarty; Dhanpat Rai & Sons
3. Electrical Machines, Vol I & II by B.L.Thareja; Dhanpat Rai & Sons
4. Electrical Motor & Power Electronics by P.C.Sen; J.Wiley.

IN-PC-210 DIGITAL TECHNIQUES

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand, demonstrate and troubleshoot the different types of logic gate
CO2: Demonstrate an understanding of minimizing logic circuits using Boolean operations
CO3: Understand principles and operations, demonstrate and troubleshoot combinational logic circuits.
CO4: Understand principles and operations, demonstrate and troubleshoot sequential logic circuits.
CO5: Understand principles and operations, demonstrate and troubleshoot registers and counters.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S							
CO2	S	S	S	S	S							
CO3	S	S	S	S	S							
CO4	S	S	S	S	S							
CO5	S	S	S	S	S							

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
INE-PCC-210	Digital Techniques	3	2	1	--	3	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions among the 4-modules, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the 4-modules, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

INE-PCC-210 DIGITAL TECHNIQUES Details of the Course Contents

Module -I

Number system and codes, signed binary numbers, Boolean relations, sum of products method, algebraic simplification, k-Maps, Karnaugh simplifications, binary addition, binary subtraction, digital operation of a digital system, OR, AND gates, inverter circuit, the inhibit (enable) operation, XOR circuits, DeMorgan's Laws, NAND & NOR gates. Logic Hardware: DTL, TTL, RTL, ECL, DCTL, Integrated injection logic, PMOS, NMOS, CMOS Logic and their characteristics, Dynamic MOS circuits,

Module -II
Binary Adders (Half Adder, Parallel Operation, Full adder, MSI Adders, Serial Operation). Arithmetic functions (True/Complement, Zero/One Element, Binary Subtraction, Digital Comparator), Decoder, Encoders, Multiplexers, Demultiplexures, Flip flops: RS Latches, Level clocking (Clocked SR flip flop), D latch, Edge triggered JK Flip Flop, JK Master Slave flip flop, T type Flip Flop.

Module -III
Shift Registers, Static and dynamic MOS Shift registers, Tristate logic and its uses in computers, synchronous & Asynchronous counters, Binary module counters, Programmable and presettable up/down counters, Applications of Counters.

Module -IV
A/D & D/A converters and their design.Digital storagedevices: ROM, RAM, EPROM, EEPROM, PAL & PLA, ULA, MOS ROM, ROM Applications

Reference Books :

1. Digital Electronics by Gothman, Prentice-Hall
2. Digital Principals & Applications by Malvino& Leach, TMH
3. System Design by Sonde, TMH
4. Digital Computer Electronics by A.P.Malvino, TMH
5. Analog and Digital Electronics by Peter.H.Beards.
6. Integrated Electronics by Millman&Halkias, McGraw Hill

IN-PRDT-14 Digital Lab

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
IN-PRDT-14	Digital Lab	1.5	--		3	3	30	--	45	75	3 Hrs

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Design basic application circuits using op-amp.
CO2: Understand and implement the working of basic digital circuits
CO3: Design multivibrators and voltage regulators
CO4: Design Counters and Timers
CO5: Design and Fabricate small projects using simulation tools and hardware

LIST OF EXPERIMENTS : Experiments beyond the syllabus should be conducted.

1. Study of flip flop. (JK, RS, D)
2. Implementation of combinational circuit
3. Design and Implementation of counters.
4. Design and Implementation of parallel and shift registers.
5. Binary adder/ subtractor
6. Digital comparator
7. Multiplexers and Demultiplexer
8. Realization of logic gates using diodes and transistors, DTL &TTL. Characteristics of TTL Gates
9. Half and full adders and subtractors using basic gates

Expected Outcome

After the completion of the course, students should be able to

- Design and implement combinational circuits
- Design and implement sequential circuits
- Get familiarized with the TTL logic family.

Text Books:

1. Charles H. Roth, Jr. Fundamentals of Logic Design, 5th edition, Thomson Books/Col
2. A. Anand Kumar, Fundamentals of Digital Circuits, PHI learning, 2/e, 2010, ISBN: 81-203-3679-7.

MODEL CURRICULUM

for

UNDERGRADUATE DEGREE COURSES IN

ELECTRICAL AND INSTRUMENTATION ENGINEERING

(Engineering & Technology)

[JULY 2019]

B.Tech Electrical and Instrumentation Engineering
SCHEME OF EXAMINATIONS

Department of Instrumentation (U.S.I.C)
Kurukshetra University
Kurukshetra

Kurukshetra University Scheme of Exam
Model Curriculum for First Year
Undergraduate Degree Courses in

ELECTRICAL AND INSTRUMENTATION ENGINEERING

Engineering & Technology

CONTENTS

Model Curriculum for First Year
Undergraduate Degree Courses in Engineering & Technology
Chapter -1
General, Course structure & Theme &
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical(Lab)/week	0.5 credits 1 credit

B. Range of credits –

A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program:

S. No	Category	Suggested Breakup of Credits(Total 160)
1	Humanities and Social Sciences including Management courses	7
2	Basic Science courses	22
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	22.5
4	Professional core courses	67
5	Professional Elective courses relevant to chosen specialization/branch	31.5
6	Open subjects – Electives from other technical and /or emerging subjects	
7	Project work, seminar and internship in industry or elsewhere	10
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	173.5*

**Minor variation is allowed as per need of the respective disciplines.*

D. Credit distribution in the First year of Undergraduate Engineering program:

	Lecture (L)	**Tutorial (T)**	**Laboratory/Practical (P)**	**Total credits (C)**
Chemistry –I	3	1		5.5
Physics	3	1		5.5
Maths-1	3	1		4
Maths -2	3	1		4
Programming for Problem solving	3	0		5
English	3	0	2	3
Engineering Graphics & Design	1	0		3
Workshop/ practical	1	0		3

Basic Electrical Engg.	3	1		5
*Biology	2	1		3
*Engg. Mechanics	3	1		4
*Maths-3	3	1		4

**These courses may be offered preferably in the 3rd semester & onwards.*

E. Course code and definition:

Course code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BS	Basic Science Courses
ES	Engineering Science Courses
HSM	Humanities and Social Sciences including Management courses
IN	Instrumentation Engineering
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
LC/ PR	Laboratory course
MC	Mandatory courses
PROJ	Project

F. Category of Courses:

BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred semester
			L	T	P		
1	EI-BS-102	Chemistry-I	3	1	3	5.5	II
2	EI -BS-101	Physics	3	1	3	5.5	I
3	EI -BS-103	Mathematics –I	3	1	0	4	I
4	EI -BS-104	Mathematics –2	3	1	0	4	II

ENGINEERING SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred semester
			L	T	P		
1	EI -ES-105	Basic Electrical Engineering	3	1	2	5	I
2	EI -ES-107	Engineering Graphics & Design	1	0	4	3	I
3	EI -ES-106	Programming for Problem Solving	3	0	4	5	II
4	EI -PR-08	Workshop/Manufacturing Practices	1	0	4	3	II
5	EI -ES-108	Basic Electronics Engineering	2	0	1	3	II
6	EI -ES-203	Basic Instrumentation Engineering	2	0	1	3	III

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P		
1	EI-HSM-109	English	3	0	2	3	I

G. Structure of curriculum

Mandatory Induction Program

• Physical activity	
• Creative Arts	**3 weeks**
• Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations	

Semester I (First year]

B.Tech. ELECTRICAL AND INSTRUMENTATION ENGINEERING UG

Sl.No	Category	Course No.	Course title	Credits	Teaching Schedule			
					L	T	P	Total
1	Basic Science Course	EI-BS-101	Physics-I	4	3	1	-	4
2	Basic Science course	EI-BS-103	Mathematics-I	4	3	1	-	4
3	Engineering Science Courses	EI-ES-105	Basic Electrical Engineering	4	3	1	-	4
4	Engineering Science Courses	EI-ES-107	Engg. Graphics and Design	1	1	-	-	1
5	Humanities courses	EI-HSM-109	English	3	3	-	-	3
6	Physics Lab	EI-PR-01	Physics Lab	1.5	-	-	3	3
7	Engineering Drawing lab	EI-PR-03	Engineering Drawing lab	2	-	-	4	4
8	Basic Electrical Lab	EI-PR-05	Basic Electrical Lab	1	-	-	2	2
9	Language Lab	EI-PR-07	Language Lab	0	-	-	2	2
			Total	20.5	13	3	11	27

Semester II (First year]

B.Tech. ELECTRICAL AND INSTRUMENTATION ENGINEERING UG

S.No.	Category	Course No.	Course title	Credits	Teaching Schedule			
					L	T	P	Total
1	Basic Science courses	EI-BS-102	Chemistry	4	3	1		4
2	Basic Science courses	EI-BS-104	Mathematics-II	4	3	1		4
3	Engineering Science Courses	EI-ES-106	Programming for Problem Solving	4	3	1		4
4	Engineering Science Courses	EI-ES-108	Basic Electronics Engineering	3	2	1		3
5	Environmental Sciences MC	EI-EVS-112	Environmental Science	--	3	0		3
6	Chemistry Lab	EI-PR-02	Chemistry Lab	1.5			3	3
7	Computer programming Lab	EI-PR-04	Computer programming Lab	1.5	-	-	3	3
8	Basic Electronic lab	EI-PR-06	Basic Electronic lab	1	-	-	2	2
9	Workshop Practice Lab.	EI-PR-08	Workshop Practice Lab.	1	-	-	2	2
			Total	20	14	4	10	28

Chapter -2

Detailed first year curriculum contents

I. Mandatory Induction program

(Please refer **Appendix-A** for guidelines. Details of Induction program also available in the curriculum of Mandatory courses.)

[Induction program for students to be offered right at the start of the first year.]

• Physical activity	**3 weeks**
• Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations	

Guide to Induction Program

1 Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.[1] *This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.)*

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

[1]A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

2 Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

[2]Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gadhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsary course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member. Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.[3]

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

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[3]The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

3 Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

3.1 Initial Phase

Time	*Activity*
Day 0	
Whole day	*Students arrive - Hostel allotment. (Preferably do pre-allotment)*
Day 1	
09:00 am - 03:00 pm	*Academic registration*
04:30 pm - 06:00 pm	Orientation
Day 2	
09:00 am - 10:00 am	Diagnostic test (for English etc.) 10:15 am - 12:25 pm
	Visit to respective depts.
12:30 pm - 01:55 pm	*Lunch*
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group. (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	*Time*	*Activity*	*Remarks*
	Day 3 onwards		
	06:00 am	*Wake up call*	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	*Bath, Breakfast, etc.*	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	*Lunch*	

IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	*Break / light tea*	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	*Rest and Dinner*	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	*Session*	*Remarks*
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days

Proficiency Modules	V	Daily, but only for those who need it

3.3 Closing Phase

Time	Activity
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor- mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline[4].

Here we list some important suggestions which have come up and which have been experimented with.

3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters.

It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

4 Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations

between teachers and students, give a broader view of life, and building of character.
The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies,
Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors),
31 March 2016, IIT Directors' Secretariat, IIT Delhi.

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[4]We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

Detailed first year curriculum contents

II. Mandatory Induction program

(Please refer **Appendix-A** for guidelines. Details of Induction program also available in the curriculum of AICTE Mandatory courses.)

[Induction program for students to be offered right at the start of the first year.]

• Physical activity	**3 weeks**
• Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations	

B.Tech Electrical and Instrumentation Engineering
SCHEME OF EXAMINATIONS
B.Tech. 1ST YEAR (SEMESTER–I) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-BS-101	Physics-I	4	3	1	-	4	40	60		100	3 Hrs
EI-BS-103	Mathematics-I	4	3	1	-	4	40	60		100	3 Hrs
EI-ES-105	Basic Electrical Engineering	4	3	1	-	4	40	60		100	3 Hrs
EI-ES-107	Engg. Graphics and Design	1	1	-	-	1	20	30		50	3 Hrs
EI-HSM-109	English	3	3	-	-	3	40	60		100	3 Hrs
EI-PR-01	Physics Lab	1.5	-	-	3	3	30		45	75	3 Hrs
EI-PR-03	Engineering Drawing lab	2	-	-	4	4	40		60	100	3 Hrs
EI-PR-05	Basic Electrical Lab	1	-	-	2	2	20		30	50	3 Hrs
EI-PR-07	Language Lab	0	-	-	2	2	--		--	--	--
	Total	20.5	13	3	11	27	270	270	135	675	

B.Tech. 1ST YEAR (SEMESTER–II) (w.e.f.2019-20)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-BS-102	Chemistry	4	3	1		4	40	60	--	100	3 Hrs
EI-BS-104	Mathematics-II	4	3	1		4	40	60	--	100	3 Hrs
EI-ES-106	Programming for Problem Solving	4	3	1		4	40	60	--	100	3 Hrs
EI-ES-108	Basic Electronics Engineering	3	2	1		3	40	60	--	100	3 Hrs
EI-EVS-112	Environmental Science	--	3	0		3	30+10	60	--	100	3 Hrs
EI-PR-02	Chemistry Lab	1.5			3	3	30	--	45	75	3 Hrs
EI-PR-04	Computer programming Lab	1.5	-	-	3	3	30	--	45	75	3 Hrs
EI-PR-06	Basic Electronic lab	1	-	-	2	2	20	--	30	50	3 Hrs
EI-PR-08	Workshop Practice Lab.	1	-	-	2	2	20	--	30	50	3 Hrs
	Total	20	14	4	10	28	300	300	150	750	

B.Tech Electrical and Instrumentation Engineering
SCHEME OF EXAMINATIONS
B.Tech. 2ND YEAR (SEMESTER–III) (w.e.f.2020-21)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PC-201	Power System I	3	2	1	--	3	40	60		100	3 Hrs
EI-PC-203	Basic Instrumentation Engineering	3	2	1		3	40	60		100	3 Hrs
EI-PC-205	Network Analysis	3	2	1		3	40	60		100	3 Hrs
EI-PC-207	Transducers and Applications	3	2	1		3	40	60		100	3 Hrs
EI-OE-209	**Open Elective I**	3	2	1		3	40	60		100	3 Hrs
EI-PR-09	Instrumentation Lab	1	--	--	2	2	20		30	50	3 Hrs
EI-PR-11	Network Analysis Lab	1	--	--	2	2	20		30	50	3 Hrs
EI-PR-13	Transducer lab	1	--	--	2	2	30		45	75	3 Hrs
EI-PR-15	Open Elective I Lab	1	--	--	2	2	30		45	75	3 Hrs
EI-PR-17	Power System Lab	1			2	2	30		45	75	3 Hrs
	Total	20	10	5	10	25	330	300	195	825	

Open Elective I

Linear Integrated Circuits
Computer Networks

B.Tech. 2ND YEAR (SEMESTER–IV) (w.e.f.2020-21)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PC-202	Power Electronics-I	4	3	1	--	4	40	60		100	3 Hrs
EI-PC-204	Electrical Measurements & Instrumentation	4	3	1	--	4	40	60		100	3 Hrs
EI-PC-206	Program Elective I	3	2	1	--	3	40	60		100	3 Hrs
EI-PC-208	Electrical Machines	4	3	1	--	4	40	60		100	3 Hrs
EI-OE-210	Open Elective II	3	2	1	--	3	40	60		100	3 Hrs
EI-PR-10	Power Electronics Lab	1	--		2	2	30	--	45	75	3 Hrs
EI-PR-12	Control System Lab-1	1	--		2	2	30	--	45	75	3 Hrs
EI-PR-14	Open Elective II Lab	1	--		2	2	20	--	30	50	3 Hrs
EI-PR-16	Machines lab	1.5	--		3	3	30	--	45	75	3 Hrs
	Total	22.5	13	5	09	27	310	300	165	775	

Program Elective I
Control System Components
Industrial Electrical Systems
Electrical Energy Conservation and Auditing

Open Elective II
Digital Techniques
Computer Organization
Electronic Devices

B.Tech Electrical and Instrumentation Engineering
SCHEME OF EXAMINATIONS
B.Tech. 3RD YEAR (SEMESTER–V) (w.e.f.2021-22)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-OE-301	Open Elective III	4	3	1	--	4	40	60		100	3 Hrs
EI-PC-303	Power Electronics-II	4	3	1	--	4	40	60		100	3 Hrs
EI-PE-305	Program Elective II	4	3	1	--	4	40	60		100	3 Hrs
EI-PC-307	Power System II	4	3	1	--	4	40	60		100	3 Hrs
EI-PC-309	Linear Automatic Control System	4	3	1	--	4	40	60		100	3 Hrs
EI-PR-19	Power Electronic Lab-II	1.5	--	--	3	3	30		45	75	3 Hrs
EI-PR-21	Power System Lab II	1.5	--	--	3	3	30		45	75	3 Hrs
EI-PR-23	Program Elective II Lab	1.5	--	--	3	3	30		45	75	3 Hrs
EI-PR-25	Control System Lab	1.5	--	--	3	3	30		45	75	3 Hrs
EI-PR-27	Industrial Training	**					40**	60**		100**	3 Hrs
	Total	26	15	5	12	32	320	300	180	800	

**** Industrial training is non-credit/ audit course.**

Open Elective III
Environment Monitoring Instrumentation
Electromagnetic Field Theory
Math III
Energy Efficient Systems

Program Elective II
Microprocessors
Analog and Digital Communication
Utilization of Electrical Engineering

B.Tech. 3RD YEAR (SEMESTER–VI) (w.e.f.2021-22)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PC-302	Program Elective III	3	2	1	--	3	40	60	--	100	3 Hrs
EI-PC-304	Electrical Machines II	4	3	1	--	4	40	60	--	100	3 Hrs
EI-PC-306	Power Plant Engineering	3	2	1	--	3	40	60	---	100	3 Hrs
EI-PC-308	Digital Signal Processing	4	3	1	--	4	40	60	--	100	3 Hrs
EI-PC-310	Microcontroller & Embedded System	4	3	1	--	4	40	60	--	100	3 Hrs
EI-PR-18	Electrical Machines Lab II	1.5	--	--	3	3	30	--	45	75	3 Hrs
EI-PR-20	Micro-controller Lab	1.5	--	--	3	3	30	--	45	75	3 Hrs
EI-PR-22	Signal Processing Lab	1.5	--	--	3	3	30	--	45	75	3 Hrs
EI-PROJ-02	Minor Project	3	--	--	6	6	50	--	100	150	3 Hrs
	Total	**25.5**	**13**	**5**	**15**	**33**	340	300	235	875	

Program Elective III
Instrument & System Design
Pneumatic and Hydraulic Instrumentation
Mechanical Measurements in Instrumentation
Electrical and Hybrid Vehicles

B.Tech Electrical and Instrumentation Engineering
SCHEME OF EXAMINATIONS
B.Tech. 4TH YEAR (SEMESTER–VII) (w.e.f.2022-23)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-OE-401	Open Elective IV	4	3	1	--	4	40	60	--	100	3 Hrs
EI -PE-403	Program Elective IV	3	2	1	--	3	40	60	--	100	3 Hrs
EI -PC-405	Electric Drives	4	3	1	--	4	40	60	--	100	3 Hrs
IN-PC-407	Advance Process dynamics and Control	4	3	1	--	4	40	60	--	100	3 Hrs
EI -PR-29	Electric Drives Lab	1.5	--	--	3	3	30	--	45	75	3 Hrs
EI -PR-31	Open Elective IV	1.5	--	--	3	3	30	--	45	75	3 Hrs
EI -PR-01	Project Work Case Study	2	--	--	4	4	40		60	100	3 Hrs
EI -PR-33	Industrial Training	--					40**		60**	100**	3 Hrs
	Total	**20**	**11**	**4**	**10**	**25**	**260**	**240**	**150**	**650**	

**** Industrial training is non-credit/ audit course.**

Open Elective IV
Computer Graphics & CAD CAM
Remote Sensing
Optical Instrumentation

Program Elective IV
Biomedical Instrumentation
Reliability Engineering
Wind and Solar Energy Systems
Power Quality and FACTS

B.Tech. 4TH YEAR (SEMESTER–VIII) (w.e.f.2022-23)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-OE-402	Open Elective V	3	2	1	--	3	40	60		100	3 Hrs
EI-PE-404	Program Elective V	4	3	1	--	4	40	60		100	3 Hrs
EI-PC-406	Industrial Process Control	4	3	1	--	4	40	60		100	3 Hrs
EI-PR-28	Process Control Lab	1.5	--	--	3	3	30		45	75	3 Hrs
EI-PR—30	Open Elective V Lab	1.5	--	--	3	3	30		45	75	
EI-PR-32	Seminar	1.0	--	--	2	2	20		30	50	
EI-PROJ-06	Major Project	4	--	--	8	8	40		60	100	3 Hrs
	Total	**19**	**8**	**3**	**16**	**27**	**240**	**180**	**180**	**600**	

Open Elective V
Artificial Intelligence
Robotics
Fuzzy Logic Control

Program Elective V
Switch Gear and Protection
Machine Design
High Voltage Engineering

EI-BS-101 Physics-I

Course Outcomes

It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of physical problems and applications that they would find useful in their disciplines. The student will learn

- Basic concepts of EM theory – application to EM-Waves
- Basic Concepts of Quantum theory – application to solids
- Further fallouts like energy band structures in solids – classification
- Basic concepts of Optics – applications in Fiber optics and lasers

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-BS-101	Physics-I	4	3	1	-	4	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Detailed Course contents:

***Module 1:* Electrostatics and Magnetostatics (5 lectures)**

Electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving si0mple electrostatics problems in presence of dielectrics. Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities. Magnetization and associated bound currents; auxiliary magnetic field $\vec{H}$; Boundary conditions on $\vec{B}$ and $\vec{H}$.

Moddule:2 Electromagnetic Theory (5 lectures)

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; to satisfy continuity equation; displace current and magnetic field arising from time- dependent electric field; calculating magnetic field due to changing electric fields in quasi- static approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave.

Module 3: Wave nature of particles and the Schrodinger equation (5 lectures)

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wavefunction, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle. Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, Numerical solution of stationary-state Schrodinger equation for one dimensional problems for different potentials.

Module: 4 Introduction to solids. (6 lectures)

Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands Numerical solution for energy in one-dimensional periodic lattice by mixing plane waves.

***Module 5: Optics* (6 lectures)**

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power. Polarization, quarter wave plate, half wave plate, Nicol prism, Polarimeter.

Module 6: Lasers and Fibre Optics (6 lectures)

Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, quality factor, power absorbed by oscillator.

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers(ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

FIBRE OPTICS**:** Propagation of light in fibres, numerical aperture, single mode and multi-mode fibres, applications.

Suggested Text Books

1. David Griffiths, Introduction to Electrodynamics
2. Eisberg and Resnick, Introduction to Quantum Physics
3. D. J. Griffiths, Quantum mechanics
4. A. Ghatak, Optics

Suggested Reference Books:

1. Halliday and Resnick, Physics
2. W. Saslow, Electricity, magnetism and light
3. Ian G. Main, Oscillations and waves in physics
4. H.J. Pain, The physics of vibrations and waves
5. E. Hecht, Optics
6. O. Svelto, Principles of Lasers

EI-BS-103 Mathematics-I

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- to application of analysis to Engineering problems.
- To deal with functions of several variables that are essential in most branches of engineering.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

B.Tech. 1ST YEAR (SEMESTER–I) (w.e.f.2018-19)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major te	Practical	Total	
EI-BS-103	Mathematics-I	4	3	1	-	4	40	60		100	3 Hrs

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Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Course code	EI-BS-103				
Category	Basic Science Course				
Course title	**Mathematics -1**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester - I

	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

Detailed contents:

MODULE-I

Applications of Differentiation : Taylor's & Maclaurin's series, Expansion by use of known series, Expansion by forming a differential equation, Asymptotes, Curvature, Radius of Curvature for Cartesian, Parametric & polar curves, Centre of curvature & chord of curvature, Tracing of Cartesian & polar curves (standard curves).

MODULE – II

Partial Differentiation & its Applications : Functions of two or more variables Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions, change of variables.

Homogeneous functions, Euler's theorem, Jacobian, Taylor's & Maclaurin's series for functions of two variables (without proof), Errors and approximations, Maxima-minima of functions of two variables, Lagrange's method of undetermined multipliers, Differentiation under the integral sign.

MODULE – III

Multiple Integrals and their Applications : Double integral, change of order of integration Double integral in polar coordinates, Applications of double integral to find area enclosed by plane curves and volume of solids of revolution.

Triple integral, volume of solids, change of variables, Beta and gamma functions and relationship between them.

MODULE – IV

Vector Calculus : Differentiation of vectors, scalar and vector point functions Gradient of a scalar field and directional derivative, divergence and curl of a vector field and their physical interpretations, Del applied twice to point functions, Del applied to product of point functions.

Integration of vectors, line integral, surface integral, volume integral, Green's, Stoke's and Gauss divergence theorems (without proof), and their simple applications.

TEXT BOOKS:

1. Advanced Engineering Mathematics : F. Kreyszig.
2. Higher Engineering Mathematics : B.S. Grewal.

REFERENCE BOOKS:

1. Engineering Mathematics Part-I : S.S. Sastry.
2. Differential and Integral Calculus : Piskunov.
3. Advanced Engineering Mathematics : R.K. Jain and S.R.K. Iyengar
4. Advanced Engg. Mathematics : Michael D. Greenberg

EI-ES-105 Basic Electrical Engineering

Course Outcomes

- To understand and analyze basic electric and magnetic circuits
- To study the single phase and three phase electric circuits.
- To study the working principles of electrical machines.
- To introduce the components of low voltage electrical installations

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-ES-105	Basic Electrical Engineering	4	3	1	-	4	40	60		100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt all questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

EI-ES-105 Basic Electrical Engineering

Details of the Course Contents:

DC Circuits (6 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

AC Circuits (7 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections. 3-phase power equation, measurement of power by two wattmeter method,

Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Electrical Installations (5 hours)

Components of domestic wiring and earthing system. Elementary calculations for energy consumption, power factor improvement.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering” , Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. L. S. Bobrow, “ Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
6. Electrical Technology (Vol-I) : B.L Theraja & A K Theraja, S.Chand

EI-ES-107 Engineering Graphics and Design

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

PROGRAM EDUCATIONAL OBJECTIVES

1. To prepare graduates for a successful technical and/or professional career.
2. To prepare graduates for higher education and research.
3. To prepare graduates to engage in resolving industrial and social issues.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-ES-107	Engg. Graphics and Design	1	1	-	-	1	20	30		50	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A and Section-B, Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 2-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and applications etc. of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 1-question out of 2-questions in Section-B Section-A carries 16 marks. Section-B carries 14 marks.**

<table>
<tr><td>Course code</td><td colspan="5">EI-ES-107</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Engineering Graphics & Design (Theory & Lab.)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>credits</td><td rowspan="2">Semester - I</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">-</td></tr>
</table>

Engineering Graphics & Design [A total of 10 lecture hours & 60 hours of lab.]
[[L : 1; T:0; P : 4 (3 credits)]
Detailed contents
Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.
Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-HM-109	English	3	3	-	-	3	40	60		100	3 Hrs

Course Outcomes
The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course code	EI-HSM-109				
Category	Humanities and Social Sciences including Management courses				
Course title	**English**				
Scheme and Credits	**L**	**T**	**P**	Credits	Semester - I
	3	**0**	**2**	**3**	
Pre-requisites (if any)	**-**				

English Detailed contents

1. Vocabulary Building
1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills
2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) *Practical English Usage*. Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar*. F.T. Wood. Macmillan.2007 (iii)*On Writing Well*. William Zinsser. Harper Resource Book. 2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Physics Lab EI-PR-01

Course Outcomes

It aims to get the practical ability to the students with standard concepts and tools at an intermediate to advanced level to perform the experiments related to the theory paper INE-BSC-101 Physics. **The student will learn**

1. Experiments in Optics/ principles
2. Experiments in acoustics/ applications
3. Experiments in Lasers/ optical principles
4. Experiments in Magnetism/ applications
5. Experiments in Semiconductor conductivity/ properties

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PR-01	Physics Lab	1.5	-	-	3	3	30		45	75	3 Hrs

Suggested list of experiments from the following:

1. Frank-Hertz experiment; photoelectric effect experiment; recording hydrogen atom spectrum
2. LC circuit and LCR circuit;
3. Resonance phenomena in LCR circuits;
4. Magnetic field from Helmholtz coil; To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus
5. To find the wavelength of sodium light by Newton's rings experiment.
6. To find the wavelength of sodium light by Fresnel's biprism experiment.
7. To find the wavelength of various colours of white light with the help of a plane transmission diffraction grating.
8. To find the wavelength of sodium light by Michelson interferometer.
9. To find the resolving power of a telescope.
10. To find the specific rotation of sugar solution by using a polarimeter.
11. To compare the capacitances of two capacitors by De'sauty bridge and hence to find the dielectric constant of a medium.
12. To find the frequency of A.C. mains by using sonometer.
13. To Find Value of high Resistance by substitution method
14. To Find the value of high resistance by leakage method
15. To Convert a galvenometer in to an Ammeter of given range.
16. To study He Ne laser
17. To find the value of e/m for electrons by Helical method, Measurement of Lorentz force in a vacuum tube.
18. To find the ionization potential of Argon/Mercury using a thyratron tube..
19. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
20. To find the value of Planck's constant by using a photo electric cell.
21. To find the value of co-efficient of self-inductance by using a Rayleigh bridge.
22. To find the value of Hall Co-efficient of semi-conductor.
23. To find the band gap of intrinsic semi-conductor using four probe method.
24. To calculate the hysteresis loss by tracing a B-H curve.
25. To find the temp coeff. of resistance by using Pt resistance thermometer by post office box

RECOMMENDED BOOKS:

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta & V.Kumar (Pragati Prakashan).
3. Advanced Practical Physics Vol.I & II – Chauhan & Singh (Pragati Prakashan).

EI-PR-03 Engineering Drawing lab

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PR-03	Engineering Drawing lab	2	-	-	4	4	40		60	100	3 Hrs

EI-PR-03 Engineering Drawing lab: Course Contents

Module 1: Introduction to Engineering Drawing covering,

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering,

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering,

those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids covering,

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering,

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation & CAD Drawing

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

EI-PR-05 Basic Electrical Lab

Laboratory Outcomes

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PR-05	Basic Electrical Lab	1	-	-	2	2	20		30	50	3 Hrs

EI-PR-05 Basic Electrical Lab

Basic Electrical Engineering Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

LIST OF EXPERIMENTS

1. To verify KCL and KVL.
2.
3. To verify Superposition theorems.
4. To study frequency response of a series R-L-C circuit and determine resonant frequency& Q- factor for various Values of R,L,C.
5. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q -Factor for various values of R,L,C.
6. To perform direct load test of a transformer and plot efficiency Vs load characteristic.
7. To perform O.C. and S.C. tests on transformer.
8. To perform speed control of DC motor.
9. To perform O.C. and S.C. tests of a three phase induction motor.
10. Measurement of power in a 3 phase system by two watt meter method.

Demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.

EI-PR-07 LANGUAGE LAB: COMMUNICATION SKILLS LABORATORY

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Imparting the role of communicative ability as one of the soft skills needed for placement

CO2: Developing communicative ability and soft skills needed for placement

CO3: Making students Industry-Ready through inculcating team-playing capacity

Pre-requisite courses:

- Functional English I
- Functional English II

PROGRAM OUTCOMES

1. Graduates will attain skills to conduct experiments/investigations and interpret data with reference to systems and standards
2. Graduates will have ability to communicate effectively in written, oral and instrumentation formats to put forth solutions and prepare detailed engineering report in the process and automation industries.
3. Graduates will be able to apply the knowledge, skill and attitude as a team player in initiating, executing and managing projects in the areas of design, manufacture, marketing and entrepreneurship in multi-disciplinary environments.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1				**M**							**M**	
CO2				**W**						**M**	**S**	
CO3				**S**						**W**	**S**	

Course Assessment methods:

Direct	**Indirect**
Presentation, Role Play, Mock interview, GD etc.	Course end survey

GRAMMAR IN COMMUNICATION 9 periods

Grammar and Usage – Building Blocks, Homonyms, Subject and Verb Agreement, Error Correction - Grammar Application, Framing Questions – Question words, Verbal Questions, Tags, Giving Replies –Types of Sentences, Listening Comprehension –Listening and Ear training.

ASSERTIVE COMMUNICATION 9 periods

Listening Comprehension in Cross–Cultural Ambience, Telephonic Conversations/Etiquette, Role Play Activities, Dramatizing Situations- Extempore – Idioms and Phrases

CORPORATE COMMUNICATION 9 periods

Video Sensitizing, Communicative Courtesy – Interactions – Situational Conversations, Time Management, Stress Management Techniques, Verbal Reasoning, Current Affairs – E Mail Communication / Etiquette.

PUBLIC SPEAKING 9 periods

Giving Seminars and Presentations, Nuances of Addressing a Gathering - one to one/ one to a few/ one to many, Communication Process, Visual Aids & their Preparation, Accent Neutralization, Analyzing the Audience, Nonverbal Communication.

CHAPTER TITLE 5 INTERVIEW & GD TECHNIQUES 9 periods

Importance of Body Language –Gestures & Postures and Proxemics, Extempore, Facing the Interview Panel, Interview FAQs, Psychometric Tests and Stress Interviews, Introduction to GD, Mock GD Practices.

Total Hrs: 45

REFERENCES

1. Bhatnagar R.P. & Rahul Bhargava, "English for Competitive Examinations", Macmillian Publishers, India, 1989, ISBN: 9780333925591

2. Devadoss K. & Malathy P., "Career Skills for Engineers", National Book Publishers, Chennai, 2013.

3. Aggarwal R.S., "A Modern Approach to Verbal & Non–Verbal Reasoning", S.Chand Publishers, India, 2012, ISBN : 8121905516

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-BS-102	**Chemistry**	**4**	**3**	**1**		**4**	**40**	**60**	**--**	**100**	**3 Hrs**

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-BS-102	**Chemistry**	**4**	**3**	**1**		**4**	**40**	**60**	**--**	**100**	**3 Hrs**

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Course code	EI-BS-102				
Category	Basic Science Course				
Course title	**Chemistry-I (Theory & Lab.)** **Contents** (i) Chemistry-I (Concepts in chemistry for engineering) (ii) Chemistry Laboratory				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –II
	3	**1**	**3**	**5.5**	
Pre-requisites (if any)	**-**				

(i) EI-BS-102 Chemistry-I (Concepts in chemistry for engineering) [L : 3; T:1; P : 0 (4 credits)]

Detailed contents

(i) Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan

(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

(iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell

(v) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(vi) Physical Chemistry, by P. W. Atkins

(vii) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

EI-BS-104 Mathematics -II

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in matrices/ linear algebra, ordinary and partial differential equations. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The mathematical tools needed in matricesand their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and functions of PDE variables that are used in various techniques dealing engineering problems.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-BS-104	Mathematics-II	4	3	1		4	40	60	--	100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Course code	**EI-BS-104**				
Category	Basic Science Course				
Course title	**Mathematics -2 (Calculus, Ordinary Differential Equations and Complex Variable)**				
Scheme and Credits	**L**	**T**	**P**	Credits	Semester-II
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

Module-I

Matrices & its Applications : Rank of a matrix, elementary transformations, elementary matrices, inverse using elementary transformations, normal form of a matrix, linear dependence and in dependence of vactors, consistency of linear system of equations, linear and orthogonal transformations, eigen values and eigen vectors, properties of eigen values.

Module -II

Ordinary Differential Equations & its Applications : Exact differential equations. Equations reducible to exact differential equations. Applications of Differential equations of first order & first degree to simple electric circuits, Newton's law of cooling, heat flow and orthogonal trajectories.

Linear differential equations of second and higher order. Complete solution, complementary function and particular integral, method of variation of parameters to find particular Integral, Cauchy's and Legender's linear equations, simultaneous linear equations with constant co-efficients.

Module -III

Laplace Transforms and its Applications : Laplace transforms of elementary functions, properties of Laplace transforms, existence conditions, transforms of derivaties, transforms of integrals, multiplication by t^n, division by t. Evaluation of integrals by Laplace transforms. Laplace transform of Unit step function, unit impulse function and periodic function. Inverse transforms, convolution theorem, application to linear differential equations and simultaneous linear differential equations with constant coefficients.

Module -IV

Partial Differential Equations and Its Applications : Formation of partial differential equations, Lagrange's linear partial differential equation, First order non-linear partial differential equation, Charpit's method. Method of separation of variables and its applications to wave equation and one dimensional heat equation, two dimensional heat flow, steady state solutions only.

TEXT BOOKS:

1. Advanced Engg. Mathematics F Kreyszig
2. Higher Engg. Mathematics B.S. Grewal

REFERENCE BOOKS :

1. Differential Equations – H.T.H. Piaggio.
2. Elements of Partial Differential Equations – I.N. Sneddon.
3. Advanced Engineering Mathematics – R.K. Jain, S.R.K.Iyengar.
4. Advanced Engg. Mathematics – Michael D. Greenberg.

EI-ES-106 Programming for Problem Solving

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-ES-106	Programming for Problem Solving	4	3	1		4	40	60	--	100	3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions uniformly spread among the entire syllabus, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the entire syllabus, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Course code	EI-ES-106
Category	Engineering Science Course
Course title	**Programming for Problem Solving (Theory & Lab.)**

Scheme and Credits	L	T	P	Credits	Semester – II
	3	0	4	5	[The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]
Pre-requisites (if any)	-				

i)Programming for Problem Solving

Detailed contents

Unit 1Introduction to Programming **(4 lectures)**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) **- (1 lecture).**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)** ***Unit 2:***Arithmetic expressions and precedence **(2 lectures)**

Unit 2: Conditional Branching and Loops **(6 lectures)**

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 3Arrays **(6 lectures)**

Arrays (1-D, 2-D), Character arrays and Strings

Unit 4Basic Algorithms **(6 lectures)**

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5Function **(5 lectures)**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6Recursion **(4 -5 lectures)**

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7Structure **(4 lectures)**

Structures, Defining structures and Array of Structures

Unit 8Pointers **(2 lectures)**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books

Text Books:

1. The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
2. C Programming – A modern approach by K.N. King, 1996, WW Norton & Co.
3. Theory and problems of programming with C, Byron C Gotterfried, TMH
4. Teach yourself all about computers by Barry Press and Marcia Press, 2000, IDG Books India.
5. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
6. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

EI-ES-108 Basic Electronics Engineering

Course Outcomes:

It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of electronics and semiconductor applications that they would find useful in their disciplines.

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor Physics
2. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

PROGRAM EDUCATIONAL OBJECTIVES

1. To prepare graduates for a successful technical and/or professional career.
2. To prepare graduates for higher education and research.
3. To prepare graduates to engage in resolving industrial and social issues.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			**S**									
CO2												
CO3												
CO4												
CO5												

Course Assessment methods:

Direct	**Indirect** Course end survey
Internal test I	
Internal test II	
Internal test III	
Assignment	
Tutorial	
Seminar	
End Semester Exam	

Course No.	**Course title**	**Credits**	**Teaching Schedule**								**Allotment of marks**
			L	**T**	**Minor test + Curricular activities**	**Major test**	**Practical**	**Total**			
EI-ES-108	Basic Electronics Engineering	3	2	1	40	60	--	100			3 Hrs

Note: The Examiner(s) will set the question paper in three sections, Section-A, Section-B, and Section-C. Section-A is compulsory. Section-A comprises 4-short answer type questions uniformly spread among the entire syllabus. Section-B comprises 4-questions among the 4-modules, asking for conceptual questions, definitions, derivations, principles, construction and working etc. Section-C comprises 4-questions uniformly spread among the 4-modules, asking for the derivations, numericals and applications of the various topics covered therein. The student has to **answer/ attempt 4-questions out of 4-questions in Section-A, 2-questions out of 4-questions in Section-B and 2-questions out of 4-questions in Section-C. Section-A carry12 marks. Section-B and Section-C carry 24 marks each.**

Course code	EI-ES-108
Category	Engineering Science Course
Course title	

Scheme and Credits	L	T	P	Credits	Semester-II
	2	1	2	3	
Pre-requisites					

EI-ES-108 **Basic Electronics Engineering -** Detailed contents

MODULE-I

Semiconductors p-type, n-type, pn junction diodes, pn junction as a circuit element, its characteristics, half wave and full wave and bridge type rectifier circuits basic filter circuits, Doide as voltage multiplier, clipper & clamper circuit. Zener diode as a voltage regulator. LED its characteristics construction & applications

MODULE -II

Characteristics of transistors in different configuration. Concept of d.c. and a.c. load line and operating point selection. Various amplifiers configurations their h-parameter equivalent circuits determination of voltage gain current gain input resistance and output resistance & power gain. Concept of feedback in amplifiers, different oscillators circuits (without analysis)

MODULE -III

Differential amplifier and its transfer characteristics. IC Op-Amps, its ideal & practical specifications and measurement of parameters. Op-Amp in different modes as inverting amplifier non inverting amplifier scale changer, differentiator & integrator.

MODULE -IV

Characteristics of JFET, MOSFET, Various amplifier configurations using FET. Characteristics and Construction of SCR, TRIAC, UJT. Their basic areas applications.

Reference :

1. Electronic Devices & Circuits - Boylstad & Nashelsky.
2. Integrated Electronics By Millman & Halkias.
3. Electronic Principles – Malvino
4. Principles of Electronics – V.K. Mehta, Shalu Melta.
5. Electronic Circuits – Donald L. Shilling & Charles Belowl

EI-EVS-112 Environmental Studies

L T P **major test: 60 marks**

Minor test + curricular activities: 30 + 10 Marks

3 **Total: 100 marks**

Duration of exam : 3 Hrs.

Sessional of 15 marks for Field report evaluation (internal assessment)

Unit 1 : The Multidisciplinary nature of environmental studies

Definition, scope and importance.

Need for public awareness.

Unit 2 : Natural Resources

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit 3 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit : 4 Biodiversity and its conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity : in-situ and ex-situ conservation of biodiversity.

Unit 5 : Environmental Pollution Definition

- Causes, effects and control measures of :
    - a) Air pollution
    - b) Water pollution
    - c) Soil pollution
    - d) Marine pollution
    - e) Noise pollution
    - f) Thermal pollution
    - g) Nuclear hazards
- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides

Unit 6 : Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness.

Unit 7 : Human Population and the Environment

- Population growth, variation among nations
- Population explosion – Family Welfare Programme
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Unit 8 : Field Work

- Visit to a local area to document environmental assets-river / forest / grassland / hill / mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems – pond, river, hill slopes, etc.

Examination Pattern : The question paper should carry 60 marks
The structure of the question paper being.

PART – A	:	Short Answer Pattern	20 Marks

PART – B	:	Essay type with inbuilt choice	40 Marks
PART – C	:	Field Work	15 Marks

INSTRUCTIONS FOR THE EXAMINERS

Part – A Question 1 is compulsory and will contain ten short-answer type question of 2 marks each covering the entire syllabus.

Part – B Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidates will be required to answer, any four of them. Each essay type question will be of the 10 marks.

The examination will be conducted by the college concerned at its own level earlier than the annual examination and each student will be required to score minimum of 35% marks each in theory and Practical. The marks obtained in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these will be shown in the detailed marks certificate of the student.

Chemistry Lab	EI-PR-02

Laboratory Outcomes

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

B.Tech. 1ST YEAR (SEMESTER–II) (w.e.f.2018-19)

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PR-02	Chemistry Lab	1.5			3	3	30	--	45	75	3 Hrs

Chemistry Laboratory[L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

LIST OF EXPERIMENTS

1. Determination of Ca^{++} and Mg^{++} hardness of water using EDTA solution.
2. Determination of alkalinity of water sample.
3. Determination of dissolved oxygen (DO) in the given water sample.
4. To find the melting & eutectic point for a two component system by using method of cooling curve.
5. Determination of viscosity of lubricant by Red Wood viscometer (No. 1 & No. 2).
6. To determine flash point & fire point of an oil by Pensky -Marten's flash point apparatus.

7. To prepare Phenol-formaldehyde and Urea formaldehyde resin.
8. To find out saponification No. of an oil.
9. Estimation of calcium in lime stone and dolomite.
10. Determination of concentration of $KMnO_4$ solution spectrophotometrically.
11. Determination of strength of HCl solution by titrating it against NaOH solution conductometerically.
12. To determine amount of sodium and potassium in a, given water sample by flame photometer.
13. Estimation of total iron in an iron alloy.

SUGGESTED BOOKS :

1. A Text Book on Experimental and Calculation – Engineering Chemistry, S.S. Dara, S. Chand & Company (Ltd.)
2. Essential of Experimental Engineering Chemistry, Shashi Chawla, Dhanpat Rai Publishing Company.
3. Theory & Practice Applied Chemistry – O.P. Virmani, A.K. Narula (New Age)

Computer Programming Lab	EI-PR-04

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PR-04	Computer programming Lab	1.5	-	-	3	3	30	--	45	75	3 Hrs

(ii) Laboratory - Programming for Problem Solving[L : 0; T:0 ; P : 4 (2credits)]

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Course No.	Course title	Credits	Teaching Schedule				Allotment of marks				Duration of Exams
			L	T	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PR-06	Basic Electronic lab	1	-	-	2	2	20	--	30	50	3 Hrs

Course Outcomes

After successful completion of this course, the students should be able to

Design biasing circuits using BJT and FET.

- Apply this knowledge to the analysis and design of basic amplifiers.
- Design and analyze the response of differential and power amplifiers.
- Identify faults in Electronic circuits.
- Design and implement single stage power amplifier

LIST OF EXPERIMENTS : Experiments beyond the syllabus should be conducted.

1. To study the half wave & full wave rectifier.
2. To study the effect of various filters circuits.
3. To study the characteristics of pnp & npn transistor in common emitter & determine H- parameter from characteristics
4. To study the characteristics of pnp & npn transistor in CB & determine h-parameter from characteristics
5. To determine the Av, Ai of RC coupled CE transistor amplifier
6. Determine the frequency of oscillation in Hartley oscillator
7. Determine the frequency of oscillation in phase shift oscillator
8. Determine the effect of negative feedback on bandwidth & gain in CE, RC coupled amplifier
9. Study IC Op-Amp as a inverting amplifier & scale changer
10. Study IC Op-Amp as a non inverting amplifier
11. Study IC Op-Amp as an integrator
12. Study IC Op-Amp as a differentiator
13. Design of BJT Amplifier using Voltage divider bias.
14. Design of FET Amplifier using Voltage divider bias.
15. Design of transistorized series and shunt regulator
16. Design of HEARING AID with PUSH PULL OUTPUT

<table>
<tr><td>Course code</td><td colspan="5">EI-PR- 08</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Workshop/Manufacturing Practices (Theory & Lab.)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-II</td></tr>
<tr><td>1</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">-</td></tr>
</table>

Workshop/Manufacturing Practices **[[L : 1; T:0; P : 0 (1 credit)]**

Lectures & videos: (10 hours) Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**

2. CNC machining, Additive manufacturing **(1 lecture)**

3. Fitting operations & power tools **(1 lecture)**

4. Electrical &Electronics **(1 lecture)**

5. Carpentry **(1 lecture)**

6. Plastic molding, glass cutting **(1 lecture)**

7. Metal casting **(1 lecture)**

8. Welding (arc welding & gas welding), brazing **(1 lecture)**

Workshop Practice Lab.	EI-PR-08

List of experiments

1. To study different types of measuring tools used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.
2. To study different types of machine tools (lathe, shape or planer or slotter, milling, drilling machines)
3. To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off.
4. To study different types of fitting tools and marking tools used in fitting practice.
5. To prepare lay out on a metal sheet by making and prepare rectangular tray, pipe shaped components e.g. funnel.
6. To prepare joints for welding suitable fo r butt welding and lap welding.
7. To perform pipe welding.
8. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
9. To prepare simple engineering components/ shapes by forging.
10. To prepare mold and core assembly, to put metal in the mold and fettle the casting.
11. To prepare horizontal surface/ vertical surface/ curved surface/ slots or V-grooves on a shaper/ planner.
12. To prepare a job involving side and face milling on a milling machine.

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., " Elements of Workshop Technology" , Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

(ii) Kalpakjian S. And Steven S. Schmid, " Manufacturing Engineering and Technology" , 4th edition, Pearson Education India Edition, 2002.
(iii) Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
(iv) Roy A. Lindberg, " Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

(ii) Workshop Practice:(60 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics**(8 hours)**
5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic molding& Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

Department of Instrumentation

Kurukshetra University Kurukshetra

M. Tech. Electrical and Instrumentation Engineering

SCHEME OF EXAMINATIONS
Session 2019-2020

DEPARTMENT OF INSTRUMENTATION
KURUKSHETRA UNIVERSITY KURUKSHETRA

Proposed Scheme for M. Tech. Electrical and Instrumentation Engineering

Semester 1

Course No.	Course title	Credits	Teaching Schedule			Allotment of marks				Duration of Exams
			L	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PC-1101	Program Elective 1	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PE -1102	Program Elective 2	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PC -1103	Advanced Electric Drive	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PC-1104	Advance Process Control	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EIPR-PC-1105	Process Control Lab	**3**	**0**	**6**	**6**	**40**	**-**	**60**	**100**	3 Hrs
EIEP -1106	Advanced Electric Drive Lab	**2**	**0**	**4**	**4**	**40**	**-**	**60**	**100**	3 Hrs
EIRM-1107	Research Methodolog y & IPR	**2**	**2**	**-**	**2**	**15+5**	**30**	**-**	**50**	
	Audit Course-1	**0**	**2**	**-**	**2**	**50***	**-**	**-**	**0**	
	Total	**19**	**16**	**10**	**26**	**260**	**270**	**120**	**650**	

Semester 2

Course No.	Course title	Credits	Teaching Schedule			Allotment of marks				Duration of Exams
			L	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PC -1201	Power Quality Monitering and Conditioning	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PC -1202	PLC & DCS	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PC -1203	Advanced Power System	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PC-1204	Biomedical Instrumentation	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EIPR-PC - 1205	Advanced Power System Lab.	**2**	**0**	**4**	**4**	**40**	**-**	**60**	**100**	3 Hrs
EIPR-PC- 1206	Power Quality and FACTS Lab.	**3**	**0**	**6**	**6**	**40**	**-**	**60**	**100**	3 Hrs
	Audit Course-1	**0**	**2**	**-**	**2**	**50***	**-**	**-**	**-**	
	Total	**17**	**14**	**10**	**24**	**240**	**240**	**120**	**600**	

Semester 3

Course No.	Course title	Credits	Teaching Schedule			Allotment of marks				Duration of Exams
			L	P	Total	Minor test + Curricular activities	Major test	Practical	Total	
EI-PC-2301	Smart & Micro Sensor Design	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PE 2302	Program Elective 3	**3**	**3**	**0**	**4**	**40**	**60**	**-**	**100**	3 Hrs
EI-PC-2303	Program Elective Lab.	**2**	**0**	**4**	**4**	**40**	**-**	**60**	**100**	3 Hrs
EI-SEM-2301	Current Literature Report & Seminar	**3**	**0**	**6**	**6**	**50**	**-**	**-**	**50**	3 Hrs
	Dissertation phase-1	**7**	**0**	**14**	**14**	**100**	**-**		**100**	
	Total	**18**	**6**	**24**	**30**	**170**	**120**	**60**	**450**	

Semester 4

Code	Subject Name	Hours per week			Minor	Major	TOTAL	Credits
		L	T	p	Minor	Major	Total	
EI-PC-2401	Dissertation	0	0	32	100	300	400	16

Students can choose PE (Program Electives) from the respective lists of electives. The option to be offered, however, will be decided by the department each year depending on the facilities available.

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***LIST OF AUDIT COURSES – 1 for 1st Semester		
1	EIAD-101	English for Research Paper Writing
2	EIAD-103	Disaster Management
3	EIAD-105	Sanskrit for Technical Knowledge
4	EIAD-107	Value Education

***LIST OF AUDIT COURSES – 2 for 2nd Semester		
1	EIAD-102	Constitution of India
2	EIAD-104	Pedagogy Studies
3	EIAD-106	Stress Management by Yoga
4	EIAD-108	Personality Development through Life Enlightenment Skills

***Audit courses are mandatory and qualifying in nature.**

Program Elective 1

EI-PC-1101(i) Control system Design
EI-PC-1101(ii) Process Equipment Design
EI-PC-1101(iii) Industrial Environmental Engineering
EI-PC-1101(iv) Power Plant Engineering
EI-PC-1101(v) Process Modeling and Control
EI-PC-1101(vi) Energy Auditing and methodology
EI-PC-1101(vii) Energy Efficient Machines

Program Elective 2

EI-PE-1102(i) Renewable & non conventional energy
EI-PE-1102(ii) Theory and Design of Neuro fuzzy controllers
EI-PE-1102(iii) Digital Control System
EI-PE-1102(iv) HVDC Transmission System
EI-PE-1102(v) Energy Management

Program Elective 3

EI-PE-2302(i) Digital Signal Processing
EI-PE-2302(ii) Sensors and Transducers
EI-PE-2302(iii) Reliability Engineering
EI-PE-2302(iv) System Theory
EI-PE-2302(v) Research Methodology
EI-PE-2302(vi) Intelligent Instrumentation
EI-PE-2302 (vii) -- Industrial Electronics

N.B

1. **The syllabus for each theory paper will contain four units and examiner will set eight questions by selection two questions from each unit. The student will answer any five questions in all, selecting at least one from each unit**

2. **The Internal assessment in each theory paper will be 40 marks, out of which 30 marks will be assigned on the basis of two written test and 10 marks will be assigned on the basis of curricular activities.**
3. **Dissertation report will be examined by external as well as internal examiners.**

Programme Outcomes

PO1 Apply the knowledge of science and basic control theories in designing, analyzing the various industrial and domestic applications.

PO2 Design the modern control circuits for specific applications and process automation.

PO3 Use modern tools, professional software platforms, embedded systems for the diversified applications.

PO4 Explore ideas for inculcating research skills.

PO5 Solve the problems which need critical and independent thinking to show reflective learning.

PO6 Imagine the larger picture and correlate the domain knowledge with the global industrial problems.

EI-PC-1101(i) -- CONTROL SYSTEM DESIGN

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT - I

INTRODUCTION: Control System Architecture, Design Specifications Functional in-equally specifications, multi-criteria optimization, norms of scalar & vector signals, norms of SISO LTI & MIMO LTI systems, state space methods for computing norms, design specifications as sets, affine & convex sets and functions, closed loop convex design specifications, convexity & duality.

UNIT - II

DESIGN SPECIFICATIONS: Reliability & closed loop stability, I/O specifications, regulation specifications, actuator effort, combined effect of disturbances & commands, differential sensitivity specifications, robustness specifications via gain bounds.

UNIT - III

COMPENSATORS & CONTROLLERS DESIGN: Selection criteria and design of lead, lag, lead-lag and cascade type of compensators using Root locus & Bode plots, Rate feedback. Controllers – configuration and fundamentals of design, cascade and feed back compensation using various controllers**.**

UNIT – IV

STATE VARIABLE FEED BACK DESIGN**:** Introduction to state variable analysis, controllability and observabilty, state feed back for SISO system, state feed back design of SISO system using control canonical form. State variable feedback _ steady state error analysis, Use of steady state error coefficients, design of state observers, Introduction to design of MIMO systems. Introduction to design of non-linear system and software.

Reference Books:

1. Modern Control Systems – A manual of design methods by John A. Borrie (Prentice Hall International)
2. Control Systems – Principle & Design by M. Gopal (TMH publication)
3. Introduction to feed back control system by Pericles E. Manuel & Edward leff (International Student Edition)
4. Linear controller designs – limits of performance by Stephen P. Boyd & Craig H. Barratt (Prentice Hall International).
5. Linear control analysis & design By John J. D’azzo & C. H. Houpis (Mc-graw Hill)

EI-PC- 1101E(ii) - PROCESS EQUIPMENT DESIGN

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT I

Valve Noise calculation and reduction: Sources of valve noise, noise control, path treatment, valve treatment, valve noise calculation. Design & construction of Globe valve: valve trends, trim design, trim flow characteristics, flow range ability, standard trim configuration, valve plug stems, Body form of single and double seated globe valve, Bonnet design of global valve.

Construction and flow characteristics of butterfly valve.

UNIT - II

Boiler control and optimization, compressor control and optimization, cooling tower control and optimization, distillation controls, evaporator controls, , reactor control and optimization

Basics of Process Equipment Design: General design procedure, Computer design, Fabrication techniques, Equipment classification, Power of rotational motion, Drives for process equipment.

UNIT - III

Pressure Vessels: Pressure vessel code, Operating conditions – at low temperatures, at elevated temperatures, Design considerations and stresses, fabrication, inspection and tests, unfired vessel codes, High pressure vessels: Constructional features, materials, solid walled, multi shell, vessel closures, Jacket for vessels, Examples. Storage Vessels: Storage of fluids, Non-volatile liquids, volatile liquids and gases, Design of tanks, rectangular tanks, nozzles and mounting, Large capacity storage tanks, Examples. Reaction Vessels: Materials for construction, agitation, classification of reaction vessels, heating systems.

UNIT - IV

Heat Exchangers: Types of heat exchangers, design of shell and tube heat exchangers. Evaporators and Crystallisers: Types of evaporators, entrainment separators, materials and design considerations, crystallisers, Examples.Process Hazards and Safety Measures in Equipment design. Process flow diagrams.

Reference Books:

- Instrument Computer Aided Process control by S.K. Singh PHI
- Computer Based Industrial Control by Krishna Kant PHI
- Instrument Engineers Handbook- Process Control by Bela G. Liiptak

EI-PC-1101(iii) -- INDUSTRIAL ENVIRONMENTAL ENGINEERING

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT I

INTRODUCTION: Source and classification of Air Pollution, Effect of Air Pollution in Human Health, Effect of Air Pollution on Animals, Effect of Air Pollution on Plants, Economics Effects of Air Pollution, Control of Air Pollution by Equipment, Control of Air Pollution by Process Changes, Air Pollution from Major Industrial Operations, Air Pollution legislation and regulation, Environment Protection Act, Air Pollution in Indian cities, Water & Noise Pollution. & its control, Green House effects & its control.

UNIT II

POLLUTION CONTROL FOR SPECIFIC POLLUTANTS: Industrial Pollution Emission and Indian Standards, Analysis of Pollutants, Control of BOD, Removal of Chromium, Removal of Mercury, Removal of Ammonia / urea, Treatment of Phenolic Effects, Removal of particular matter, Removal of Sulphur Dioxide, Removal of Oxides of Nitrogen, Removal of Vapour from Efficient case, Control of CO_2 and CO.

UNIT III

POLLUTION CONTROL IN SELECTED PROCESS INDUSTRIES: General considerations of Pollution Control in Chemical Industries, Pollution Control aspects of fertilizer industries, Pollution Control in Petroleum & Petrochemical Units,

UNIT IV

Pollution Control in Pulp & Paper Industries, Tanning Industries, Sugar Industries, Alcohol Industries, Electroplating & Metal Finishing Industries, Radioactive Wastes, Pollution Control methods used in Power Plants.

Reference Books:

1.Air Pollution by H V Rao, McGraw Hill
2.Pollution Control in Process Industries by S P Mahayar, McGraw Hill
3.Encyclopedia of Environmental Pollution & Control, Vol. 1 & 2, Enviro Media, Karad, India.
4.Envoronmental Water Pollution & its control by G R Chhatwal, M.C. Mehra & Others, Anmol Publication, Delhi.
5. Environmental Air Pollution & its control by G.R. Chhatwal & Others, Anmol Publication, Delhi.

EI-PC-1101 (iv) -- POWER PLANT ENGINEERING

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

UNIT-I

Steam generators, condensers and turbines: Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control.
Steam power plant: Classification, Operation, Description of Rankin cycle, Regenerative cycle, Reheat-Regenerative Cycle, Binary Vapour Cycle, Selection of plant site and its layout, coal handling system, combustion system, Fluidised bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

UNIT-II

Hydro-electric power plants: Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classification of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydro-station, layout of hydro power plant.
Nuclear power plants: Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Site selections, safety measures, plant layout, Fusion reaction, Future of nuclear power.

UNIT-III

Gas turbine: Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations.
Diesel power plants: Classifications of IC Engines and their performance, Four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Celane number, knocking, super charging, operation and layout of diesel power plant.

UNIT-IV

Combined operation of different power plants: Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.
Pollution control: Pollution from thermal & nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

Recommended books:

1. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., *A Textbook on Power System Engineering*, Dhanpat Rai & Co.
2. EI-Wakit M.M., *Power Plant Engineering*, McGraw Hill, USA
3. Rajput R.K., *Power Plant Engineering*, Luxmi Publications
4. Sharma P.C., *Power Plant Engineering*, Kataria & Sons
5. Skrotzki B.G.A. and Vapot W.A., *Power Station Engineering and Economy*, Tata McGraw-Hill

EI-PC-1101(v) -- PROCESS MODELLING AND CONTROL

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be Eight questions in all. Two questions from each Unit. Answer five questions in all, selecting at least One from each Unit.

UNIT- I

Simulation and Modelling: Importance of Simulation, Mathematical Modelling, Process dynamic of fluid flow and heat transfer system, Mass transfer dynamics and distillation column, Reaction kinetics of chemical processes. Process control aim and objectives classification of process control system, techniques for process control. Modelling and simulation for plant Automation-case studies.

UNIT- II

PREDICTIVE CONTROL SYSTEM: Model based control system (Internal mode control, Model Predictive control and Process Model based control), Plant wide Control , Inferential control, Multiple-loop (Multivariable) control system. Interaction and Decoupling of control loops. Design of cross controllers and selection of loop using RGA. Prosperities and application of RGA.

UNIT- III

ADAPTIVE AND LEARNING CONTROL SYSTEM: Basic principles of Adaptive and learning systems, MRAC & STAC, Adaptive control techniques, Types of Learning- Supervised and Unsupervised Learning control system, On-line and Off-line Learning control system.

UNIT- IV

Real time control system: Characteristics and classes of real time systems, program classification: Sequential, multitasking real time, concurrency and synchronization. Design strategies, Reability, fault detection, fault tolerance real time operating system, Distributed computing systems, Software Process models (Build and mix model, waterfall, rapid prototyping, Incremental and Spiral model) Design techniques and tools

Reference Books:

- Techniques of Process Modelling, Simulation and Control for Engineer by Astrom, Luyben, McGraw Hill.
- Computer Controlled System by Astrom, K.J and B. Wittenmark PHI
- Chemical Process Control by Stephanopolous PHI
- Process Control Modeling ,Design and Simulation by B.Wayane Bequette, PHI

EI-PC-1101(vi) -- ENERGY AUDITING AND METHODOLOGY

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be Eight questions in all. Two questions from each Unit. Answer five questions in all, selecting at least One from each Unit.

UNIT- I

Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act- 2001 and its features. **Energy Management and Audit:** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

UNIT- II

Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams. **Financial Management:** Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of energy savings companies (ESCOs).

UNIT- III

Electrical system: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues **Compressed air system:** Types of air compressors, Compressor efficiency, efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency.

UNIT- IV

High Voltage Alternating Current and Refrigeration System: Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

Reference books recommended:

1. Abbi, Y.P. and Jain, S., *Handbook on Energy Audit and Environment Management*, Teri Bookstore
2. Diwan, P., *Energy Conservation*, Pentagon Press (2008).
3. Younger, W., *Handbook of Energy Audits,* CRC Press (2008)
4. Sawhney and Maheshwari, *Solar Energy and Energy Conservation*, Prentice Hall (India)
5. Rao S. and B. B. Parulkar, *Energy Technology,* Khanna Publishers
6. Sukhatme S. P., *Solar Energy,* Tata McGraw Hill
7. David S., *Hand Book of Industrial Energy Conservation,* Van Nostrand Reinhold Publishing Company.

EI-PC-1101(vii) -- ENERGY EFFICIENT MACHENES

L T P
3 0 0 Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be Eight questions in all. Two questions from each Unit. Answer five questions in all, selecting at least One from each Unit.

UNIT- I

INTRODUCTION: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.

UNIT- II

ENERGY EFFICIENT MOTORS: Standard motor efficiency, why more efficient motors? An energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labelling, energy efficient motor standards. Motor life cycle

UNIT- III

POWER FACTOR: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor

UNIT- IV

INDUCTION MOTORS AND ADJUSTABLE DRIVE SYSTEMS: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

REFERNCE BOOKS RECOMMENDED:

1. Andreas John C., Energy efficient electric motors, Marcel Dekker Inc. 1992.
2. Thuman Albert, Introduction to Efficient Electric System Design, The Fairmount Press Prentice Hall.
3. Tripathi S.C. , Electric Energy Utilization and Conservation, Tata McGraw-Hill 1991.
4. Belove Charles, Handbook of Modem Electronics and Electrical Engineering, John Wiley & Sons.

EI-PE-1102 (i) -- RENEWABLE & NON CONVENTIONAL ENERGY

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be Eight questions in all. Two questions from each Unit. Answer five questions in all, selecting at least One from each Unit.

Unit -I

Introduction to Energy sources: Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.

Unit -II

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters,solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaics - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems.

Unit -III

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations

Energy from Biomass: Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.

Unit -IV

Hydrogen Energy: Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas,hydrogen as alternative fuel for vehicles.

Fuel cell: Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

Reference Books:

1. Non conventional Energy sources, G.D. Rai, Khanna Publishers.
2. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
3. Non conventional Energy, Ashok V. Desai, New Age International Publishers Ltd.
4. Renewable energy resources and emerging technologies, D.P. Kothari, Prentice Hall of India Pvt. Ltd.

EI-PE-1102 (ii) -- THEORY AND DESIGN OF NEURO – FUZZY CONTROLLERS

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be Eight questions in all. Two questions from each Unit. Answer five questions in all, selecting at least One from each Unit.

Unit -I

NEURAL NETWORK

Introduction - Biological neurons and their artificial models – Learning, adaptation and neural networks learning rules types of neural networks – Single layer, multiplayer – Feed forward, feedback networks; back propagation – Learning and training – Hop field network.

Unit -II

NEURAL NETWORKS IN CONTROL

Neural network for non-linear systems – Schemes of neuro control – System identification forward model and inverse model – Indirect learning neural network control applications – Case studies.

Unit -III

FUZZY LOGIC

Fuzzy sets – Fuzzy operation – Fuzzy arithmetic – Fuzzy relations – Fuzzy relational equations – Fuzzy measure – Fuzzy functions – Approximate reasoning – Fuzzy propositions – Fuzzy quantifiers – If–then rules.

Unit -IV

NEURAL NETWORKS IN CONTROL

Structure of fuzzy logic controller – Fuzzification models – Database – Rule base – Inference engine defuzzification – Module - Non-linear fuzzy control – PID like FLC – Sliding mode FLC – Sugeno FLC – Adaptive fuzzy control – Fuzzy control applications case studies.

REFERENCE BOOKS

1. Jacek. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. Kosko, B. "Neural Networks and Fuzzy Systems", Prentice Hall of India Pvt. Ltd., 1994.
3. Klir G.J. & Folger T.A. "Fuzzy sets, uncertainty and information", Prentice Hall of India Pvt. Ltd., 1993.
4. Zimmerman H.J., "Fuzzy set theory – and its application" – Kluwer Academic Publishers, 1994.
5. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.
6. Farin Wah S.S., Filev, D. Langari, R. "Fuzzy control synthesis and analysis", John Wiley and Sons, 2000.

EI-PE-1102 (iii) -- DIGITAL CONTROL SYSTEMS

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60
Total Marks : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT - I

DIGITAL CONTROL**:** Introduction to digital control, sampling, Data reconstruction principles, Pulse transfer functions, Block diagram & signal flow graph, Digital Control Techniques-PID, Deadbeat. Time domain analysis, correlation between time response & root location in S & Z transform, effect of pole-zero configuration in Z-plane on maximum overshoot & peak time transient response, Stability in Z-plane using modified Rouths criteria, Jury's criteria.

UNIT - II

Digital control system design : Design by Emulation, Direct design by root locus in z-plane, Frequency response method, Direct design method by Ragazzini.

NON LINEAR CONTROL SYSTEM: Introduction to non linear feedback control system, special features of linear system; limit cycle, jump response, sub harmonics etc., describing function and phase plane techniques for analysis of non linear system, concept of local, global, asymptotic and total stability of non linear system, Liapunov's stability criterion.

UNIT - III

PID CONTROL AND ROBUST CONTROL:

Tuning procedure for PID controllers, modification of PID control schemes, two degrees of freedom control. Design considerations for Robust control

UNIT - IV

ADAPTIVE AND LEARNING CONTROL SYSTEMS: Basic Principles of Adaptive and Learning Control Systems, Model Reference Adaptive Control, Types of Learning-Supervised and Unsupervised Learning Control Systems, On-line and Off-line Learning Control Systems.

Reference Books:

1. Digital control system By B. C. Kuo (PHI)
2. Modern control engineering By Ogata (PHI)
3. Control System Engineering By Nagrath & Gopal (Wiley Eastern)
4. Control System Engineering By Phillips and Nagle (PHI Publications)
5. Control System Engineering by Norman S Nise, Wile
6. Modern Control System by R C Dorf, R H Bishop, Addision Wesley
7. Systems, Modeling & Analysis by I J Nagrath, M Gopal, TMH
8. Digital Control & State Variable Methods by M Gopal, TMH

EI-PE-1102 (iv) -- HIGH VOLTAGE DIRECT CURRENT TRANSMISSION SYSTEM

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60
Total Marks : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT - I

Direct Current (DC) power transmission technology: Introduction, comparison of Alternating Current (AC) and Direct Current (DC) transmission, application of DC transmission, application of DC transmission, description of DC transmission system, Configurations, planning for High Voltage Direct Current (HVDC) transmission, modern trends in DC transmission. Introduction to Device: Thyristor valve, valve tests, recent trends.

UNIT -II

Analysis of High Voltage Direct Current (HVDC) converters: Pulse number, choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.

UNIT - III

Converter and HVDC system control: General, principles of DC link control, converter control characteristics, system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link, power control, higher level controllers, telecommunication requirements. **Converter faults and protection:** Introduction, converter faults, protection against over-currents, over-voltages in a converter station, surge arresters, protection against over-voltages.

UNIT - IV

Smoothing reactor and DC line: Introduction, smoothing reactors, DC line, transient over voltages in DC line, protection of DC line, DC breakers, Monopolar operation, effects of proximity of AC and DC transmission lines. **Component models for the analysis of AC/DC systems:** General, converter model, converter control, modelling of DC network, modelling of AC networks.

REFRENCE RECOMMENDED BOOKS:

1. Bagamudre, Rakesh Das *Extra High Voltage A.C. Transmission Engineering*, New Age International Publishers.
2. Kimbark E.W., *High Voltage DC Transmission*, Wiley-Interscience
3. Kamaraju V. and Naidu M.S., *High Voltage Engineering,* Tata McGraw-Hill Education
4. Jha R.S., *High Voltage Engineering, Dhanpat Rai*
5. Kuffel, E. and Abdullah, M. High Voltage Engineering, Pergamon Press
6. Wadhwa C. L., *High Voltage Engineering,* New Age Publications.
7. Padiyar, K.R. HVDC Power Transmission Systems: Technology and System Interactions, New Age International

EI-PE-1102(v) --ENERGY MANAGEMENT

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT I

INTRODUCTION: Various Sources of Energy, Conventional and non- Conventional energy, Concept and Classification of Renewable energy, Concept of Energy Conservation and Energy Management, Present Energy Scenario in India (Conventional and non- Conventional energy)

UNIT II

RENEWABLE ENERGY SOURCES: Potential and Utilization status of Renewable Energy in India, Solar Energy: Solar Water Heater Systems, Solar Air dryer Systems, Solar Photo-voltaic Systems, Solar Cookers and Solar ponds, Wind Energy: Selection Criteria for Wind farms, Wind Mills, Bio Gas Plants-Construction and Operation, Bio Mass Gasification, Bio Mass Briquetting; Mini and Micro Hydel Power Plants, Geo-Thermal Energy, Ocean Energy.

UNIT III

ENERGY CONSERVATION AND MANAGEMENT: Actual energy requirement assessment techniques of any industry and energy consumption status, possibility of reduction of energy consumption by using various energy conservation techniques or equipments e.g. variable speed drives, constant voltage transformers, electronic chokes, CFLs etc.

UNIT IV

Importance of instrumentation and control techniques in the energy conservation and management, SCADA systems, Instruments required to carry out energy audit exercise, optimal mixing of renewable energy sources and load rationalization for reducing load on conventional energy sources**.**

Reference Books:

1. Hand Book of Industrial Energy Conservation by S David; Van Nostrand Reinhold Publishing Company.
2. Energy Technology by S Rao & B. B. Parulkar; Khanna Publishers
3. Solar Energy by S. P. Sukhatme; TMH publications
4. Solar Energy & Energy Conservation by Sawhney & Maheshwari; PHI publication.

EI-PC-1103— ADVACED ELECTRIC DRIVE

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all

UNIT-I

Electric Drive: Concept, classification, parts and advantages of electrical dives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia, Steady state stability, Transient stability. Multiquadrant operation of drives. Load equalization.

UNIT-II

Motor power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination ofmotor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.

Starting of Electric Drives:Effect of starting on Power supply, motor and load. Methods of stating of electric motors. Acceleration time Energy relation during stating, methods to reduce the Energy loss during starting.

Braking of Electric Drives: Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking.

UNIT-III

DC motor drives: Modeling of DC motors**,** State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current chopper controlled DC motor drives.

Induction motor drives: Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.

UNIT-IV

Synchronous motor drives: Variable frequency control, Self Control, Voltage source inverter fed synchronous motor drive, Vector control.

Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive.

Industrial application: Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.

Reference &Text Books:

1. Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.
2. Electric Drives, Vedam Subrahmanyam, TMH
3. A first course on Electrical Drives, S.K. Pillai, , New Age International Publication.
4. Electric motor drives, R. Krishnan, PHI
5. Modern Power Electronics & Ac drives, B.K. Bose, Pearson Education.
6. Electric Motor & Drives. Austin Hughes, Newnes.

EI-PC-1104 ADVANCE PROCESS CONTROL

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT – I

PID controller tuning procedures: Close loop oscillation based tuning, Ziegler-Nichol close-loop method. Tuning rules for first order + dead time processes: step testing quarter decay ratio response, Ziegler-Nichol open loop method, Cohen-Coon parameters. Synthesis of feedback controllers: Development of the controller synthesis formula, specifications of close loop response, direct synthesis for minimum and non-minimum phase processes, controller modes and tuning parameters derivative mode for dead time process. Dead Time Compensation (Algorithms for Smith Predictor), & effect of process modeling error.

UNIT – II

Control Valve Design: Control valve flow characteristics, Valve & process characteristics, range availability of control valve, control valve sizing for gas, liquid, vapors and steam, Control valve cavitation and flashing, flow control cavitation index, vibration curve cavitation index, calculation of flash fraction, Control valve gain, sequencing of control valve . Valve application, selection, valve capacity testing.

UNIT - III

Additional control techniques: Cascade control,. Selective control & Split range control, Cascade control for various processes , dynamic characteristics of Cascade control system and its tuning. Override and Auctioneering control system for various processes, Feedforward control system, Feedforward control of various processes. Design of Feedforward controllers, Feedforward – Feedback control & their relative advantages & disadvantages.

UNIT -IV

Ratio control system, Predictive control control Statistical control Adaptive and Inferential control system: Programmed Adaptive control, gain scheduling Adaptive control, Self tuning regulator (STR), MRAC, Multivariable Process Control.

Reference Books:

- Principles and Practice of Automatic Process Control by Carlos A Smith, John wiley & sons
- Computer Aided Process control by S.K. Singh PHI
- Process Control Modeling, Design, and Simulation by B.Wayane Bequette PHI
- Chemical Process control by Stephanopolous PHI

EI-PC-1201 POWER QUALITY MONITORING AND CONDITIONING

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT-I

Overview and definition of power quality (PQ): Sources of pollution, and regulations, Power quality problems rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages, **Definitions Voltage sag analysis and mitigation:** Sag caused by motor starting, Sag caused by utility fault clearing, Sag mitigation, Sag magnitude and duration calculations in single-phase systems, Equipment performance in presence of sag, Computers, Alternating current (AC) and direct current (DC) drives.

UNIT-II

Harmonics: Effects-within the power system, Interference with communication Harmonic measurements. Harmonic elimination. **Harmonic distortion:** Power system harmonics: harmonic analysis, Harmonic sources-the static converters, Transformer magnetization and non-linearities, Rotating machines, arc furnaces, Fluorescent lighting. Introduction to power converters, Fourier analysis, Total harmonic distortion, rms and average value calculations, Arcing and saturable devices, Effects of harmonic distortion, System response characteristics.

UNIT-III

Principles for controlling harmonics: Locating sources of harmonics, Passive and active filters, Harmonic filter design. **Monitoring power quality:** Monitoring essentials, Power quality measuring equipment, Current industry trends.

UNIT-IV

Power Conditioning: Electric power conditioning, Active and passive filters, IEEE, IEC, ANSI standards, Power Acceptability Curves, Various standards

REFRENCE BOOKS:

1. Beaty, H. and Santoso,S., *Electrical Power System Quality*
2. Kennedy, B., *Power Quality Primer*, McGraw Hill (2000).
3. Bollen, M.H.J., *Power Quality Problems: Voltage Sag and Interruptions*, IEEE Press (2007).
4. Mohan, N., *Power Electronics*, New Age International (P) Limited, Publishers (2007).

EI-PC-1202 PROGRAMMABLE LOGIC CONTROLLERS AND DISTRIBUTED CONTROL SYSTEM

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

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UNIT - I

Direct Digital Control – Structure and Software: The position algorithm (simplifying PID control equation, deriving position algorithm); the velocity algorithm (velocity algorithm, deriving the velocity algorithm); Multi variable control (Cascade control using velocity algorithm, radio control using velocity algorithm).

UNIT - II

Discrete State Process Control System: Development and analysis of ladder diagram, logic diagram from ladder diagram, Function description of PLC, Programming fundamentals , hardware and system sizing and selection, PLC peripherals, programming, PLC networking, PLC programmable languages, ladder diagrams language, Boolean mnemonics language, functional block language, PLCs.

UNIT - III

Distributed Process Control System: Functional requirement of DPCS, DCS configurations/ architecture, data highway cables, field buses, protocols used in DCS, Software configuration: controller function configuration, multiplexer and party line system.

UNIT - IV

Supervisory control and Data Acquisition system (Functions of SCADA, channel scanning, conversion to engineering units, data processing, distributed SCADA system, Remote terminal unit). DCS supervisory computer and configurations: supervisory computer function, supervisory control techniques and consideration, Supervisory control algorithm, DCS system integration with PLC and computer. Fiber optic local area networks – map and top.

Popular Distributed Control Systems: CP 80 system.

Reference Books:

1. Computer Aided Process control by S.K. Singh PHI
2. Computer Based Industrial Control by Krishna Kant PHI
3. Instrument Engineers Handbook- Process Control by Bela G. Liiptak
4. Microprocessor in Process control by C.D. Johnson
5. Principles and Practice of Automatic Process Control by Carlos& A Smith

EI-PC-1203 ADVACED POWER SYSTEM

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT - I

SYSTEM MODELLING: System modelling of synchronous machines, transformers, loads etc, per unit system, single line diagram of electrical networks, single phase impedance diagrams. Formulation of impedance and admittance matrices for the electrical networks.

UNIT - II

LOAD FLOW STUDIES: Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal method and Newton Raphson Method.

UNIT - III

FAULT ANALYSIS: Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical Line-to-ground (LG), Line-to line (LL), double line to ground (LLG) faults using symmetrical components.

UNIT - IV

POWER SYSTEM STABILITY: Steady state stability, Dynamics of a synchronous machine , Power angle equations , Transient stability, equal area criterion, Numerical solution of swing equation , factors effecting transient stability.

REFRENCE BOOKS RECOMMENDED:

1. Elgerd O.I., *Electric Energy Systems Theory*, Tata McGraw Hill
2. Nagrath I.J., Kolthari D.P., *Modern Power System Analysis*, Tata McGraw Hill
3. Stevenson W.D., *Elements of Power System* Analysis, McGraw Hill
4. Nagrath I.J. and Kothari D.P., *Power System Engineering, Tata McGraw Hill*
5. Arrillaga J. and Arnold C.P., *Computer Analysis of Power Systems, John Wiley & Sons*
6. Stagg Glenn W. and Ei-Abiad Ahmed H., *Computer Methods in Power System Analysis, Tata* McGraw Hill
7. Kusic G.L., *Computer Aided Power System analysis, Prentice Hall, India*

EI-PC- 1204 BIO-MEDICAL INSTRUMENTATION

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all, two from each unit. Answer five questions selecting one from each unit.

UNIT - I
Characteristics of Transducers and Electrodes for Biological Measurement: Introduction to human body; block diagram, classification, characteristics, various physiological events and suitable transducer for their recording, bioelectric potentials.

UNIT - II
Cardiac & System: Cardiac musculature, Electro cardiography, ECG recording, Phonocardiography, holter recoding ECG lead system, Heart rate meter, vector cardiography, Pacemakers, Defibrillators. Blood Pressure and Blood Flow Measurement: Invasive and non-invasive methods of Blood pressure, Characteristics of blood flow and heart sound, Cardiac output measurement, Plethysmography. Respiratatory System: Mechanics of breathing, Parameters of respiration, Respiratory system measurements, Respiratory therapy instruments.

UNIT - III
Instrumentation for Measuring Nervous Function: EEG signal, frequency band classification, Lead systems, EEG recording, Clinical applications of EEG signal, X-ray CT scan, MRI, PET. Muscoskeletal systems: EMG, Clinical applications, and Muscles stimulator. Clinical Laboratory Instrumentation: Test on blood cell, Blood cell counter, Blood glucose monitors, auto analyzer, Pulse-oximeter.

UNIT - IV
Recent Trends in Biomedical Engg.: Patient care and monitoring, Non-invasive diagnostic instrumentation, Biotelementry, Telemedicine, Prosthetic devices, Lie detector test, Application of lasers and ultrasonic in biomedical field. Troubleshooting & Electrical Safety of Biomedical Instruments: Physiological effect of current and safety measurement.

REFERENCE BOOKS:

1. Medical instrumentation application & design, John G Webster, John wiley, 1998.
2. Review of medical physiology, W.F. Ganong, Medical publisher, 1977
3. Biomedical instrument and measurement, Cromwell, PHI, 2000
4. Handbook of biomedical instrument, R S Khandpur, TMH

EI-PC-2301 SMART & MICRO-SENSORS DESIGN

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be Eight questions in all. Two questions from each Unit. Answer five questions in all, selecting at least one from each Unit.

UNIT I

MEMS: Introduction, principle of MEMS, Example of Mems, small and large scaling, fabrication technology, micromachining: photolithography, thin film deposition and doping, wet chemical etching, waferonding, plasma etching, surface micromachining.

UNIT II

Mechanics of Membrane and beams: dynamics, string, beams, diaphragms and membrane Transduction of Deformation: Metal strain gauges, Semiconductor Strain Gauges, Capacitive Transducers, Force and Pressure sensors: Force Sensors, Pressure sensors, Thermocouples Semi conducting Thermo resistors, Fiber Optical sensors, concept of smart and intelligent sensor, bio sensors.

UNIT-III

Acceleration Sensors: introduction, Bulk Michromachined Accelerometers, surface Michromachined accelerometers, force feedback, angular rate sensors, Flow Sensors: The laminar boundary layer, Heat Transport in the limit of very small Reynolds Numbers, Thermal Flow Sensors, Skin Friction Sensors, Dry fluid Flow Sensors, wet fluid flow sensors, Resonant Sensors: Basic principle and physics.

UNIT IV

Definition of intelligence and of intelligent instrumentation system: Features characterizing intelligence and Features intelligent instrumentation, component of intelligent instrumentation. Design of intelligent instrumentation systems.

Smart and Intelligent transmitters, smart features standard for smart sensing, setting standards for smart sensors and system, IEEE 1451.1, IEEE 1451.2, STIM, IEEE P1451.3, IEEEP 1451.4, Field buses systems.

Reference Books:

1. E.O. Doeblin Measurement System Application and Design, McGraw Hill
2. Beeweth and Buck- Mechanical Measurement, Nares Puti
3. Nortan- Hand Book of transducers, PHI
4. Conside-Process and industrial instrumentation, McGraw Hill
5. Mechanical Microsensors, M.Elwenspoek, R. Wiegerink, Springer

EI-PE-2302(i) DIGITAL SIGNAL PROCESSING

L T P
3 0 4

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT – I

Introduction: Signals, Systems and Signal processing, Classification of Signals, Concept of frequency in continuous time and discrete time signals. **Discrete Time Signals and Systems:** Discrete time signals, Discrete time systems, Analysis of discrete time linear time-invariant systems, Discrete time systems described by difference equations, Implementation of discrete system, Correlation of discrete time signals. **Z-Transform:** The Z-transformation, properties of Z-transformation, Rational Z-transformation, Inversion of Z-transform, Analysis of linear time invariant systems in Z-domain.

UNIT – II

Frequency Analysis of Signals and Systems: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier Transform for discrete time signals, Frequency domain characteristics of linear time invariant systems, linear invariant systems as frequency selective filters, Inverse systems and de-convolution.

The Discrete Fourier Transform: Frequency domain sampling, Properties of Discrete Fourier Transform (DFT), Linear filtering methods based on DFT, Frequency analysis of signals using the DFT. FFT algorithm : Decimation-in-time (DIT) algorithm and Decimation-in-frequency(DIF) algorithm.

UNIT – III

Design of Digital Filters: General considerations, Design of Finite Impulse Response (FIR) filters, FIR digital filter design using Fourier series method, window design techniques. Optimal equiripple desgn techniques, frequency sampling design techniques. Design of Infinite Impulse Response (IIR) filters from analog filters, Comparison of IIR and FIR filters.

UNIT – IV

Realization of digital systems: FIR and IIR system realization. Two-dimensional Discrete time Signals and systems, Two–dimensional Z-Transform theorems and properties. Wavelets and Wavelets transform .

Reference Books:

1. Digital filter analysis and Design by Andreas Antoniou McGraw Hill
2. Digital Signal Processing by David J. Defalta
3. Digital Signal Processing by A.V. Oppenhein and Schafer PHI
4. Digital Signal Processing by J.G.Proakin, D.G. Manolakis, PHI
5. Modern filter theory by Johnson and Johnson
6. Wavelets and Signal Processing by Lokenath Debnath, Birkhauser Boston Basel Berlin

EI-PE-2302 (iv) SYSTEM THEORY

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all, two from each unit. Answer five questions selecting one from each unit.

UNIT - I

Controllability & Observability: Introduction, general concept of controllability, general concept of observability, controllability tests for continuous time systems, observability tests for continuous time systems, controllability & observability for discrete time systems, controllability & observability of state model in Jordan canonical form, loss of controllability & observability due to sampling, controllability & observability canonical forms of state model.

UNIT - II

State variables and input output descriptions: introduction, input output maps from state models, LTI continuous time systems, LTI discrete time systems, linear time varying systems, output controllability, reducibility, state model from input output maps realization of scalar transfer functions, phase variable canonical forms, realization of transfer function matrices, realization of pulse transfer functions.

UNIT - III

Stability: Introduction, equilibrium points, stability concepts and definitions, stability of linear time invariant systems, equilibrium stability of non-linear continuous time autonomous systems, direct method of Lyapunov and the linear continuous time autonomous systems, aids to find Lyapunov functions for non-linear continuous time autonomous systems, use of Lyapunov functions to estimate transients, the direct method of Lyapunov and discrete time autonomous systems.

UNIT - IV

Model control: Introduction, controllable and observable companion forms for single input/single output systems & multi-input/multi-output systems, the effect of state feedback on controllability & observability, pole placement by state feedback, full order observers, the separation principle, reduced order observers, deadbeat control by state feedback, deadbeat observers.

REFERENCE BOOKS:

1. Modern control system theory by M. Gopal (New age international)
2. Modern control systems – a manual of design methods by John A Borrie (Prentice hall international)
3. Digital control and state variable methods by M. Gopal (Tata McGraw Hill)

EI-PE-2302 (v) -- RESEARCH METHODOLOGY

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT I

Nature and objective of the research

Methods of Research: Historical, descriptive and experimental.
Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses, Feasibility, preparation and presentation of proposal.

UNIT II

Introduction to statistical analysis: Probability and probability distributions, binomial, Poisson, exponential and normal distributions, and their applications.
Sampling: Primary and secondary data, their collection and validation, methods of sampling, stratified random sampling, and systematic sampling.

UNIT III

Regression and correlation analysis: Tests of significance based on normal, t and chi square distributions, analysis of variance.
Basic Principles of design of experiments, completely randomized and randomized block designs.

UNIT IV

Edition, tabulation, & testing of hypotheses, Interpolation of results, presentation, styles for figures, tables, text, quoting of reference and bibliography. Use of software for statistical analysis like SPSS, Mini tab or MAT lab, Report writing, preparation of thesis.

Reference Books:

- Research Methodology by C.R Kothari, Wishwa Prakashan
- Research Methodology by P.G . Tripathi
- Research Methodology in Social Science by Sadhu Singh, Himalya Publishers
- Business Research Methods, Donald cooper, Tata McGraw Hill
  Statistical analysis for Engineers & Scientists, J. W. Barnes, McGraw Hill

EI-PE-2302 (vi) -- INTELLIGENT INSTRUMENTATION

L T P
3 0 0

Minor test+ curricular activities = **30 + 10**
Major test: 60 Marks
Total : 100 Marks
Time : 3hrs.

UNIT-I

Introduction: Definition of intelligence and of an intelligent instrumentation system; features characterizing intelligence and features of intelligent instrumentation; components of intelligent instrumentation; Block diagram of an intelligent instrumentation system.

UNIT-II

Smart Sensors: Primary sensors**;** Excitation**;** Amplification; Filters**;** Converters; Compensation (Nonlinearty**:** look up table method**,** polygon interpolation, polynomial interpolation**,** cubic spline interpolation, Approximation & regression; Noise & interference**;** Response time**;** Drift; Cross-sensitivity)**;** Information Coding/ Processing**;** Data Communication**;** Standards for smart sensor interface**;** The automation.

UNIT-III

Interfacing Instruments & Computers: Basic issues of interfacing; Address decoding; Data transfer control; A/D converter; D/A converter; Other interface considerations.

UNIT-IV

Software Filters (Digital Filters) : Description of Spike Filter**,** Low pass filter, High pass filter etc.

Recent Trends in Sensor Technologies: Introduction**;** Film sensors (Thick film sensors, Thin film sensors)**;** Semiconductor IC technology – standard methods; Microelectro-mechanical systems (Micro-machining, some application examples)**;** Nano-sensors**.**

Reference Books:

- Alan S. Morris, 'Principles of measurement & Instrumentation', PHI.
- Wai-Kai Chen, 'Passive and Active Filters: Theory and Implementations', John Willey & Sons (Asia) Ptr. Ltd., New Delhi.
- D. Patranabis, 'Sensors & Transducers', PHI, 2003.
- Roman Kuc, 'Introduction to Digital Signal Processing', Mc Graw Hill Introduction Edition N.York.

EI-PE-2302 (vii) -- INDUSTRIAL ELECTRONICS

L T P
3 0 0 Minor test+ curricular activities = **30 + 10**
Major test: 60
Total : 100 Marks
Time : 3hrs.

There will be 8 questions in all. Two questions from each unit. Answer five questions in all selecting one from each unit.

UNIT-I

INTRODUCTION: Review of semiconductor power devices (Power diodes, Power Transistors, MOSFETS, IGBT, SCR, GTO, MCT, DIAC, TRAIC, PUT, SUS, SCS), Review of choppers, converters, inverters, cyclo-converters.

CLOSED LOOP CONTROL OF DC DRIVES: Single Quadrant variable speed drives; Four Quadrant variable speed drives, Armature voltage control at constant field, field weakening, details of various blocks of closed loop drives; drive employing armature reversal by a contactor, drive employing a dual converter with non- simultaneous and simultaneous control.

UNIT-II

Industrial application of Industrial Electronic Devices: Control of electric drives used in manufacturing and process industries, protection of electric drives using solid state devices and controllers, analysis of drive systems.Testing for drive controllers: Design and testing if microprocessor based drive controllers, analysis of solid state control of industrial drives, design and testing of thyristor based controllers for electric drives.

UNIT- III

FREQUENCY CONTROLLED INDUCTION MOTOR DRIVES: Control of IM by VSI-3 phase VSI, six step inverter voltage control, PWM inverter, breaking and multiquadrant control, VSI variable frequency drives; control of IM by CSI- 3 phase CSI, current sources, Braking, PWM in a thyristor CSI, PWM GTO CSI, CSI variable frequency drives.

UNIT- IV

SELF -CONTROLLED SYNCHRONOUS MOTOR DRIVES: Self control, brushless & commutatorless, DC & AC motors synchronous motor control-operation of a wound field and permanent magnet synchronous motor from a variable frequency current source; source, permanent magnet, operation of a permanent magnet motor at the maximum torque to armature current ratio and at the maximum torque to flux ratio; operation of self controlled synchronous motor drives- CSI drives, VSI drives, cyclo-converters drives, brush-less and commutator-less AC & DC motor drives and their applications.

Reference Books:

1. Industrial Electronics by Frank D. Petruzella (Mc Graw- Hill)
2. Industrial Electronics by Morris (McGraw-Hill)
3. Power semiconductor drives by G.K.Dubey, Prentice Hall Inc, New Jersey

EIRM-1107 - Research Methodology and IPR

L T P
2 0 0

Minor test: 50

UNIT-1

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-2

Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT- 3

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT- 4

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT- 5

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT- 6

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

AUDIT 1 and 2:

ENGLISH FOR RESEARCH PAPER WRITING

L T P Minor test: 50
2 0 0

Course objectives:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT - 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT - 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT - 3

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT - 4

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT - 5

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNITS 6

useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AUDIT 1 and 2: DISASTER MANAGEMENT

L T P Minor test: 50

2 0 0

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT - 1

Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. 4

UNIT - 2

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills,Outbreaks Of Disease And Epidemics, War And Conflicts. 4

UNIT - 3

Disaster Prone Areas in India: Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics. 4

UNIT - 4

Disaster Preparedness And Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness. 4

UNIT - 5

Risk Assessment: Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. 4

UNIT - 6

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India. 4

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

AUDIT 1 and 2:

SANSKRIT FOR TECHNICAL KNOWLEDGE

L T P Minor test: 50
2 0 0

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. huge knowledge from ancient literature

UNIT - 1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences 8

UNIT - 2

Order , Introduction of roots, Technical information about Sanskrit Literature 8

UNIT - 3

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics 8

Suggested reading

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

AUDIT 1 and 2:

VALUE EDUCATION

L T P Minor test: 50
2 0 0

Course Objectives

Students will be able to
1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

UNIT - 1

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgements. 4

UNIT - 2

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness., Honesty, Humanity. Power of faith, National Unity, Patriotism.Love for nature,Discipline 6

UNIT - 3

Personality and Behavior Development - Soul and Scientific, attitude. Positive Thinking. Integrity and discipline., Punctuality, Love and Kindness., Avoid fault Thinking., Free from anger, Dignity of labour., Universal brotherhood and religious tolerance., True friendship., Happiness Vs suffering, love for truth., Aware of self-destructive habits., Association and Cooperation., Doing best for saving nature 6

UNIT - 4

Character and Competence –Holy books vs Blind faith., Self-management and Good health. Science of reincarnation., Equality, Nonviolence, Humility, Role of Women., All religions and same message., Mind your Mind, Self-control., Honesty, Studying effectively 6

Suggested reading

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University, Press, New Delhi

Course outcomes

Students will be able to
1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

AUDIT 1 and 2:

CONSTITUTION OF INDIA

L T P Minor test: 50
2 0 0

Course Objectives:
Students will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT - 1

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) 4

UNIT - 2

Philosophy of the Indian Constitution: Preamble, Salient Features 4

UNITS - 3

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties. 4

UNIT - 4

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions 4

UNIT - 5

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation., Pachayati raj: Introduction, PRI: Zila Pachayat., Elected officials and their roles, CEO Zila Pachayat: Position and role., Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy 4

UNITS 6

Election Commission: Election Commission: Role and Functioning., Chief Election Commissioner and Election Commissioners., State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women. 4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

AUDIT 1 and 2:

PEDAGOGY STUDIES

L T P Minor test: 50
2 0 0

Course Objectives:
Students will be able to:
4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
5. Identify critical evidence gaps to guide the development.

UNIT - 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions**.,** Overview of methodology and Searching. 4

UNIT - 2

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries., Curriculum, Teacher education. 2

UNIT - 3

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies., How can teacher education (curriculum and practicum) and the school, curriculum and guidance materials best support effective pedagogy?, Theory of change., Strength and nature of the body of evidence for effective pedagogical practices., Pedagogic theory and pedagogical approaches., Teachers' attitudes and beliefs and Pedagogic strategies. 4

UNIT - 4

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community., Curriculum and assessment Barriers to learning: limited resources and large class sizes 4

UNIT - 5

Research gaps and future directions, Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact. 2

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2:

STRESS MANAGEMENT BY YOGA

L T P Minor test: 50
2 0 0

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

UNIT- 1

Definitions of Eight parts of yog. (Ashtanga) 8

UNIT - 2

Yam and Niyam. Do`s and Don't's in life. 8

i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - 3

Asan and Pranayam 8

i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

AUDIT 1 and 2:

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P Minor test: 50
2 0 0

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

UNIT- 1

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom) 8
Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's)

UNIT- 2

Approach to day to day work and duties., Shrimad Bhagwad Geeta: 8
Chapter 2 - Verses 41, 47, 48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6 - Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT - 3

Statements of basic knowledge., Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 8
Chapter 12 -Verses 13, 14, 15, 16, 17, 18, Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42, Chapter 4-Verses 18, 38, 39, Chapter18 – Verses 37,38,63

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication
2. Department), Kolkata
3. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
4. Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

B.A. (Mass Communication)

Syllabus

Duration: three year

Eligibility: 10+2 in any discipline

w.e.f. Academic Session: 2017-2018

Institute of Mass Communication and Media Technology

Kurukshetra University

B.A. (Mass Communication)

<u>Scheme of Examination</u>

w.e.f. Academic Session 2017-18

First Semester	T	P	IA	Total
Paper-I: Introduction to Communication	80	-	20	100
Paper-II: Language and Media(Hindi-I)	80	-	20	100
Paper-III: Computer Applications for Mass Media	50	30	20	100
Paper-IV: General Awareness and Current Affairs-I	80	-	20	100
Paper-V: Personality Development & Communication Skills	50	30	20	100
Second Semester				
Paper-VI: Language and Media (English-I)	80		20	100
Paper-VII: Communication and Society	80	-	20	100
Paper-VIII: Basics of Mass Communication	80	-	20	100
Paper-IX: Introduction to Reporting	50	30	20	100
Paper-X: Media and Polity	80	-	20	100
Environment Studies				
Third Semester				
Paper-XI: Language and Media (Hindi-II)	80	-	20	100
Paper-XII: Basics of Editing	50	30	20	100
Paper-XIII: Fundamentals of Advertising and Public Relations	80	-	20	100
Paper-XIV: Introduction to Photography	50	30	20	100
Paper-XV: Introduction to Audio-Visual Media	80	-	20	100
Forth Semester				
Paper-XVI: Language and Media (English-II)	80	-	20	100
Paper-XVII: New Media	50	30	20	100
Paper-XVIII: Media Laws and Ethics	80	-	20	100
Paper-XIX: Development Communication	80	-	20	100
Paper-XX: Current Affair & Media Issues-II	80	-	20	100
Fifth Semester				
Paper-XXI: Media Management	80	-	20	100
Paper-XXII: Radio Production	50	30	20	100
Paper-XXIII: Writing for Radio and Television	50	30	20	100
Paper-XXIV: Reporting Skills & Practice	50	30	20	100
Paper-XXV: Current affair & Media Issues-III	80	-	20	100
Sixth Semester				
Paper-XXVI: Print Production	50	30	20	100
Paper-XXVII: Television Production	50	30	20	100
Paper-XXVIII: Research Methodology	50	30	20	100
Paper-XXIX: Personality Development and Presentation Skills	80	-	20	100
Paper-XXX: Current Affairs & Media Issues-IV	80	-	20	100

* ***Environment studies paper is qualifying subject compulsory for all students of the UG course and the same will be conducted in the 2^{nd} semester of the course.***

Optional paper for Foreign and non Hindi students in place of paper II and XI

Basics of English language – I 80+20

Basics of English language – II 80+20

Paper-XVIII

Media Law& Ethic

Time: 3 Hrs.

Theory Marks: 80
Internal Assessment: 20

Question paper for each theory paper will have two questions from each of the four units. Student will be required to answer any one question from each unit. Unit V of the question paper will have six questions out of which the student will be required to answer any four questions. Each unit will carry equal marks. Students have the option to answer some questions in Hindi and others in English but within an answer to a question the language should be pure (not bilingual) and correct

Unit-I

Freedom of Speech and Expression: Main features, Scope and Importance of Article 19

Interpretation of Article 19: Defining the freedom of the Press and Media

Supreme Court Judgments related to Article 19

Fundamental Rights and Duties

Unit-II

Official secrets act 1923
Law of defamation
Contempt of court act 1971
Copyright act.
Right to privacy
Cable TV network regulation Act 1995
Information technology Act 2000

Unit-III

Ethics in journalism, freedom and responsibility of press
RTI act, 2005 with its importance and background
Law relating to covering of election
Guidelines for parliamentary coverage
AIR code for election coverage.

Unit-IV

Press commissions
Press Council of India, The Editor build of India, NBA, BCC of India
Working Journalist Act
Autonomy of public broadcasting

Reference Books:

- Universal Publishers Criminal Law Manual (relevant Sections of IPC)
- Universal Publishers Law Dictionary [Constitution of India (Article 19 (1) and 19 (2) 105, 194)]
- D D Basu Law of the Press, Wadhwa & Company, Nagpur
- Vidisha Barua Press and Media Law Manual, Universal Law Publishing Co. Pvt. Ltd. New Delhi
- P.K. Ravindranath Press Laws and Ethics of Journalism, Author Press, Delhi
- Pranjay Guha Takhurata, Media Law & Ethics, Sage Publication

B.Tech (Printing, Graphics & Packaging)

Credit based system

Syllabus

w.e.f. Academic Session: 2019-2020 for 5th to 8th semester

Institute of Mass Communication and Media Technology

Kurukshetra University

STUDIES & EXAMINATIONS
5th semester

w.e.f. 2019-20 in phased manner

B. Tech. (Printing, Graphic & Packaging) – 2019-20

Subject Code	Subject area	subject Title	Teaching Schedule				Credits	Allotments of Marks				Duration of Exams(Hrs)
								Major Test	Minor Test	Practical	Total	
			L	T	P	Hours/Week						
PGP 501	PC	PRINTING MATERIAL	4		0	4	4	60	40		100	3
PGP 502	PC	PRE PRESS TECHNOLOGY	4		0	4	4	60	40		100	3
PGP 503	PC	WEB OFFSET TECHNOLOGY	3		0	3	3	60	40		100	3
PGP 504	PC	FLEXOGRAPHY TECHNOLOGY	4		0	4	4	60	40		100	3
PGP 505	PC	PRINTING IMAGE GENERATION	3		0	3	3	60	40		100	3
PGP 506	PC	PLASTICS IN PACKAGING	3		0	3	3	60	40		100	3
		LAB										
PGP 511	PC	PREPRESS TECHNOLOGY LAB			2	2	1		30	45	75	3
PGP 512	PC	WEB OFFSET TECHNOLOGY LAB			2	2	1		30	45	75	3
PGP 513	PC	FLEXOGRAPHY TECHNOLOGY LAB			2	2	1		30	45	75	3
PGP 514	PC	PRINTING IMAGE GENERATION LAB			2	2	1		30	45	75	3
		Total					25/25	360	360			

501
PRINTING MATERIALS

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit - I

Metals

Type of metals and characteristics of metals used for type alloys for foundry types, hot metal composition and stereos, Physical and chemical properties of aluminum, zinc, copper, nickel, chromium, magnesium in relation to printing applications.

Photographic Materials

Main kinds of films and photographic papers used in graphic orgination Films positives, mainbase, stripping, thickness, right and wrong reading, negatives; paper positive materials. Developers, Reducers, Intensifiers.

Unit - II

Light Sensitive Materials

Various sensitized materials, used and relationship with processes Silver halide emulsions-classification according to speed, contrast and spectral sensitivity.

Paper and Ink

Fibrous and Non-fibrous materials used in paper and board manufacturing. General characteristics and requirements of printing inks formulations pigments, vehicles, varnishes, solvents, agents.

Unit - III

Adhesives

Classes and characteristics of adheisves used in binding and warehouse work and their range of applications selection for specific purpose.

Miscellaneous Materials

Book binding materials Different types of rubber used in printing. Use of leather, cloth, rexine, threads, tapes, stitching wire, metal foils and covering materials used for binding and print finishing.

Unit - IV

Materials Handling

A brief Survey of materials handling and storage, Handling and storage of paper, printing surfaces, films, chemicals and other printing materials. Systems and methods of storage. Precautions in handling, storage, use and care of various printing substrates, materials and chemicals. wastage reduction. Receiving, storage and delivery of raw, semi finished and finished products.

Recommended Books :-

- Printing Surface Praperation by C. S. Mishr

502

PRE-PRESS TECHNOLOGY

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit - I

Introduction to colour

Basic colour theory - additive and substractive colours , process colours, application of the colour theory to colour reproduction. Overview of colour reproduction from original to printing, Exposure, colour balance, memory colours; graining, contrast; Film transparency.

Unit - II

Colour Reproduction

Process camera, Parts of process camera and their types. Tone and colour controls - Gray scale and colour control patches , densitometers.

Colour Separating methods

Basic principles of colour separation, Direct separation method and Indirect colour separation method, Black Printer negative for the indirect method, for making continuous tone positives. Final Screened negatives and positives establishing a colour reprodcution procedure.

Unit - III

Colour correction

Objectives of colour correction ; Hand correction, Purposes and procedure followed; retouching techniques; correcting colours, tones and shades given inks and paper. Dot etching, purposes and procedure, flat ethcing, staging and etching, local reduction, blending; Masking; purposes of masking types of maskings, their clarification and uses; Electronic colour seperation and correction.

Unit - IV

Colour proofing

Press proofing methods and various pre-press proofing systems; uses and limitations of prepress sheet, Interpreting pre press proofs and predicting, press results Control devices for proofing systems.

Planning for colour work

Scanner, Types of scanner - Drum, Flat Bed Scanners. Image Setters.Types of imagesetter.

Recommended Books :-

1. Dr. R.W.G. Hont :- The reproduction of colour. Fountain Press, 4th edition.
2. Miles Southworth& Donna Southworth :- Colour Reproduction. Graphic Arts Publishing, 3.1 edition.
3. Gary G. Field :- Tone & Colour correction (GATF).

503

WEB OFFSET TECHNOLOGY

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit - I

Development and growth of web offset press

Full size and mini web press; four basic types of web offset press, Press specially used for newspaper and magazine production in single and multicolour, Factors to be considered for selecting the press.

Components of web offset press

Infeed, tension control Pre-conditioners, drier and chill rolls, folders, sheeters and winders, Adjustment, operation and maintenance of the major components.

Inking systems and dampening systems for web offset

Conventional and non-conventional dampening systems, UV inks and setting systems Causes and correction of ink-related problems, Properties and requirements of heat set inks.

Unit - II

Web Control

Roll stands and automatic pasters, Detection of web breaks and control of tension, Web Flutter, casues and correction of misregister, Control of fan out, Sidelay, cut-off, web-to-web and ribbon control.

. **Auxiliary equipment**

Various types of in-built and optional equipment availability for web-offset and their uses; - Remote control console, Plate scanners, scanning densitometer, closed-loop system, web preconditioners, sheet cleaners, ink agitators, water coded ink oscillators, fountain solution recirculation systems, fountain solution mixers, refrigerating fountain solution, automatic blanket washers, side lay sensors, web break defectors, remoisturizers-liquid applicator system, roller applicators systems, antistatic devices, Imprinters, Perfectors, cutoff controls, straboscope, synchroscope, counters-Denex laser counter, stobb counter.

Web-paper ,Plate and blankets

Properties and requirements of paper used for web offset Printability, Care and handling of rolls. Various types used for web-offset, their characteristics, merits and demerits for specific work, Cylinder pressures and Printing Make-ready.

Unit - III

Dry Offset

Dry-offset; advantages and disadvantages, Comparative study of dry offset, letterset and lithographic offset processes, difference between dry offset and letterset machines and inks job suitability.

Description of the process, Method of producing image and non-image areas, Importance of the correct formulation of waterless lithographic inks.

Unit - IV

Introduction to types of drives used in web offset machines
Brief introduction to control panels of the web offset machines.

Folders

Introduction, folding principles, parts of folder, combination folder, ribbon folder, double-former folder, the me-chanics of folding process of jaw fold, chopper fold mechanism. Operation of collect cylinder, press folders, double former prefolder, flow folders, insert folders.

Recommended Books :

Web offset press operating- **David B. Crouse**Offset M/c II - **C. S. Mishra**Manual for Lithography Press Operation - **A. S. Porter**

504
FLEXOGRAPHY TECHNOLOGY

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit - I

Introduction to Flexography:
Definition. flexographic printing, flexographic market, flexographic products, growth potential, Advantages of flexography, Press development. Mechanical principles of flexography - Fountain roll, Anilox roll, plate cylinder, impression cylinder.

Image carriers for flexography:
Introduction. Thickness of flexo graphic plates. Photopolymer flexographic plates Advantages of photo polymer plates. Disadvantages of photo polymer plates. Solid photo polymer plates. Photo initiators and photo sensitizers. Washout solvents. Liquid photo polymer plates. Base material for photo polymer plates. Rubber flexo plates, photo engravings, duplicate plates. Rubber plate making process – Advantages of rubber plates, disadvantage of rubber plates. Photo polymer plate making process, sheet photo polymer plate making, liquid photo polymer plate making. Letter press plates – Introduction, photo polymer letterpress plates

Unit - II

The Printing press:
Flexo press types - Stack press, Central impression cylinder press, Inline press, Tension control in flexographic m/c, Unwind equipments - general, single-position unwind - flying-splice unwind, unwind tension systems, cooling drum a out feed unit. Rewind equipments - surface winders, center winders, rewind tension systems. Web guides. Printing stations - two roll, anilox roll, reverse angle doctor blade system, Deck control, Continuous inking, side and circumferential register control, Dryers. Mechanical components - CI drum, plate cylinders. Anilox roll - construction, cell structure, anilox roll wear, selecting the night anilox roll, chrome plating. Fountain rolls - formulating rubber for rolls, Flexo roller covering, Care of covered rolls.

Unit - III

Mounting and Proofing:
Introduction. Checking the equipment. Operation care of equipment. Understanding the mounting instructions. Mounting and proofing a complete line job - proofing the first set of plates, proofing for printability, methods of prepress makeready, wrapping mounted cylinders. Miscellaneous procedures - removing plates from the cylinder, mounting metal-backed plates, reusing sticky back, plate staggering, use of release agents. Tools for the operator. Basic requirements for process colour printing. Press room practices. Environment and safety concerns.
Flexography and Barcoding:
Barcode structures. Types. Verifying/Analyzing printed barcodes. UPC and flexographic printing. UDC film masters and printing capability tests. The shipping container symbol (SCS). SCS shipping contain Barcode printing.

Unit - IV

Beyond the Horizon- Tomorrows Flexography:

Flexographic substrates. Narrow web presses-Narrow web press components, Future narrow web flexography. Wide web presses. Corrugated presses. Pre printed liner presses. Future of Ink distribution system. Tomorrows flexographic plates. News print for water-base flexography. Markets for today and tomorrow.

Recommended Books :

Flexography principles and practices - Foundation of flexographic technical association.

505

PRINTING IMAGE GENERATION

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit - I

Assembly of film images:

Photographic film- camera film, contact film, room light handling films, duplicating films. Proofing materials - diazo papers, polymer papers, brown print paper, diffusion transfer material, Stripping supplies - screen tints, pressure sensitive tapes, adhesives opaques, cleaning solutions, starch filler, register tabs button & pins. Register masks, GATF image contact masks. Basic steps in planning a film image assembly Film assembly for single color printing. Assembly for film multiple color printing. Assembly for multiple imaging of plates and film.

Unit - II

Planographic plates:

Introduction. Light sensitive coating -dicromated colloids, diazo compounds, photo polymers, diffusion and transfer methods, electrostatic. Sensitivity of coating to light. Dye-sensitized photo polymerization, dark reaction, post exposure, safe lights, reciprocity law. Action of light sources on coatings, stabilities of coatings. Positive working plates, Negative working plates- additive presensitized plates, subtractive diazo PS plates, photo polymer presensitized plates, aqueous developable plates, driographic plates, multi metal plates. Producing a multimetal plate. Types- bimetalic, trimetalic. Projection-speed negative plates. Positive working lithographic plates- Presensitized plates, Baking of positive plate Process of making deep etch plate - counter etching, exposing, developing, deep etching, cleaning the image areas, stopping out unwanted areas, copperizing the image areas on aluminum plate, applying non blinding lacquer applying deep etch developing ink, remaining the gum stencil, desensitizing, gumming up,

Unit – III

Driography- Outline, system, structure, processing and use, precautions.
Waterless plates – outline, structure, processing and use, advantages and disadvantages.
Role of photopolymer in Image formation – Raised and Recessed.
Diffusion processes – Reflex and Projection plates.
Electro photography – Introduction, process, toner transfer theory, Equipment.
Water soluble photosensitive resin plates – introduction, characteristics, structure, processing, image reproductivity.
Laser plate making – introduction, system outline, system performance, implifications.
Computer-to-plate: – Thermal plate, Polyester plate.

Unit - IV

Digital Image Carriers:

Image generation of a Digital Offset Machine. Basics of other digital image carriers.
Auto plate processor ,Troubleshooting for plates,Quality control aids for plate making.

Recommended Books:-

Heidelberg DI Press- Manual   Chemistry for Graphic Arts - **Dr. Nelson R. Eldred**.
Offset Plate Making - **Robert F. Reed**.
Printing Technology 3rd Edition. - **Adams, Fax &Rieber**.
Screen Process Printing - **John Stephens**.
Sheetfed Offset Press Operating - **Lloyd P. Dejidas**.
Flexography Premier - **Donna C. Mulvihill**.
Stripping - **Harold L. Peck**.
Gravure Process And Technology –GAA.
Selecting The Right Litho Plate - BPIF.
A. L. Gatehouse; Manual for film planning and plate making; roper – GATF Publication, 1983 edition.
Lithographers manual – GATF seventh edition.
Paul J.Hartsuch Chemistry for the Graphic Arts, GATF, 1983 edition.
Lan Faux, Modern lithography, MacDonald & Evans Publication, 1973. Edition.
W.R. Durrant Printing – A guide to systems and their uses, Heinemann Professional Publishing, 1989 edition.
D.C. MulvihillFlexo Primer, GATF & Foundation of FTA 1985 editon

Plastics in Packaging (506)

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit I

Plastic Introduction

Packaging, Types of packaging,Purposes of packaging.Plastic-introduction, Classification of synthetic polymer. Techniques of polymerization, Distinction between Plastic, Fibres and Elastomers. Application of plastic in packaging

Unit II

Classification of Plastic

Miscellaneous plastics - polycarbonate, nylon , Low-Density Polyethylene (LDPE), Linear low-density polyethylene (LLDPE) High-Density Polyethylene (HDPE) High molecular high density Polyethylene(HM HDPE)Polyethylene Terephthalate (PETE or PET), Polyvinyl Chloride (PVC) - Introduction, properties and applications.

Unit III

Environment and pollution in plastic industry

Plastic Industry effects on environment and its components; water, soil, air and living things, Storage and handling of plastics, Pollution and Hazards related to Plastics, Plastic Waste Management- Public awareness regarding hazards caused by indiscriminate use of plastics, proper disposal of plastics.Alternate Packaging material.

Unit IV

Testing and Recycling of plastic

Introduction, Process, Solubility test, Lenition test, Dry distillation test, Chemical color identification test, Pyrolysis test, Refractive index. Recycling of plastic-Processes–Thermal depolymerization, distributed recycling, plastic identification code

RECOMMENDED BOOKS

1. Handbook of Plastics, Elastomers and Composites by Charles A. Harper; Published by McGraw Hill Company, New Delhi
2. Plastic Waste Management by Nabil Mustufa; Marcel Dekker
3. Introduction to Environmental Engineering and Science by Gilbert M Masters; Prentice Hall of India, New Delhi
4. Recycling and Recovering of Plastics by Brandrup (Hanser Publications)

511
PRE PRESS TECHNOLOGY- LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Making of Half tone negative using process camera.
2. making of own colour control patches.
3. Gray Scale (Drawing).
4. Drawings spectrophotometric curve by using spectrodensitometre.
5. How to make colour separtion negative of a four coloured original by using Electronic colour seperation system.
6. Working of Image Setter and obtaining output on Image Setter.
7. colour Correction by using photography masking.
8. Six Colour Wheel.
9. Planning for four Colour Newspapers designs.
10. Software for colour seperationphotoshop, coreldraw, quark express.
11. Preparation of originals for separation - reflection type and transparency.
12. Exposing tonal correction mask, making UCR mask/GCR mask etc.

512
WEB OFFSET TECHNOLOGY- LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

1. Premake ready operations.
2. Make ready operations.
3. Multicolour job printing.
4. Trouble shooting during printing.
5. Study of electronic panel.
6. Blanket and plate cylinder setting.
7. Damping roller setting.
8. Inking roller setting.
9. Study of Web-breaks.
10. Operations of Folding machine.

513
FLEXOGRAPHY TECHNOLOGY - LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Introduction and familiarizing flexo machine and other related elements.
2. Preparation of rubber plates.
3. Preparation of I .Liquid photo polymer plates, II. Sheet photo polymer plates.
4. Registering and plate mounting on flexo plate cylinder.
5. Make ready procedures a flexo machine.
6. Printing i.singlecolor, ii.twocolor, iii.fourcolor.
7. Studying of 6 color and 8 colorflexomachines.

514
PRINTING IMAGE GENERATION - LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Comparative study of various materials and equipments used in Image Generation Department.
2. Preparation of wipe-on plates, Albumin plates.
3. Preparing deep-etch plates ,pre-sensitized plate,
4. Preparation of letter set plates.
5. Study of gripper margin and registration processes,
6. Positioning of images for plate making,
8. Page makeup -folders, pamplets, journals/magazines, newspaper, book work.
9. Layout preparation - Single page layout, 2 page layout, 4 page layout, 8 page layout, 16 page layout, 32 page layout, 64 page layout for work & turn, work & tumble, work & twist.

SCHEME OF STUDIES & EXAMINATIONS
6th semester
w.e.f. 2019-20 in phased manner
B. Tech. (Printing, Graphic & Packaging) – 2019-20

Subject Code	Subject area	subject Title	Teaching Schedule				Credits	Allotments of Marks				Duration of Exams(Hrs)
								Major Test	Minor Test	Practical	Total	
			L	T	P	Hours/Week						
PGP 601	PC	PRINTING SUBSTRATE	4		0	4	4	60	40		100	3
PGP 602	PC	SECURITY AND STATIONARY PRINTING	4		0	4	4	60	40		100	3
PGP 603	PC	Food Packaging	3		0	3	3	60	40		100	3
PGP 604	PC	NEWSPAPER PUBLISHING	4		0	4	4	60	40		100	3
PGP 605		a. SALES AND ADVERTISING b). RESEARCH & DEVELOPMENT C)PLANNING &COORDINATION	3		0	3	3	60	40		100	3
PGP 606	PC	COSTING AND ESTIMATING	3		0	3	3	60	40		100	3
		LAB										
PGP 611	PC	PRINTING SUBSTRATE LAB			2	2	1		30	45	75	3
PGP 612		FOOD PACKAGING LAB			2	2	1		30	45	75	3
PGP 613	PC	Newspaper Publishing			2	2	1		30	45	75	3
PGP 614	PC	SECURITY AND STATIONARY PRINTINGLAB			2	2	1		30	45	75	3
		Total					25/25	360	360			

A Special Paper of Environment Studies will be the part of 6th semester curriculum

601

PRINTING SUBSTRATE

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit - I

Paper:

Introduction, Paper fibers& Non Fibers materials, Fiber structure- cellulose, hemi celluloses and lignin, Paper manufacture – Stage 1 - pulp preparation, mechanical pulp - refiner mechanical pulp, thermo mechanical pulp, chemical pulp processes - sulfate or Kraft process, sulfite process, Semi - chemical process. Screeing, Cleaning Bleaching: Stage 2- stock preparation, Stage 3- Paper Making Machine. Wet-end, Head box and slice. MD: CD ratio. Wire section, Press and drier sections. Calendaring and Finishing- Hard calendaring, soft nip calendaring, super calendaring, machine glazing, paper coatings - coated papers and boards.

Unit - II

Recycled paper:

Recycling Process, fiber preparation- screening, centrifugal cleaning, flotation, washing, deinking plant function, continuous drum pulper, prescreening and cleaning, primary flotation, cleaning, fine screening, thickening, dispersing, brightness control, washing, thickening and storage. Deinking chemistry - Bleaches - Hydrogen peroxide, Oxygen & Ozone bleaching, reductive bleaching agents, chelating agents, sodium silicate, catalase enzyme, agglomerating chemicals, surfactants. Biodegradation of surfactants, dispersants and the principles of washing.

Unit - III

Choosing a suitable paper:

Characteristics of paper. Paper varieties for printing. Printing defects associated with paper. Reel defects. Ppaer Testing, Measurement and calculations: - Paper sizes. Influence of moisture and RH on paper and boards. Paper storage – Requirement. Methods. Variables affecting paper storage. Paper properties -, printability, runnability. Surface and directional properties of paper & board – substance, caliper, bulk, compressibility, surface smoothness/roughness, air permeance, static and dynamic friction. Surface strength and internal bond strength - picking, fluffing, splitting. Strength properties - stiffness, folding endurance, bursting strength, tear resistance. Optical properties - gloss, brightness, whiteness, yellowness and tint indices, flurescence, opacity.

Unit - IV

Introduction to Non Paper substrates

Surface preparation – Coating , plastics-properties. Metalized films - Aluminum foil, Foil laminations. Advantages, limitations. Future in Printing & Packaging.

602

SECURITY AND STATIONARY PRINTING

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Unit-I

Introduction:

Security Printing its definition and requirement, currency printingIntroduction to Security Printing, Optical document security, importance of security printing of bank note papers and boards, passports and government documents. UV visible Printing, rainbow printing, micro lines, guilloches, numbering, Line-printing, stamp embossing, hot-foil-embossing, embossing / punching, fibres, hologram, solvent colour, multi colour UV-fluorescence stitching thread, holographic foil or lamination of a page, Digital Watermark.

Unit-II

Inks and Brand Security Inks:

Invisible inks, Specialist security printers inks; such as thermo chromic, UV fluorescing, water fugitive, solvent sensitive inks, combifuge, photo chromic, Fluorescent Inks, Watermarks, Testing, Deterrent measures Brand Security: First line inspection of documents using optical elements such as Holograms, optical variable graphics, diffraction structures, liquid crystal materials, optical security in laminates etc., invisible document security and Brand protection**.**

Unit-III

Security Products:

Credit Cards, Smart cards, club cards, credit / debit cards, Plastic ID cards, Water mark cards, RFID technology, Bar codes, Printers used for bar codes, Cheques and their value documents, MICR/OCR/Cheque printing technology Counterfeit, fraud prevention, Cheque fraud prevention, method and arrangement for processing negotiable instruments. First line inspection of documents using optical elements such as Holograms, optical variable graphics, diffraction structures, liquid crystal materials, optical security in laminates etc. invisible document security and Brand protection..

Unit-IV

Applications

Security design and processes for various print products: Barcodes, Holograms, cheque printing-MICR cheques and Reserve Bank of India (RBI) specifications, finishing, paper specifications-Manufacturing process of – Bank Notes – Business forms – CertificatesPassports – Packaging - Card printing. Different types of machines used for producing various security products. Recent trends and developments in security printing.

Recommended Books :

603

FOOD PACKAGING

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-1

Introduction

- Food packaging: Definition,
- Functions of food packaging,
- Need of food packaging
- Role of packaging in extending shelf life of foods
- Safety assessment of food packaging materials
- Different forms of packaging.
- Rigid, semi-rigid, flexible forms of packaging in food industries..
- Different packaging system for-Dehydrated foods, Frozen foods, Dairy products, Fresh fruits, Vegetables, Meat, Poultry, Sea foods.

UNIT 2

Aseptic packaging of foods

- Principles of sterilization,
- sterilization of packaging material,
- verification of sterilization processes,
- aseptic packaging systems: carton systems, can systems,
- bottle systems, sachet and pouch systems, cup systems[redacted]

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UNIT 3

Active and Smart packaging

- Definition
- Smart packaging systems
- intelligent packaging systems: Quality Indicators, Time-temperature indicators, gas concentration indicators, RFID;
- Safety and Regulatory issues

UNIT 4

Properties & selection of packaging materials

- Tensile strength, bursting strength, tearing resistance, puncture
- resistance, impact strength, tear strength,
- Barrier properties of packaging materials,,
- prediction of shelf life of foods,

REFERENCE BOOKS:

- Gordon L. Robertson, Food Packaging: Principles and Practice, Third Edition,2013.
- Gordon L. Robertson, Food Packaging and Shelf Life: A Practical Guide,2010.
- Ruben Hernandez, Susan E. MSelke, John Culter, John D. Culter, Plastics Packaging: Properties,Processing, Applications, and Regulations,2000.
- Walter Soroka, Fundamentals of Packaging Technology-Fourth Edition,

604
NEWS PAPER PUBLISHING

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-1

Introduction to Newspaper organization
Newspaper Hierarchy - editorial organization, sources of news; mechanical aspects of newspaper organization-composition, printing the newspaper, basic operations, business aspects of newspaper organization, flowcharts of staff in newspaper organization, Circulation and Advertisement departments, distribution channels.

UNIT-II

Policy of a newspaper. Headlines. History and their significance. Functions of headlines, kickers, blurbs. Thegrammar of headlines. Unit count in headlines. Treating photographs; cropping. Captions for photographs.The aesthetics of design. Achieving symmetry/asymmetry, balance/off-balance, use of colour, placement of various elements in design. The written word and illustration. Principles of adapting content to form.
Attracting attention.

UNIT-III

Newspaper layout & designing
Difference between design and layout. The various kinds of layout. The importance of visual appeal in pagemaking.Playing up/down a story. Colour, boxing, verbal and non-verbal languages in design. Graphics/diagrams and illustrations and their importance.
Flow of stories into a newspaper office, The various sources and copy for each page. Reporters, correspondents, agencies, syndicates,columnists, readers. Fascimiles copy & photographs.

UNIT-IV

Editorial content and news. The OP-ED page. Thegatekeeping function.
Editorial Organization Newspaper PublishingSources of news wire services, syndicates The role of copy editors, city editors, news editors, editorialcartoonist, artists, Sunday editors, sports editor, business editor, journalist & reporters, Information to aprinter by editor.
Recommended Books :
News Reporting and writing - Melvin Mecher
The Journalist; Handbook - M. V. Kamath
Editing; A Handbook for Journalists - TJS George
Editing; A Handbook for Journalists - TJS George, Indian Institute of Mass communication, Delhi.
Telling Stories, Taking Risks - Klement/Mataline
Journalism in India - R. Parthasarathy
Headlines and Deadlines - Baskette, Floyd

605 (A)
SALES & ADVERTISING

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

UNIT-I

Advertising as a tool of communication, Role of Advertising in marketing mix. Types of Advertising – Product advertising, Service advertising, Institutional Advertising, Public Relations advertising, Public Service Advertising, Financial Advertising Sales Management: Introduction, Sales Management, Sales organization, functions of sale department, duties of sales manager. The selling concept vs marketing concept. Sales forcasting, advertising, sale promotion, channels of distribution, product packaging.

UNIT-II

Market & Advertising Research – Types / Scope of research, Market Research – Market surveys – Audience surveys Market segmentation Targeting, Advertising Research, Advertising evaluation, ADGMAR approach, Types of Advertising evaluation

UNIT-III

Media & Product Types of media, Media Vehicles, Functions, Audience surveys, TRP, NRS, ABC, Product research meaning & scope, Analyzing& Testing of products, Important of product research, Limits, Product Positioning

UNIT-IV

Construction of advertisement Construction of effective advertising, Visualization, cope writing, Headlines, slogan, Types of copy, Requisites of an effective layout, Advertising agency structure, Responsibilities of personnel , Advertising Budget, methods of budgeting, Budgeting process.

Recommended Books:-

Mass Communication Principal & Concept- SeemaHasan
Business Ethics Concepts & Cases - **SadhriSorab**.
Advertising Theory & Practice - **Chunawalla, Kumar, Sethia, Subramanian, Suchak**.
The Concept of Marketing-By Philip Kotler
Advertising and Promotion-By Belch & Belch

605(B)

Research & Development

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Unit-I

Introduction: Introduction of Research& Development, types of R & D-Basic Research, Applied research, development. R&D in business,Innovation, New product development, Design ,Product design, R& D Decision- Proprietariness, Timing ,Risk ,Cost. Importance of R& D

Unit-II

R&D Process: Foster ideas, Focus ideas, Develop, Prototype and trials. Regulatory, Product development activities, Launch. An effective R& D Process, Advantages of R& D- Tax breaks, cost ,financing, recruitment,Patents. R&D challenges- High cost, Uncertain result, Market condition.

Unit-III

R&D in the Printing Industry – Innovation in Printing, Reducing the environmental impact of printing, Waste reduction of printing processes, Minimizing solvent use,Process and machine optimisation in offset and flexo printing, Quality evaluation and standardisation in digital printing, Packaging and label printing, Print finishing, Measurement and testing methods for controlling machine settings and the printing process,Functional coatings,Ink curing and migration

Unit IV

R&D in Packaging Industry-Packaging machinery research and development, especially paperboard forming, Converting of fibre-based packaging materials,Tool design and manufacturing, Sealing solutions for fibre-based packages, Package quality control development, Packaging material technology, Coating and dispersion barriers,Digital printing,Fibre engineering and technology,Nanothin functional coatings.

605(C)

PLANNING & COORDIANTION

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

UNIT-I

DECISION MAKIING

TIME AND HUMAN RELATIONSHIPS IN DECISION MAKING, PROBLEM AND OPPORTUNITY FINDING

THE NATURE OF MANAGERIAL DECISION MAKING

Programmed and Nonprogrammed Decision, Certainty, Risk, and Uncertainty .

UNIT-II

THE RATIONAL MODEL OF DECISION MAKING

Stage 1: investigate the Situation, Stage 2: Develop Alternatives , Stage 3: Evaluate Alternatives and Select the Best One Available , Stage 4: Implement and Monitor the Decision ,

UNIT-III

PLANNING: AN OVERVIEW

THE IMPORTANCE OF PLANNING AT ORGANIZATIONS

The Hierarchy of Organization Plans

HOW STRATEGIC AND OPERATIONAL PLANS DIFFER

The Strategic Management Process .

UNIT-IV

THE CONTENT OF A CORPORATE STRATEGY

The corporate Portfolio Approach , "Five Forces" Corporate Strategy , Corporate Enterprise Strategy

LEVELS OF STRATEGY:SOME KEY DISTINCTIONS

Corporate-Level Strategy ,Business-Unit Strategy ,Functional-Level Strategy

606

COSTING AND ESTIMATING

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Printing Company Organization:

Printing management, principles, functions, Organizational criteria, Skills requirements, Types of business, Printing company management structures, Management team responsibilities, Business plan, Management styles, Management decisions, Communications, Print marketing and sales - marketing, sales.

UNIT-II

Human Resource Management Concepts:

HRM for printing, employment policy, evaluation of skills requirements for printing occupations, recruitment, job evaluation, staff appraisal, motivation training, human resources factors that limit productivity, staff flexibility. Manning and training requirements, States of industry, Analysis and development of human resources strategy. Management personal skills and development, job satisfaction through involvement.

UNIT-III

Estimating:

Purpose and functions of estimating from printer point of view & customers point of view. Difference between costing & estimating. Qualifications of an estimator, working environment, estimators tools, estimating paper - selection of paper, allowance for waste, allowance for trimming, weight of loose sheets, weight of a reel of paper. Estimating Ink - Ink consumption formula, Ink allowance for spoilage. Estimating binding materials - Board requirement, estimating covering materials, estimating sewing thread, estimating stitching wire, estimating adhesives. Terms and conditions-approved by AIFMD. Estimate Form and Computer Aided Estimating.

UNIT-IV

Costing:

Job costing, its need and procedures. Elements of cost and their method of recovery. Cost sheet. Daily Docket. Work Instruction Ticket and their importance in costing.

Recommended Books :

Principles of Accounting - B. S. Raman
Fundamentals of Financial Management - Prasanna Chandra.
Cost Accounting - B. R. Bhar
Print Management - Derek Porter
Printer's Costing & Estimating - B. D. Mendiratta
Management Aspect of Printing Industry - T. A. Saifuddin.
Estimating Methods and Cost Analysis for Printers - K. S. Venkataraman, K. S. Balaraman.
Printing Estimating Principle & Practice - Philip Kent Ruggles
Print Production Management - Gray G. Field
Principles of Applied Costing for Printing Industry - K. S. Venkataraman.

Special Paper

ENVIRONMENTAL STUDIES

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions The students are required to attempt any five questions. All questions will carry equal marks.

Unit I :

The Multidisciplinary nature of environmental studies
Definition, scope and importance.
Need for public awareness.

Unit II :

Natural Resources

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources : Use and exploitation, environmental effects of extracting and mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit III

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :
  a) Forest ecosystem
  b) Grassland ecosystem
  c) Desert ecosystem
  d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit : IV

Biodiversity and its conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity : in-situ and ex-situ conservation of biodiversity.

Unit 5 : Environmental Pollution

Definition

- Causes, effects and control measures of :
  - a) Air pollution
  - b) Water pollution
  - c) Soil pollution
  - d) Marine pollution
  - e) Noise pollution
  - f) Thermal pollution
  - g) Nuclear hazards
- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

Unit 6 : Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness.

Unit 7 : Human Population and the Environment

- Population growth, variation among nations
- Population explosion – Family Welfare Programme
- Environment and human health.
- Human Rights.

- Value Education.
- HIV/AIDS
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Unit 8 : Field Work

- Visit to a local area to document environmental assets-river / forest / grassland / hill / mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems – pond, river, hill slopes, etc.

611
PRINTING SUBSTRATE LAB.

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Different samples of Papers and their study.
2. Light fastness test.
3. Machine Direction and Cross Direction of paper.
4. Effect of Humidity and Temperature on paper.
5. GSM Test.
6. Printed samples of different printing processes and their study.
7. Ink Viscosity Test.
8. Introduction to various chemicals used in printing.
9. Consumables and miscellaneous used in printing.
10. Study of different printing defects associated with paper

612
FOOD Packaging

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Identification of different types of packaging and packaging materials
2. Determination of tensile strength of given material
3. Determination of tearing strength of paper
4. Determination of bursting strength of packaging material
6. Determination of drop test of food package
7. Visit to relevant industries
8 Introducing the students with the latest trends in packaging consulting the web sites and magzines

613

NEWS PAPER PUBLISHING -LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Introduction to type of Web Presses as per the configuration & end products.
2. Study of various units & their setting.
3. Study of pre-make ready &makeready operations.
4. Printing single & multicolour jobs.
5. Introduction to Digital Web presses & their working.

614

SECURITY AND STATIOARY PRINTING LAB

1. Total Credit: 1 Max. External: 45
2. Internal: 30
3. Time Allowed: 3 Hrs.
4. Marks: 75
5. Design of fan fold forms computer letter & mailers
6. Design of computer envelops and snap-out-forms
7. Various types of web offset printing
8. Processes use for packaging and dispatch
9. Study of collators
10. Dot loss and dot gain in film imaging
11. Plate making
12. Colour sequence for security printing

SCHEME OF STUDIES & EXAMINATIONS

7th semester

w.e.f. 2019-20 in phased manner

B. Tech. (Printing, Graphic & Packaging) – 2020-21

Subject Code	Subject area	subject Title	Teaching Schedule				Credits	Allotments of Marks				Duration of Exams(Hrs)
								Major Test	Minor Test	Practical	Total	
			L	T	P	Hours/Week						
PGP 701	HC	MANAGEMENT PROCESS	4		0	4	4	60	40		100	3
PGP 702	PC	PRINTING PLANT LAYOUT	4		0	4	4	60	40		100	3
PGP 703	PC	GRAVURE TECHNOLOGY	3		0	3	3	60	40		100	3
PGP 704	PC	PRINTING INK TECHNOLOGY	4		0	4	4	60	40		100	3
PGP 705	PC	PRINT FINISHING	3		0	3	3	60	40		100	3
PGP 706	PC	QUALITY CONTROL IN PRINTING & PACKAGING	3		0	3	3	60	40		100	3
		LAB										
PGP 711	PC	GRAVURE TECHNOLOGY LAB			2	2	1		30	45	75	3
PGP 712	PC	PRINTING INK TECHNOLOGY LAB			2	2	1		30	45	75	3
PGP 713	PC	PRINT FINISHING LAB			2	2	1		30	45	75	3
PGP 714	PC	QUALITY CONTROL IN PRINTING & PACKAGING LAB			2	2	1		30	45	75	3
PGP 770	PC	MINOR PROJECT				2	1		-	-	50	3
		Total					26	360	360		950	

701

MANAGEMENT PROCESS

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Business Environment – Printing Industry in India & Abroad. Impact of globalization & IT. Management – Nature scope and importance of Management, Functions of Management – Scientific, Management, CPM & PERT (Introduction)

UNIT-II

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Production and operations Management – Locations and Layout of plant, Maintenance management. Quality assurance, Total quality management (TQM), ISO.

Marketing management – Marketing and its functions, distribution channels, salesmanship and advertising.

UNIT-III

Human resource management: Manpower planning – recruitment, selection, Training performance appraisal Wage and salary administration.

Financial Management, Nature, Scope objectives and functions of Financial Management.

UNIT-IV

Work flow and organizational structure in a printing press.

Cost Accounting: Cost concept, cost sheet, B.E.P.analysis,cost reduction and cost control.

. Depreciation – Introduction to different methodes and their comparison.

Recommended Books :-

1. T.A. Saifuddin – Management aspects of printing industry by NirmalSadanadn Publishers, Mumbai, Ist edition.
2. G.G. Field- Printing Production Management by Graphic Arts Publishing, 1996.
3. Balaraman – PMCA by Ramaya Features & publications, 1987.
4. Mendiratta B.D. – Estimating & Costing by Print Trade Publications, 1999-2000.
5. Ruggles – Printing Estimating Principles and Practices by Delmer Publication 1985.
   (a.) Maintenance Engineering Handbook
   (b.) Lindley R. Higging, McGraw Hill International Edition.
   (c.) Operator's Manually by GATF.
6. R.D. Aggarwal-Organisation and Management-Tata McGraw Hill Publishing Ltd., New Delhi

702
PRINTING PLANT LAYOUT

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Site Selection:

Strategic issues of location. The supply-distribution system, Dynamic nature of plant location, strategyfactors influencing choice of location. State regulations on location. Backward areas and Industrial policy. Govt. Policies fordecentralization, Industrial estates, comparison of locations-urban v/s rural areas advantages, sub-urban area. Economic survey of site selection. Analytical approach.

UNIT-II

Plant Layout:

Objectives of good plant layout, principles of plant layout, importance of plant layout, situations in which layout problem may arise, factors influencing plant layout, Methods of plant and factory layout-operation process chart, flow processchart, flow diagrams, string diagrams, machine data cards, templates three dimensional models, correlation chart, travel chart, load path matrix method. Types of plant layout –product layout or live layout – process layout or functional layoutcombination layout – static layout or fixed position layout. Symptoms of bad layout. flow pattern-line flow, L type flow, circular flow, U type flow, S or inverted S combination of U and line flow pattern. Characteristics and place of application

UNIT-III

.

Factors governing flow patterns:

Combination of line flow and S type of pattern. Combination of line flow and circular type. Processing upwards. Retration type, Inclined flow. Workstation design-Storage Space requirements.

Plant layout procedure:

Accumulate basic data, Analysis and coordinate basic data, decide the equipment and machinery required, Select the material handling system, sketch plan of the plot for making factory building. Determine a general flow pattern, Design the individual workstation. Assemble the individual layout into the total layout calculate storage space required, Make flow diagrams In work stations and allocate them to areas on plot plan, Plan and locate service areas, make master layout. Check final layout, Get official approval of the final layout, install the approved layout.

UNIT-IV

Factory Building (Press Building):

Introduction, Advantages of a good factory building, Factors affecting the factory building – nature of manufacturing process, flexibility, expandability, service facilities, employee facilities, lighting, heating, ventilating, air conditioning, appearancedurable construction-security measures-noise control. Types of factory building – single story building, high bay and monitor type buildings, multi storey buildings, building of special types. Comparison between single storey and multistory building. Types of construction of factory building Wood frame construction, Brick construction, Slow burning mill construction, Steel frame construction,Reinforced concrete construction, Precast concrete construction. Specific parts of factory buildingroof, walls,floor.

Plant layout-An analytical approach:

Heuristic and other methods of line balancing. Planer single facility location problems. Minisum examples, insights for minisum problem, minisum location problem with distance. MLP with Euclidean distance.

Recommended Books :

Facility layout and location-Richard L.Francis, John A. White. Computer Aided Production Management – Mahapatra

Production and Operations Management – Mchelmann Oakland, Lockyer

Practical Plant Layout – HeroldB.Maynard

Industrial Engineering Management System- Dr. S. Dalela, Dr.Mansoor Ali

Industrial Engineering & Management – O. P. Khanna

Industrial Engineering and Production Management-M. Mahajan.

Materials handling for Printer – A. John Geis, Paul L. Addy.

703

GRAVURE TECHNOLOGY

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Gravure:

History of gravure, Gravure products and markets – Publication gravure – gravure packaging and converting – product gravure. Gravure Screens. Gravure cylinder preparation – Diffusion etch – Direct Transfer-Electromechanical process – Laser cutting. Electronic engraving systems today. Chemical engraving methods and equipments – cell configurations-advantages and disadvantages. Cylinder correction methods – Re-etching electro mechanical engravings, Colour balance etches, spot plating. Well formation – variables, basic types. Cylinder construction and preparation – Cylinder design, types. Balancing the cylinder. Copper plating and polishing, Reuse of cylinders.

UNIT-II

GravureDoctor blade assembly –

Blade angles. Blade distance from Nip, Blade edge, Blade mounting. Doctor Blade wear – Fatigue, Corrosion, Abrasive, Adhesive wear, Doctor blade materials, Doctor blade Holder configurations, Blade setting procedures, Preparing blade for use, Doctor blade problems. Gravure Impression Roller – function, Roller covering, Roller pressure, Cylinder diameter, Roller design & configuration. Balance-static & Dynamic. Roller setting. New developments. Storage of impression rollers. Impression roller problems. Impression mechanismsmechanical, Hydraulic, Pneumatic.

UNIT-III

Gravure Press and Its components:

A generic printing unit.Sleeve&solid cylinder,single and two revolution ,sheet fed and web fed machines, Typical press configurations.Gravure publication press-characteristics. Packaging Gravure Press – Folding carton Press. Flexible Packaging press, Label press. Product gravure. Other gravure press – Intaglio plate printing, offset gravure and flexogravure. Gravure with flexo units. Gravure units as other equipment. Gravure roller coating. Gravure folders – types. Gravure Ink Dryers – Need for ink dryers,Drying water based inks, Dryers functioning,Dryer limitations, supply air valves, balancing the dryer, filters & dampers, roller condition vital. Heat Sources – steam, electric and gas, combination gas/oil, thermic oil, waste heat form incinerators. Solvent Recovery Methods. Gravure cylinder preparation- basic construction, surface finishing, sleeve and integral shafting of cylinder, Electo-mechanical, electron beam & Laser engraving.

UNIT-IV

Gravure Substrates:

Paper substrates-Rotonews papers, Coated papers, Gravure packaging paper substrates – properties. Label stock, Paper board. Non Paper substrates – surface preparation, plastics-properties. Metalized films – Aluminium foil, Foil laminations. Gravure advantages, limitations. Future of Gravure Printing Industry.

Recommended Books :

Gravure process and technology – GAA.
Printing Technology – Adams, Faux, Rieber.

704
PRINTING INK TECHNOLOGY

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Printing Inks

Solvent Based Inks, Water Based Ink, Ingredients in Ink- pigments Vehicles, Additives . Drying mechanisms – physical drying mechanisms, absorption drying, evaporation drying, chemical drying systems, oxidation polymerization drying, radiation drying and curing, microwave drying, infrared drying. Viscosity – Newtonian flow, units of viscosity, viscosity & temperature, factors influencing viscosity, simple low viscosity inks, complex high viscosity inks. Ink requirements for printing processes – offset, letterpress, flexography, gravure, screen printing. Optical properties of ink films, rheology and ink transfer requirements, ink distribution and transfer on the press, method for the direct measurement of ink setting on coated paper.

UNIT-II

Printing Ink manufacturing machines &equipments

Paste inks – single roll mill, twin roll mill, triple roll mill, ball mill, twin horizontal mixer, uni-roll mill, high speed stirrer milling. Liquid inks – ball mill, pearl mill, sand mill, bead mill, shot mill. Trends and developments in ink manufacturing process.

UNIT-III

Radiation curing

Introduction, radiation curing inks, ink cure considerations, chemistry of uv curing-photo initiation, propagation, termination. Cationic curing, electron beam curing

UNIT-IV

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Security Inks

Range of security inks, Special Security Features – fluorescence, phosphorescence, reflected by improved filters, magnetism, Different types of security printing inks. Application of security printing inks. Security inks conformity tests and Q.C.tests – tests for chemical resistance, light fastness, rub resistance test, crumpling resistance test, grinding control, colour control, control of the rheological properties, control of drying time, control of various specific properties. Environmental considerations in security printing.

Recommended Books :-

Printing materials science & technology – Bob Thompson-PIRA
Advances in printing science & technology Vol.24 – J. Anthony Bristow
Hand book of Print & Production – Micheal Barnard, John Peacock
Introduction to Printing Technology – Hugh M.Speirs. SIGPA – 1987

705
PRINT FINISHING

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Introduction:

Latest Developments in Print Finishing. Organization and Workshop Layout. Growths Factors in Print Finishing. Book Binding Tools &Equipments,Book Binders Materials & Quality Control.. Kinds of Paper and Boards. Reinforcing Materials. Securing Materials, Covering Materials, Adhesives and Types of Adhesives in Print Finishing, Solvent Based Adhesives, Water Based Adhesives, Pressure Sensitive Adhesives.Adhesion- Physical, Specific. Miscellaneous Material.

UNIT-II

Structure Of A Book:

Physical Parts of a Hard Bound Book.Forwarding Operations, Finishing Operations. Planning Imposition, Folding Schemes. Hand Folding- Folding To Paper, Folding To Print, Lump Folding, Puckering, Advantages & Limitations Of Hand Folding. Machine Folding – Knife Principles, Buckle Principle, Combination of Knife & Buckle. Folding & Machine Direction. Advancements & Developments On Folding Machine, Folding Machine Paper Feeders. Gathering, Collating – Collating Marks,Insetting and Inserting.

UNIT-III

Securing Methods:

Kinds of Stitching and SewingAdhesive Binding/Perfect Binding – Advantages. Quality Control in Adhesive Binding. Lay-Flat Adhesive Binding. Mechanical Binding – Loose Leaf Binding – Traditional Styles Used. Spiral Binding. Wire 'O' Binding, Plastic Comb Binding. Case Binding. –Stages in Case. Ring Binding – Inter Screw, Ring Metal – Types, Loose Leaf Ring Binding. Ring Shapes. Burst Binding, On Demand Booklet Binding.

End Papers:

Purposes, Kinds of end Rapers, Quality of Paper Required for Pasting End Papers. Pressing, Gluing The Spine, Smashing the Spine, trimming the Book Edges, Rounding, Backing, Lining – Advantages. Head-Tail Bands, Caps, Book Marker. Method Of Attaching Head & Tail Bands. Covering – Covering Styles. Pasting Down, Pressing,

UNIT-IV

Finishing Processes:

Cover Decoration & other Processes. Print Finishing Operations – Embossing &Debossing, Blind Embossing, Gold Blocking /Foil Stamping. Die Printing. Thermography, Velvet Printing, Marbling, Varnishing, Graining, Laminating, Gumming, Gluing, Punching, Perforating, Drilling. Label Puching, Appliqué. Edge Decoration – Requirement, Colouring The Edges, Marbling Edges, Edge Guilding. Round Corner Cutting.

Numbering

Folio Numbering, Double Numbering, Duplicate Numbering. Principle of Rotary Numbering. Skip Numbering, Automatic Numbering.

Kindes of Indexes. Ruling – Principle of Pen & Disk Ruling, M.C. Ruling Terms. Banding & Lacing, Poly Bagging, Mailing, Creasing, Bundling, Tacketing. Ultra Violet Curing &Infra Red Curing.

Binding & Finishing Machines:

Study of Various Modern Machines. Modern Guillotines – Single Knife Guillotines. Three Knife Trimmers. Knife Grinding M/C. Gold Blocking/Foil Stamping M/C. Wire Stitching M/C. Straw Board Cutter. Laminating M/C – Small Laminating M/C. Pouch Laminating M/C. Tunnel Laminating M/C. Tipping M/C. Smashing M/C. Back Gluing M/C. Roller Gliding M/C. Inline Rounding M/C. Lining M/C. Modern Lining M/C. Cloth Cutting M/C. Foil Blocking M/C. Rotary Blocking M/ C. Casing In M/C. Case Making M/C. Box Waste Disposal Process. Adhesive binding machine.

Recommended Books :-

Binding And Finishing – Ralph Lyman Binding And Finishing Part-1 – B.D.Mendiratta
Binding Finishing Mailing – T.J.Tedesco Introduction to Printing & Finishing – Hugh Speirs
Finishing Process in Printing – A.G.Martin.

QUALITY CONTROL IN PRINTING AND PACKAGING

Total Credit: 4 Max. External: 60
Internal: 40
Time Allowed: 3 Hrs.
Marks: 100

Note: The Examiners will set eight questions, taking two from each unit. The students are required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Introduction

Definition of Quality, Quality control, its meaning and purpose setting up a Quality Control Programme, and establishng necessary System and procedures, economic consideration.

UNIT-II

Management Consideration

Quality Control as an attitude and management tool, management's responsibility, organization and personnel functions, getting everybody involved. Total Quality Control. Quality Control procedures and methods. Different shapes of quality control.

UNIT-III

Materials Control

Establishing clear specifications and standardization of materials to be purchased – particularly paper, ink, plates, blankets and rollers, Inspection and testing of incoming materials as part of quality control; importance of proper handling and maintaining records of performance of materials Sampling and sampling plans.

Establishing Quality control programme in different departments of Printing organization.

UNIT-IV

Quality Control Instrumentation

Paper and paper board testing instruments for testing printability, print quality and end-use requirements, Ink testing instruments for testing optical and working properties and end-use requirements Process control instruments, devices and aids used in the galley and dark-room, striping department, plate room and press room for specific processes and for general purposes Press sheet control devices used for production of multicolor printing jobs Basic principles of these instruments and devices how they function and what they measure, minimum instrumentation necessary to produce a product consistent with the appropriate quality level.

c. **Introduction to ISO:9000 and ISO:14000 series.**

Recommended Books:

1. W.H. Banks, Inks, Plates and Print Quality, Pergamon Press
2. Quality Control for quality printing, Graphic Arts, Technical Foundations.

711
GRAVURE TECHNOLOGY LAB.

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Study of various Gravure printing machine configurations.
2. Study of various components of a Gravure printing machine.
3. Pre-make ready in Gravure Printing Process.
4. Plate preparation/ Cylinder preparation.
5. Make-ready in Gravure Printing Process.
6. Study of feeding unit of a Sheet-fed/ Web-fed Gravure printing machine.
7. Single and Multi colour printing by using Grauvre Printing Process.
8. Printing on different substrates by using Grauvre Printing Process.
9. Study of delivery unit of a Sheet-fed/ Web-fed Gravure printing machine.
10. Cylinder setting in a Gravure printing machine.
11. Check the practical problems in a Gravure printing process.

712
PRINTING INK TECHNOLOGY LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1.Printed samples of different printing processes and their study.
2. Different samples of Inks and their study.
3. Study of various component of ink.
4. Effect of Humidity and Temperature on INK.
5. Ink tackiness Test.
6. Light fastness test.
7. Ink Viscosity Test.
8. 8Introduction to various chemicals used in printing.
9. Consumables and miscellaneous used in printing.

713
PRINT FINISHING LAB

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

I. Preparation of the following types of books.

1. Quarter bound a/c books,Half bound a/c books,Full bound a/c books by – French sewing method, Tape sewing method, Cord sewing method, Saddle sewing method, Side sewing method, Whip sewing method..
2. Preparation of Receipt books with numbers in duplicate & triplicate.
3. Preparation of Cheque books with 25 leaves.
4. Preparation of following type of Mechanical binding – Spiral wire binding, Wire 'O' binding, Ring binding.
5. Preparation of files of following designs – Loose leaf file – single piece, Loose leaf file – Two piece tab binder, Loose leaf guard file – Boards joined with spine strip, Court case file, Portfolio – Closed file to keep confidential loose sheets.
6 Preparation of these types of End papers – Single End paper, Double or Inserted End paper, Made end paper, Cloth joint end paper, ZigZag end paper, Cloth joint ZigZag end paper.
7. Preparation of telephone directory with Indexes and Tabs.
8. Study of various controls, operations and mechanisms of the following machines: Folding machine, Guillotine machine, Cutter and Creaser, Varnishing machine, Laminating machine, Sewing & Stitching machine, Miscellaneous machine.

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714
QUALITY CONTROL IN PRINTING AND PACKAGING LAB.

Total Credit: 1 Max. External: 45
Internal: 30
Time Allowed: 3 Hrs.
Marks: 75

LIST OF EXPERIMENTS

1. Paper testing checking grain direction.
2. Tensile strength of paper, burst strength of paper.
3. Substance, caliper, porosity test, cob sizing value test.
4. Tearing testing of paper, brightness test of paper.
5. Operating test, gloss test, lighting color filter sensor.
6. G.S.M. testing, folding endurance.
7. Moisture contents test, ash contents test.
8. Hot air oven tester, absorbing test.
9. Pick strength, humidity control test, room temp testing.
10. Ink film thickness test.
11. Investigation of pigment properties.
12. Investigation of solvent properties.
13. Measurement of viscosity, tack measurement.
14. Test a printed sheet – proof printing and measurement of colour using spectro photometer, resistancetesting of prints.
15. Measurement of ink film thickness.