KURUKSHETRA UNIVERSITY, KURUKSHETRA

('A^{++}' Grade, NAAC Accredited)

SCHEME OF EXAMINATION FOR MASTER OF TECHNOLOGY

(Civil Engineering)

(W.e.f. SESSION: 2025-26)

SEMESTER- I

S. No.	Course Code	SUBJECT	L	T	P	Total	Evaluation		Cr.	Duration of Exam (Hrs.)
							Mid Sem	End Sem		
1	MTCE-101 A	Advanced solid mechanics	3	-	-	3	40	60	3	3
2	MTCE-103A	Concrete Technology	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	MTCE-121A	Soil Mechanics lab-1	-	-	2	2	40	60	2	3
6	MTCE-123A	Advanced Concrete Lab	-	-	2	2	40	60	2	3
7	MTRM-111 A	Research Methodology and IPR	2	-	-	2	40	60	2	3
8	***	Audit Course-I	2	-	-	0	100	-	0	0
	TOTAL		**16**	**0**	**4**	**18**	**380**	**420**	**18**	
							800			

***Program Elective - I**		****Program Elective- II**	
MTCE-105A	Environmental Ethics and Legislation	MTCE-113A	Advanced Soil Mechanics
MTCE-107A	Life Cycle Analysis and Design for Environment	MTCE-115A	Advanced Foundation Engineering
MTCE-109A	Water quality Management	MTCE-117A	Ground Improvement Techniques
MTCE-111A	Water and Wastewater Treatment Processes	MTCE-119A	Pavement Analysis and Design

***** Audit Course-I**	
MTAD-101 A	English for Research Paper Writing
MTAD-103 A	Disaster Management
MTAD-105 A	Sanskrit for Technical Knowledge
MTAD-107 A	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	Evaluation		Cr.	Duration of Exam (Hrs.)
							Mid Sem	End Sem		
1	MTCE-102A	Construction Planning & Control	3	-	-	3	40	60	3	3
2	MTCE-104 A	Design of High Rise Structures	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	MTCE-122 A	**Traffic Lab**		-	2	2	40	60	2	3
6	MTCE- 124 A	**Structural Design Lab**	-	-	2	2	40	60	2	3
7	MTCE- 126 A	Mini Project	-	-	4	2	40	60	2	3
8	***	Audit Course-II	2			0	100		0	3
		TOTAL	**14**		**8**	**18**	**380**	**420**	**18**	
							800			

***Program Elective – III**		****Program Elective – IV**	
MTCE-106 A	Bridge Engineering	MTCE-114A	WATER RESOURCES PLANNING AND SYSTEMS ENGINEERING
MTCE-108A	Pavement, Construction, Maintenance & Management	MTCE-116A	DESIGN OF HYDRAULIC STRUCTURES
MTCE-110 A	Advanced Railway Engineering	MTCE-118A	Theory and Applications of Cement Composites
MTCE-112 A	Transportation Safety & Environment	MTCE-120A	Advanced Design of Foundations

***** Audit Course - II**	
MTAD-102 A	Constitution of India
MTAD-104 A	Pedagogy Studies
MTAD-106 A	Stress Management by Yoga
MTAD-108 A	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.

SEMESTER-Ⅲ

S. No.	Course Code	Subject	L	T	P	Total	Evaluation		Cr.	Duration of Exam (Hrs.)
							Mid Sem	End Sem		
1	*	Program Elective-V	3	-	-	3	40	60	3	3
2	**	Open Elective	3	-	-	3	40	60	3	3
3	MTCE-209 A	Dissertation Phase-I	-	-	20	20	100	-	10	3
		TOTAL	**6**		**20**	**26**	**180**	**120**	**16**	
							300			

***Program Elective –V**	
MTCE-201 A	Traffic Engineering
MTCE-203 A	Modern Construction Materials
MTCE-205 A	Fracture Mechanics of Concrete Structures
MTCE-207 A	Disaster Mitigation and Management

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

SEMESTER-IV

S. No.	Course Code		L	T	P	Total	Evaluation		Cr.	Duration of Exam (Hrs.)
							Mid Sem	End Sem		
1	MTCE-202 A	Dissertation Phase-II	-	-	32	32	100	200	16	3
	TOTAL						**300**		**16**	

Total Credits of all four semesters: 68

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

Evaluation of Mid Sem.(40 Marks) for all the semesters:

(a)Mid semester examination(s): Two Nos each of 10 marks=20 Marks

(b)Attendance/ Regularity : 10 Marks

(c) Teacher's Assessment / Quizzes/ Assignments etc.: 10 Marks

MTCE-101 A	Advanced Solid Mechanics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Solve simple problems of elasticity and plasticity understanding the basic concepts*						
CO2	*Apply numerical methods to solve continuum problems*						

Unit I

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

Unit II

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

Unit III

Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy'sstress Function, Two-Dimensional Problems in Polar Coordinates.

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes

Unit IV

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, vonMises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

References:

1) Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.
2) Elasticity, Sadd M.H., Elsevier, 2005.
3) Engineering Solid Mechanics, Ragab A.R., Bayoumi S.E., CRC Press,1999.
4) Computational Elasticity, Ameen M., Narosa, 2005.
5) Solid Mechanics, Kazimi S. M. A., Tata McGraw Hill, 1994.
6) Advanced Mechanics of Solids, Srinath L.S., Tata McGraw Hill, 2000.

MTCE-103A	Concrete Technology						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Study Ingredients, different properties & Production process of Concrete.*						
CO2	*Design Mix to achieve the specified grade of concrete.*						
CO3	*Understand Non-destructive testing & Concrete deteriorations.*						
CO4	*Introduction to advancement in Concrete.*						

UNIT – I

Concrete as Pavement Material: Introduction. Preparation and grade of concrete.

Concrete Ingredients: Types of cement. Aggregates. Classification of aggregate. Properties of aggregate. Quality of mixing water. Admixtures.

UNIT – II

Properties of Concrete: Introduction, workability, stress strain characteristics of concrete, young's modulus of concrete, creep and shrinkage of concrete, permeability, durability of concrete, joints.

UNIT – III

Production of Concrete: Batching, mixing, transportation, compaction, vibration, curing, formwork removing. Ready mixed concrete.

Non-Destructive Testing of Concrete: Significance. Rebound hammer. Ultrasonic pulse velocity technique. Penetration technique. Pullout test. Cover meter. Core tests.

UNIT – IV

Deteriorations: Causes, deteriorations by water, surface weir, frost action, chemical Reaction, corrosion of reinforcement etc, preventive measures.

Advances in Concrete: Introduction to light weight concrete. High strength concrete. Prestressed concrete. Fibre reinforced concrete. Polymer concrete composites.

References:

1) M.L.Gambhir, "Concrete Technology" TMH Pub. N Delhi.
2) Shetty M.S. "Concrete Technology" S. Chand & Co. N Delhi.

MTCE-121A	SOIL Mechanics lab-1						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Evaluation**	**Mid Semester Evaluation**	**Total**	**Time**
0	**0**	**2**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes(CO)							

Syllabus Content:

List of Experiments:

1. Determination of Moisture Content and Specific gravity of soil
2. Grain Size Distribution Analysis and Hydrometer Analysis
3. Atterberg Limits (Liquid Limit, Plastic limit, Shrinkage limit)
4. Visual Classification Tests
5. Vibration test for relative density of sand
6. Standard and modified proctor compaction test
7. Falling head permeability test and Constant head

permeability test Consolidation test

MTCE-123A	Advanced Concrete Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
0	**0**	**2**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Design high grade concrete and study the parameters affecting its performance*						
CO2	*Conduct Non Destructive Tests on existing concrete structures*						
CO3	*Apply engineering principles to understand behavior of structural/ elements*						

List of Experiments:

1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.

2. Effect of cyclic loading on steel.

3. Non-Destructive testing of existing concrete members.

4. Behavior of Beams under flexure, Shear and Torsion.

References:

1. Properties of Concrete, NevilleA. M.,5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M.S., S. Chandand Co., 2006.

MTRM -111 A	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
2	**0**	**0**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand Research problem formulation*						
CO2	*Analyze research related information*						
CO3	*Follow research ethics*						
CO4	*Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.*						
CO5	*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.*						
CO6	*Understand that IPR protection provides an incentive to inventors 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*.						

Unit I

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 II

Effective literature studies approaches, analysis Plagiarism, and 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 III

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 IV

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, 2nd 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.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand

MTCE-102 A	Construction Planning & Control						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Course Content

Project Management: Basic forms of organization with emphasis on Project and matrix structures; project life cycle, planning for achieving time, cost, quality, project feasibility reports based on socio-techno-economic-environmental impact analysis, project clearance procedures and necessary documentation for major works like dams, multistoried structures, ports, tunnels, Qualities, role and responsibilities of project Manager, Role of Project Management Consultants, Web based project management.

Project Scheduling – Non-Networking Techniques: Gantt-Chart, Networking Techniques: Formulation and Applications of Critical Path Method (CPM) and Program Evaluation & Review Technique (PERT), Precedence Diagram Method (PDM), RPM (Repetitive Project Modeling) techniques. Linear Scheduling, LOB technique, Mass haul diagrams.

Project Control - Man-Material-Machinery-money optimization, scheduling, monitoring, updating. Resource Planning - Resource Constrained Scheduling, Resource Levelling. Time-cost tradeoffs – Network crashing

Performance Measurement, Earned Value, Multiple Construction Projects, Real time Applications

References

1. Project Management for Engineering and Construction, GD. Oberlender, McGraw-Hill, 3rd Edition, 2014.
2. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley & Sons, 6th Edition, 2016.
3. Construction Project Scheduling, Callaghan, MT., Quackenbush, DG. and Rowings, JE., McGraw-Hill, 1992.
4. A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Sixth Edition, An American National Standard, 2018.
5. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019.
6. Jerome D. Wiest and Ferdinand K. Levy, "A Management Guide to PERT/CPM", Prentice Hall of India Publishers Ltd., New Delhi, 2012.

MTCE-104A	Design of High Rise Structures						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Analyze, design and detail Transmission/TV tower, Mast and Trestles with different loading conditions*						
CO2	*Analyze, design and detail the RC and Steel Chimney*						
CO3	*Analyze.designanddetailthetallbuildingssubjectedtodifferentloadingconditions Using relevant codes*						

Unit 1

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

Unit 2

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

Unit 3

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions

Unit4

Application of software in analysis and design.

References:

1) StructuralDesignofMulti-storeyedBuildings,VaryaniU.H.,2ndEd.,SouthAsian Publishers, New Delhi, 2002
2) Structural Analysis and Design of Tall Buildings, TaranathB.S.,McGrawHill,1988
3) Illustrated Design of Reinforced Concrete Buildings (GF+3storeyed), Shah V. L. & Karve S. R., Structures Publications, Pune, 2013
4) Design of Multi Storeyed Buildings,Vol.1&2,CPWDPublications,1976
5) Tall Building Structures, Smith By ranS.and CoullAlex,WileyIndia.1991
6) High Rise Building Structures,Wolfgang Schueller,Wiley.,1971
7) Tall Chimneys, Manohar S. N., Tata McGraw Hill Publishing Company,New Delhi

MTCE-122 A	Traffic Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
0	**0**	**2**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Study Traffic Volume & speed using Videography technique.*						
CO2	*Speed study by different methods*						
CO3	*Determine reaction time & Bitumen content*						
CO4	*Study parking, accident investigation & accident prone location.*						

1) Traffic volume study using video graphy technique.

2) Traffic speed study using video graphy technique.

3) Speed study by radar gun

4) Speed study by endoscope

5) Determination of reaction time of driver

6) Parking study

7) Accident investigation study

8) Study for improvement of an accident prone location

9) Bitumen content determination through centrifuge extrude

10) Proportioning of aggregate

MTCE-124A	Structural Design Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
0	**0**	**2**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Design and Detail all the Structural Components of Frame Buildings.*						
CO2	*Design and Detail complete Multi-Storey Frame Buildings*						

Syllabus Content:

Design and detailed drawing of complete G+3 structures by individual student using latest relevant IS codes.

MTCE-126 A	Mini Project						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Identify structural engineering problems reviewing available literature*						
CO2	*Study different techniques used to analyze complex structural systems.*						
CO3	*Work on the solutions given and present solution by using his/her technique applying engineering principles.*						

Syllabus Content:

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Semester and End Semester will be monitored by the departmental committee.

Program Elective –I

MTCE-105 A	Environmental Ethics And Legislation						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Course Learning Objectives

1. To deliberate the issues of environmental ethics and legislation.
2. To deliberate the role of judiciary in sustainable development
3. To impart knowledge on the policies, legislations, institutional frame work and enforcement mechanisms for environmental management in India
4. To learn the legal aspects of environmental problems

Course Content

Environmental Ethics- Need, Issues and Possible Solutions. Constitutional Provisions and Environment Protection in India – National Environmental policies – Sustainable development and role of Indian Judiciary in promoting it with special reference to Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – Forms of legislation / regulations - multilateral environmental agreements, conventions and protocols.

Acts related to environmental protection – Water (P&CP) Act 1974, Air (P&CP) Act 1981, Environment (Protection) Act 1986 - Relevant provisions of Forest (Conservation) Act 1982, Wild Life (Protection) Act 1972 ;

Issues involved in enforcement of Environmental Legislation. Public interest litigation – writ petitions - SupremeCourtJudgmentsinlandmarkcases–IndianCouncilforEnviro-legalActionv.UOIAIR1996 SC 1446, MC Mehta v. Union of India (Oleum gas leak case) AIR 1987 SC 1086, MC Mehta v. UOI(Kanpur Tanneries case), Indian Handicraft Emporium v. UOI (2003) 7 SCC 589.

Books:

1. Divan S. and Roseneranz A.: Environmental law and policy in India – Cases, Material & Statements, Oxford University Press, New Delhi, 2001.
2. CPCB: Pollution Control Acts, Rules and Notifications issued the re under Pollution Control Series, Central Pollution Control Board, N. Delhi.
3. DiwanP. : Environmental administration–law and judicial attitude Vols. I & II, Vedamse Books (P) Ltd, N. Delhi, 1992.
4. JaswalP.S.andNistha:IntroductiontoEnvironmentalLaw,AllahabadLawAgency,Allahabad,2017

Program Elective –I

MTCE-107 A	Life Cycle Analysis And Design For Environment						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Course Outcomes: At the end of the course the student will be able to:

CO1	Perform life cycle inventory analysis of products.
CO2	Develop strategist to bring energy efficiency in all stages of the product development cycle.
CO3	Formulate plans for comprehensive environmental protection, in order to comply with environmental laws.

Detailed Syllabus:

Engineering Products and Processes: Environmental health and safety, Product life cycle stages, material toxicity, pollution anddegradation,environmentallyconsciousdesignandmanufacturingapproaches,Sustainabledevelopmentandindustrial ecology, System life cycle from cradle to reincarnation, Product life extension, Organizational issues. Pollution prevention practices, Manufacturing process selection and trade-offs. Design for environment: Motivation, concerns, definitions, examples, guidelines, methods and tools.
Recyclability assessments, design for recycling practices. Re-manufacturability assessments, design for remanufacture/ Reuse practices.
Industrial ecology and eco-industrial parks, eco labels and life cycle analysis (LCA): LCA methodology, steps, tool sand problems, Life cycle accounting and costing.
ISO14000 Environmental Management Standards, New Business paradigms and associated design practices.

Readings:

1. Ciambrone, D.F., Environmental Life Cycle Analysis, CRC Press, 1997
2. HandbookonLifeCycleAssessment:OperationalguidetotheISOstandards,KluwerAcademicPublishers,2004

Program Elective –I

MTCE-109 A	Water Quality Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Pre-requisites: NONE

Course Outcomes: Attend of the course the student will be able to:

CO1	Meaning of important parameters for measuring water quality, water quality criteria and standards, and their relation to public health, environment and urban water cycle.
CO2	Water quality test sand to determine how the parameters related to each other.
CO3	Principles and the practical approaches and techniques required to effectively monitor the chemical, hydrological, microbiological and aquatic elements of water quality.
CO4	Water quality test sand to determine how the parameters relate to each other.

Detailed syllabus:

Introduction: Quality parameter and classification of natural water, Physico-Chemical and biological water quality classification of aquatic systems. Sources of pollution: characteristics of point and non-point sources of pollution. Eutrophication in natural water bodies: causes processes and control Toxic wastes: Sources, transportation and management strategies.

Thermal pollution: causes model and control.

Acid rains: Occurrences, impact sand strategies for control

Water quality monitoring: Objectives, requirements, planning and various techniques.

Case studies related to water quality monitoring under various river action plans including Ganga and Yamuna Action plans.

Readings:

1. Reckho wand Chapra (1983) Engineering Approaches for Lake Management, Vol.1, Butterworth, Boston.
2. Thomson and Mueller(1987)Principles of Surface Water Quality Modelling and Control, Harper and Row, NY.
3. Tchobanoglous and Schroeder (1987) Water Quality: characteristics, Modelling and modification, Addition – Wesley Pub. Co., USA
4. APHA(1998)StandardMethodsforExaminationofWaterandWastewater,20thEdition,Washington,D.C.
5. Velz,C.J.(1970) Applied Stream Sanitation, Wiley Interscience, NY.

Program Elective –I

MTCE-111 A	Waste Water And Treatment Processes						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Pre-requisites: NONE

Course Outcomes: At the end of the course the student will be able to:

CO1	Analyze water quality
CO2	Epidemiological and toxic aspects
CO3	Design conventional water treatment systems
CO4	Design treatment systems for removal of dissolved solids
CO5	Analyze and design water distribution systems

Detailed Syllabus:

Structure and basic properties of water and their significance in environmental engineering. Source of water impurities; Water quality parameters; Epidemiological and toxic aspects; physical and chemical interactions due to various forces; Suspension and dispersions; Surface and colloidal chemistry; Settling of particles in water, Coagulation and flocculation, floatation, filtration mechanisms and interpretations, ion exchange and adsorption, Chemical Oxidation/reduction processes; Disinfection using chlorine, UV, ozonation. Water stabilization, aeration and gas transfer. Reverse osmosis, electro dialysis and desalination; treatment and sludge management.

Readings:

1. HowardS.Peavy,DonaldR.RoweandGeorgeTchobanoglous,EnvironmentalEngineering,McGrawHill.,1984
2. Viessman Jr, Hammer J.M, Perez,E.M,and Chadik, P.A, Water Supply and Pollution Control, PHI Learning, New Delhi, 2009
3. M. Hanif Chaudhary , Applied Hydraulic Transients,3rdEd.,Springer.,2014

Program Elective -II

MTCE-113 A	Advanced Soil Mechanics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Teaching Scheme
Lectures:3 hrs./Week

COURSEOUTCOME

- The students obtain the complete knowledge on strength of soil mass
- Thestudentsareabletodevelopmathematicalmodelsforsolvingdifferentproblemsinsoil mechanics

Syllabus Contents:

Unit I

Compressibility of soils: consolidation theory (one two, and three dimensional consolidation theories), consolidation in layered soil and consolidation for time dependent loading, determination of coefficient of consolidation (Casagrande method and Taylors method)

Unit II

Strength behavior of soils; Mohr Circle of Stress; UU, CU, CD tests, drained and undrained behavior of sand and clay, significance of pore pressure parameters; determination of shear strength of soil; Interpretation of triaxial test results.

Unit III

Stress path; Drained and undrained stress path; Stress path with respect to different initial state of the soil; Stress path for different practical situations.

Unit IV

Critical state soil mechanics; Critical state parameters; Critical state for normally consolidated and over consolidated soil; Significance of Roscoe and Hvorslev state boundary surface; drained and undrained plane. Critical void ratio; effect of dilation in sands; different dilation models.
Elastic and plastic deformations: elastic wall; introduction to yielding and hardening; yield curve and yield surface, associated and non-associated flow rule.

References:

Atkinson, J.H.and Bransby, P.L,The Mechanics of Soils: An introduction to Critical soil mechanics, McGraw Hill, 1978.

Atkinson J.H, An introduction to the Mechanics of soil sand Foundation, McGraw-Hill Co.,1993. Das, B.M., Advanced Soil Mechanics, Taylor and Francis, 2nd Edition, 1997.

Wood,D.M.,SoilBehaviorandCriticalStateSoilMechanics,CambridgeUniversityPress,1990.Craig, R.F., Soil Mechanics, Van No strand Reinhold Co. Ltd., 1987.

Terzaghi, K., and Peck, R.B., Soil Mechanicsin Engineering Practice,JohnWiley&Sons,1967. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley & Sons, 1979.

Program Elective -II

MTCE-115 A	Advanced Foundation Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Teaching Scheme
Lectures: 3hrs/week

COURSEOUTCOME

- The students will be able to decide the type of foundations to be recommended for construction of different engineering structures
- The students will be able to design different types of foundations

Syllabus Contents:

Unit I

Planning of soil exploration for different projects, methods of subsurface exploration, methods of borings along with various penetration tests

Unit II

Shallow foundations requirements for satisfactory performance of foundations, methods of estimating bearing capacity, settlements of footing sand rafts, proportioning of foundations using field test data ,IS codes.
Well foundation, IS and IRC codal provisions, elastic theory and ultimate resistance methods

Unit III

Pile foundations, methods of estimating load transfer of piles, settlements of pile foundations, pile group capacity and settlement, negative skin friction of piles, laterally loaded piles, pile load tests, analytical estimation of load-settlement behavior of piles, proportioning of pile foundations, and lateral land uplift capacity of piles
.

Unit IV

Foundations on problematic soils: Foundations for collapsible and expansive soil
Cofferdams, various types, analysis and design Foundations under uplifting loads

References:

- Bowles. J.E., Foundation Analysis and Design, Tata McGraw-HillInternationalEdition, 5th Edn, 1997.
- Das B.M., Shallow Foundations: Bearing capacity and settlement, CRC Press, 1999.
- Tomlinson M.J., Pile design and construction Practice, Chapmanand HallPublication, 1994.
- Poulos, H.G.and Davis, F.H.,"Pile Foundation An analysis and Design", Wiley and Sons. 1980

Program Elective -II

MTCE-117A	Ground Improvement Technique						
Lecture	Tutorial	Practical	Credit	End Sem	Mid Sem	Total	Time
3	0	0	3	60	40	100	3Hrs.

Unit I

Introduction: situations where ground improvement becomes necessary

Unit II

Mechanical modification: dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, stone columns; Hydraulic modification: dewatering systems, preloading and vertical drains, electro-kinetic dewatering

Unit III

Chemical modification; modification by admixtures, stabilization using industrial wastes, grouting
Thermal modification :ground freezing and thawing.

Unit VI

Soil reinforcement: Reinforced earth, basic mechanism, type of reinforcements, selection of stabilization/improvement of ground using Geotextiles, Goegrid, Geomembranes, Geocells, Geonets, and soil nails.

Application of soil reinforcement: shallow foundations on reinforced earth ,design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road designs with geo synthetics

References:

- Hausmann, M.R., Engineering Principles of Ground Modification, McGraw-Hill International Editions,1990.
- Yonekura,R.,Terashi,M.andShibazaki,M.(Eds.),GroutingandDeepMixing,A.A. Balkema,1966.
- Moseley,M.P.,GroundImprovement,BlackieAcademic&Professional,1993.
- Xanthakos,P.P.,Abramson,L.W.andBruce,D.A.,GroundControlandImprovement,John Wiley & Sons, 1994.

- Koerner,R.M.,DesigningwithGeosynthetics,PrenticeHallInc.1998.
- Shukla,S.K.,Yin,Jian-Hua,"FundamentalsofGeosyntheticEngineering",Taylor&Francis.

Program Elective -II

MTCE-119A	PAVEMENT ANALYSIS AND DESIGN						
Lecture	Tutorial	Practical	Credit	End Sem	Mid Sem	Total	Time
3	0	0	3	60	40	100	3Hrs.

Unit I

Philosophy of design of flexible and rigid pavements, **Analysis** of pavements using different analytical methods,

Unit II

Selection of pavement designing put parameters–traffic loading and volume

Unit III

Material characterization, drainage, failure criteria , reliability

Unit IV

Design of f lexible and rigid pavements using different methods,

Comparison of different pavement design approaches, design of overlays and drainage system.

References:

- Yang and H.Huang, Pavement Analysis and Design, Pearson Prentice Hall,2004.
- Yoder and Witzech, Pavement Design, Mc Graw-Hill, 1982.
- Sharma and Sharma, Principle sand Practice of Highway Engg. , Asia Publishing House,1980.
- Teng,Functional Designing of Pavements,McGraw-Hill,1980.

Program Elective -III

MTCE-106 A	Bridge Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Study different types of Bridge & loading as per IRC & IRS specifications*						
CO2	*Design RC & steel bridges by specifications & standards*						
CO3	*Study different types of bearing used in Bridges with their functions.*						

UNIT - I

Types of Bridges: Consideration of loads and stresses in bridges, bridge loading as per IRC and IRS specifications, traffic lanes, footway, kerbs, railing and parapet loading, impact, wind load, longitudinal forces, temp effects, secondary stresses, erection stresses, earth pressure, effect of live load on back fill and on the abutment.

UNIT – II

Design of RC Bridges: Slab culvert, box culvert, pipe culvert, T-beam bridge, super structure, design examples, brief introduction to rigid frame, arch and bow string girder bridges. Design of pre-stressed concrete bridges, pre-tensioned and post tensioned concrete bridges, analysis and design of multi-lane prestressed concrete T-beam bridge super structure.

UNIT – III

Steel Bridges: Types, economical span, loads, permissible stresses, fluctuation of stresses, secondary stresses, plate girder bridges, general arrangement, bridge floors, plate girder railway bridges, deck type plate girder bridges, design example. Truss bridges, types, wind force on lattice girder bridge, bracings, truss bridge for railway – through type truss bridge. Pier, abutment and wing walls, types of piers, forces on piers, stability, abutments, bridge code provisions for abutments, wing walls, design examples.

UNIT – IV

Bearings: Functions, bearings for steel and concrete bridges, bearings for continuous span bridges, IRC provisions for bearings, fixed bearings, expansion bearings, materials and specifications, permissible stresses, design considerations for rocker and roller cum rocker bearings, sliding bearings. Foundations, types, general design criterion, design of well and pile foundations for piers and abutments.

References:

1) Victor DJ, Essentials of Bridge Engineering, Oxford & IBH Pubb Co.
2) Rowe RE, Concrete ridge Design

Program Elective -III

MTCE-108 A	Pavement Construction, Maintenance & Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Study the construction procedure of different types of Bituminous, Non-Bituminous & cement concrete Pavements*						
CO2	*Study the Maintenance techniques for different types of Pavements.*						

UNIT – I

Introduction: History of road construction, stages of construction, seasonal limitations of pavement construction.

Stabilization of Soil: Mechanical stabilization, cementing additives and chemicals, thermal stabilization.

UNIT – II

Construction of Non-bituminous Pavements: Brief introduction to earthwork machinery: shovel, hoe, clamshell, dragline, bulldozers, cleaning and grubbing, excavation for road and drain, principles of field compaction of embankment / sub grade. Compacting equipments. Granular roads. Construction steps of GSB, WBM and WMM.

Construction of Bituminous Pavements: Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of busg, premix carpet, BM, DBM and AC. Brief coverage of machinery for construction of bituminous roads: bitumen boiler, sprayer, pressure distributer, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MORTH specifications.

UNIT – III

Construction of Cement Concrete Roads: Construction of cement concrete pavements, machinery involved in construction, slip-form pavers, joints in cement concrete pavements, IRC and MORTH specifications. Construction of other types of pavements: basic concepts of the following: soil stabilized roads, use of geo-synthetics, reinforced cement concrete pavements, prestress concrete pavements, roller compacted concrete pavements and fiber reinforced concrete pavements. Use of fly ash in cement concrete road construction.

UNIT – IV

Highway Maintenance: Pavement distresses, Maintenance operations, Maintenance of WBM, bituminous surfaces and cement concrete pavements. Functional and structural evaluation of pavements, pavement maintenance, maintenance management

Related Topics: Emulsified bituminous mix, pre coating of aggregates, recycling of bituminous pavements, shoulder construction.

References:

1) Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
2) Highway Engg. By S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.

Program Elective -III

MTCE-110 A	Advanced Railway Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Study Railway Track Components*						
CO2	*Understand important terms related to Railway Curves, Control System & Rehabilitation.*						

UNIT - I

Railway Track: Track and track stresses. Train resistances and hauling power of locomotives. Railway track components.

UNIT - II

Point & Crossings: Important features. Railway curves. Super elevation, gradients and grade compensation. Points and crossing and their design approaches.

UNIT-III

Maintenance, Control System: Construction and maintenance of railway track. Control of train movements. Signals and interlocking,

UNIT-IV

Railway Rehabilitation: Modernization of railways and future trends. Track standards and track rehabilitation. Essential Reading.

References:

1) J.S. Mundrey, Railway Track Engineering, Tata McGraw Hill Co. Ltd., 3rd Edition, 2000.
2) M.M. Agarwal, Railway Track Engineering, Standard Publishers, 1st Ed 2005.
Supplementary Reading.
3) S. Chandra and Agarwal, Railway Engineering, Oxford University Press, 1st Ed. Feb 2008.
4) A.D. Kerr, Fundamentals of Railway Track Engineering, Simmons Boardman Pub Co (December 30, 2003)

Program Elective -III

MTCE-112 A	Transportation Safety & Environment						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Analyze the Road Accidents & the safety measures to reduce accidents*						
CO2	*Role of different organisation for Road safety.*						

UNIT – I

Road Accidents & safety measures: Trends in roads and highways development. Problem of road accidents in India. Characteristics of road accidents. Causes of accidents. Global and Indian road safety scenario. Factors responsible for success stories in road safety. Role of highway professionals in highway safety.

UNIT – II

Various Aspects for traffic safety: Planning of roads for safety. Land use planning and zoning. Development control and encroachment. Network hierarchy. Route planning through communities. Access control. Traffic segregation. Traffic calming designing for safety: road link design, alignment design. Cross-sectional elements. Traffic control devices. Road side safety. Road side facilities. Some critical elements. Junction design Basic principles. Selection of junction type. Factors affecting safety at various junction types. Elements to improve road safety. Provisions for vulnerable road users.

UNIT – III

Road safety audit: Concepts of road safety audit, Road safety auditors & key personnel in RSA. Organizing and conducting a road safety audit. Example and commonly identified. Issues during RSA, Road safety audit report. Development of cost-effective of road safety audit accident investigation and prevention. Basic strategies for accident reduction. Significance of accident data. Accident investigation and identification of potential sites for treatment. Problem diagnosis. Selection of countermeasures. Example of selection of counter measures. Detailed design and implementation of countermeasures.

UNIT – IV

Road safety Evaluation: Monitoring and evaluation non-engineering measures for road safety, behavioral counter measures, education. Training and publicity. The goal of police traffic control activities. Strategy for road safety management by police. Role of NGOs in road safety. Legal framework for road safety transport related pollution, noise pollution, air pollution, effects of weather conditions, vehicular emission parameters, pollution standards. EIA requirements of highway projects, world bank guidelines, EIA practices in India. Fuel crisis and transportation, factors affecting fuel consumption, fuel economy in various modes of transportation, various types of alternative fuels.

References:

1) Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
2) Highway Engg. By S.K.Khanna& C.E.G. Justo, New Chand Bros., Roorkee.

Program Elective –IV

MTCE-114 A	Water Resources Planning And Systems Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

INTRODUCTION: Planning, Meaning and Significance. Need for water resources systems planning, Issues in planning. Planning process.

PLANNING FOR WATER RESOUCES DEVELOPMENT: Statement of objectives. Data requirements. Project formulation. Environmental considerations in planning, Systems analysis. Pitfalls in project planning. Conservation and augmentation of water resources. Multipurpose projects. Functional requirements in multi-purpose project. Compatibility of multipurpose uses.

ECONOMIC ANALYSIS: Equivalence of kind. Equivalence of time, Value. Cost. Benefit. Discounting factors, Discounting techniques. Measurement of cost and benefit. Benefit-cost analysis. Project evaluation, Benefit-cost variation. Limitations of benefit-cost analysis. Dynamic of project analysis.

FINANACIAL ANALYSIS: Role of financial analysis. Distinctions from economic analysis. Financial feasibility, Separable and non-separable costs. Cost allocation, allocation consequences. Water resources pricing.

WATER RESOURCES SYSTEMS: Concepts of systems engineering in water resources. Objective function, Production function and optimality conditions. Linear, non-linear and dynamic programming, Sensitivity analysis, Stochastic models, Statistical decision theory. Application of water resources systems engineering to practical problems.

BOOKSRECOMMENDED:

1. Water Resources Engineering by R.K.Liniley and Franzini,McGraw-HillBookCo.
2. Water Resources Systems Engineering by Halland Dracup, Mc Graw Hill BookCo.
3. Economics of Water Resources Engineering by L. Douglas James. and Robert R. Lee McGraw Hill Book Co.
4. Design of Water Resources Systems by Arther Mass et. Al, Harward Univ. Press Cambridge. 1967
5. Optimization Theory and Applications by S.S.Rao, Willy East Ltd.

Program Elective –IV

MTCE-116 A	Design of Hydraulic Structures						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

GRAVITY DAMS: Darn parameters, Criteria for selection of dam sites, seals, Joints & keys of loads, Cooling arrangement, Water stops at joints, Closing gaps, forces acting on darns, Types of loads, Modes of failure, Elementary profile of a gravity dam, Step by step method, Stability analysis methods, Safety criteria, Gravity analysis, Galleries.

ARCH DAMS: Development of arch dam, Valleys suited for arch darns, Arch darns layout,Types of arch dams, Appurtenantworks,Thincylindertheoryandmosteconomicalcentral angle, Design of arch dam, Effects of foundation elasticity on the behaviors of an arch dam.

BUTTRESSDAMS: Types of buttress darn, Selection of type of buttress dam, Most economical profile having no tension, Design principles, Buttress design by Unit column theory.

SPILLWAYS AND ENERGY DISSIPATORS : Factors affecting design, Components and profile of different types of spillways, Design principles, Non-conventional types of spillways, Hydraulic design ogee spillway, Side channel spillway, Chute spillway, Siphon spillway, Shaft- spillway, Energy dissipation below spillways, Bucket type energy dissipaters, Selection and design of various types of stilling basins.

WEIRSANDBARRAGES: Components of diversion head works and their functions, Design of weirs & barrages on permeable foundation, Khosla theory of independent variable, Schwarz Christoffel transformation, Upstream and downstream protection, Flow nets, Design of sloping glacis weir.

BOOKSRECOMMENDED:

1. Engineering for Dams by Creager, J ustin & Hinds, Willey Eastern Pvt.Ltd.,Delhi
2. Concrete Dams by R.S.Varshney, Oxford & IBHPub. Co. Delhi.
3. Dams-Part I Gravity Dams by K.B. Khushalani, Oxford & M N, Delhi.
4. Design of Weirs on Permeable Foundations, CBIP Pub.No20,Delhi
5. Hydraulic Design of Spillways, ASCE Technical Engg. No. 12, Design guides as adapted from the US Army Corps.
6. Hydraulic Structures; P.Novak, AIBM off at, C.Nalluri, and R.Narayanan:Taylor & Francis, New York

Program Elective -IV

MTCE-118 A	Theory and Applications of Cement Composites						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.*						
CO2	*Classify the materials as per orthotropic and anisotropic behaviour.*						
CO3	*Estimate strain constants using theories applicable to composite materials.*						
CO4	*Analyse and design structural elements made of cement composites.*						

Unit 1

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Unit 2

Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness

Unit 3

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing

Unit 4

Mechanical Properties of Cement Composites :Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion

Unit 5

Application of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants

Unit 6

Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON and Fibre Reinforced Concrete.

References:

1) Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis ,BSP Books, 1998. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980
2) New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983

Program Elective -IV

MTCE-120A	Advanced Design of Foundations						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Decide the suitability of soil strata for different projects						
CO2	Design shallow foundations deciding the bearing capacity of soil						
CO3	Analyze and design the pile foundation						
CO4	Understand analysis methods for well foundation						

Unit-I

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests

Unit-II

Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws

Unit-III

Pile Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles

Unit-IV

Well Foundation, IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods

Unit-V

Tunnels and Arching in Soils, Pressure Computations around Tunnels

Unit-VI

Open Cuts, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types

Unit-VII

Coffer Dams, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

Reference Books

1) Design of foundation system, N.P. Kurian, Narosa Publishing House
2) Foundation Analysis and Design, J.E. Bowles, Tata Mc Graw Hill New York
3) Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co.Pvt. Ltd, New Delhi

Program Elective –V

MTCE-201A	Traffic Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Course Outcomes

CO1	Apply the Concept for determine the different Trip Generation Models and various model in Urban Transport Planning.
CO2	Apply the concept of Mean, Mode and variance for determining the speed, flow and density.
CO3	Identify model computed are good or not applicable for existing Urban planning condition.

Syllabus

Traffic Characteristics: Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road. **Traffic Studies:** Traffic volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys.

Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures.

Capacity and Level of Service: Fundamental diagram of traffic flow. Relationship between speed, volume and density. Level of service. PCU. Design service volume. Capacity of non-urban roads. 1RC recommendations. Brief review of capacity of urban roads.

Traffic Regulation and control Devices: Traffic control devices: signs, signals, markings and islands. Types of signs, Types of signals. Design of signals. Intersections at grade and grade separated intersections. Design of a rotary. Types of grade separated intersections.

Design of Parking Lighting and Terminal Facilities : Parking surveys. On street parking, off street parking.

Traffic Regulation: Need and scope of traffic regulations. Regulation of speed, vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management.

Books Recommended

(i) Principles of Transportation Engineering by Chakroborty & Das,Prentice Hall,India.
(ii) Highway Engg by S.K.Khanna & C.E.G.Justo, NemChand Bros., Roorkee.
(iii) Traffic Engg and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi.
(iv) Principles of Transportation and Highway Engineering by G.V.Rao,Tata McGraw-Hill Publishing Co.Ltd.N.Delhi.
(v) Traffic Engg.by Matson, T.M., Smith, W.S. and Hurd, F.W, McGraw-Hill Book Co.,New York.
(vi) Traffic Flow Theory. By Drew, D.R .,Mc Graw- Hill Book Co., New York.
(vii) Basic Statistics- Simpson and Kafks; Oxford and IBH Calcutta, 1969.
(viii) Fundamentals of Mathematical Statistics– Gupta, S. Cand Kapoor, K.V. Sultanchand.

Program Elective –V

MTCE-203A	Modern Construction Materials						
Lecture	Tutorial	Practical	Credit	End Sem. Evaluation	Mid Sem. Evaluation	Total	Time
3	0	0	3	60	40	100	3 Hrs.

Course Content

Aggregates: Introduction, Historical back ground of Light weight aggregate concrete, Artificial aggregates, Physical properties of aggregates, Light weight aggregate concrete, Applications of light weight aggregate concrete, Properties of green light weight aggregate concrete, Effect of size aggregate on the strength properties of LWAC made with palm oil shells, Recycled aggregate, Pre placed aggregate concrete.

Fibers in Concrete: Types of Fibers - Glass fiber reinforced concrete, Natural fiber reinforced concrete, Polymer Fiber Reinforced Concrete, Steel Fiber reinforced Concrete. Behavior - Workability, Mechanical and Physical properties of Fiber in reinforced concrete.

Special Concretes: High strength concrete, Effect of RHA on the properties of HSC, High performance concrete –applications, Self-Compacting Concrete, Concrete made with waste rubber, Special Concretes, Sulfur Concrete, Ferro cement, Geo synthetics, Nano Concrete, Changes in concrete with respect to time.

Steel construction, Types of steel used for construction, Methods of utilizing steel in construction, Advantages and Applications of steel in construction

Advanced Materials: Adhesives in construction industry-Acrylics, Bridge bearings, Industrial waste materials in concrete Rapid wall panels, Moisture Barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

Reference

1. Adam M Neville, Properties of Concrete, 5th Edition, Longman Sc and Tech Publishers, 2012.
2. Kumar Mehta. P and Paulo J M Monteiro, Concrete Microstructure, Properties and Materials, McGraw Hill, 4th Edition, 2013.

Program Elective -V

MTCE-205A	Fracture Mechanics of Concrete Structures						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Identify and classify cracking of concrete structures based on fracture mechanics*						
CO2	*Implement stress intensity factor for notched members*						
CO3	*Apply fracture mechanics models to high strength concrete and FRC structures*						
CO4	*Compute J-integral for various sections understanding the concepts of EFM*						

Unit I

Introduction: Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis

Unit II

Stress at Crack Tip: Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith‟s Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin‟s Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD

Unit III

Material Models: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

References:

1) Fracture Mechanics,Suri C.T.and Jin Z.H.,1stEdition,ElsevierAcademicPress, 2012
2) Elementary Engineering Fracture Mechanics, Broek David,3rd Rev.Ed.Springer, 1982.
3) Fracture Mechanics of Concrete Structures–Theory and Applications, Elfgreen L.,RILEM Report, Chapman and Hall, 1989
4) FractureMechanics ApplicationstoConcrete,Victor,LiC.,BazantZ.P.,ACISP118,ACI Detroit, 1989

Program Elective –V

MTCE-207A	Disaster Mitigation and Management						
Lecture	Tutorial	Practical	Credit	End Sem. Evaluation	Mid Sem. Evaluation	Total	Time
3	0	0	3	60	40	100	3 Hrs.

Course Content

Meaning and types of hazards, disasters and catastrophes – Disaster Management; Earthquakes: causes and effects – measurements - earthquake zones India – vulnerability and microzonation; - volcanic hazards;

Landslides: Causes and effects – landslide prone zones in India –Cyclone: Origin and types - effects on land and sea – damage assessment; Flooding: Tsunami –Soil Erosion-Drought: Characteristics- Occurrence – Preventive measures

Emerging approaches in Disaster Management- Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/forcasting& warning- Preparing disaster preparedness plan- Land use zoning- Disaster resistant house construction- Population reduction in vulnerable areas- Awareness

Emergency Stage - Rescue training for search & operation at national & regional level- Immediate relief- Assessment surveys - Post Disaster stage-Rehabilitation- Political Administrative Aspect- Social Aspect-

Economic Aspect- Environmental Aspect
Mitigation - Role of Media - Monitoring Management- Preventive Measures- A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster& Disaster in Hills with particular reference to India -Ecological planning for sustainability & sustainable development in India-Sustainable rural development

Soft Solutions for Disaster Management - Case studies - Earthquake, volcano and landslide - Flood prone area analysis and management – risk assessment – cyclones and floods - Drought and desertification

References

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.
3. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.
4. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.

Open Elective

MTOE-201 A	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)							
PO1	*Understand the role of business analytics within an organization*						
PO2	*Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization*						
PO3	*To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making*						
PO4	*To become familiar with processes needed to develop, report, and analyze business data*						
PO5	*Use decision-making tools/Operations research techniques*						
PO6	*Mange business process using analytical and management tools*						
PO7	*Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc*						
Course outcomes (CO)							
CO1	*Students will demonstrate knowledge of data analytics*						
CO2	*Students will demonstrate the ability of think critically in making decisions based on data and deep analytics*						
CO3	*Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making*						
CO4	*Students will demonstrate the ability to translate data into clear, actionable insights*						

Unit I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

Unit II

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization

Unit IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression ore casting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model

Unit V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without 8 Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making.

Unit VI

Recent Trends in Embedded and collaborative business intelligence, Visual data 4 recovery, Data Storytelling and Data journalism.

References

1) **Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press**
2) **Business Analytics by James Evans, persons Education**

Open Elective

MTOE-203 A	Industrial Safety						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**

Unit I

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, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit II

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 III

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 IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need andapplications, 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 V

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.

References

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

Open Elective

MTOE-205 A	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
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 I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

Open Elective

MTOE-207 A	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Students should able to learn the cost concepts in decision making*						
CO2	*Student should be able to do cost planning and Marginal Costing*						
CO3	*Students should be able to create a database for operational control and decision making.*						

Unit I

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 II

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical 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 III

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 IV

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

Open Elective

MTOE-209 A	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

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 II

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 III

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 IV

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.

Open Elective

MTOE-211 A	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

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 II

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 III

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 IV

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.

Audit-I

MTAD-101 A	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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-I

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

Unit II

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

Unit III

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 IV

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

Audit -I

MTAD-103 A	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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

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

Unit-II

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 III

Disasters 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

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 -IV

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.

Audit -I

MTAD-105 A	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

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

Unit II

Order, Introduction of roots, Technical information about Sanskrit Literature

Unit III

Technical concepts of Engineering: Electrical, Mechanical

Unit IV

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.

Audit I

MTAD-107 A	Value Education						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

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

Unit II

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 III

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 IV

Character and Competence –Holy books Vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Non violence, 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

Audit II

MTAD-102 A	Constitution of India						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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.

Audit-II

MTAD-104 A	Pedagogy Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

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.

UnitII

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.

UnitIII

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 IV

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.

Audit II

MTAD-106 A	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

Definitions of Eight parts of yog (Ashtanga).

Unit II

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

Unit III

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

Unit IV

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

Audit II

MTAD-108 A	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Sem. Evaluation**	**Mid Sem. Evaluation**	**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 I

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 II

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 III

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

Unit IV

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

MTCE-209 A Dissertation Phase – I

(Credits =10: P= 20)

Teaching Scheme

Lab work: 20 hrs/week for Dissertation Phase- I
Mid Semester Evaluation weightage- 30% and End Semester Evaluation weightage- 70%

Course Outcomes:

At the end of this course, students will be able to

1. Identify structural engineering problems reviewing available literature.
2. Identify appropriate techniques to analyze complex structural systems.
3. Apply engineering and management principles through efficient handling of project

Syllabus Contents:

The dissertation-I will have mid semester presentation and end semester presentation. The mid semester presentation will include identification of problem based on literature review on the topic referring to latest literature available.
End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individual contribution.
Continuous assessment of Dissertation-I and Dissertation-II at mid semester and end semester will be monitored by the departmental committee.

MTCE-202 A Dissertation Phase – II
(Credits =16 : P =32)

Teaching Scheme

Contact Hours: 3hrs/week for Dissertation Phase- II

Course Outcomes:
At the end of this course, students will be able to:

1. Solve complex structural problems by applying appropriate techniques and tools.
2. Exhibit good communication skill to engineering community and society.
3. Demonstrate professional ethics and work culture.

Syllabus Contents:

Dissertation-II will be extension of the work on the topic identified in Dissertation-I
Continuous assessment should be done of the work done adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre-submission seminar at the end of academic term. After the approval the student has to submit the detailed report and external examiner is called for the viva-voce to assess along with guide.

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Guidelines for Dissertation Phase – I and Phase-II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – 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 Civil Engineering, Structural Engineering and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while 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.

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

Phase – 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 Phase-I work.

During phase – 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.

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

Phase – 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 work

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