PC-AI-301A	**SOFTWARE ENGINEERING**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	3	75	25	100	**3 Hour**
Purpose	To learn the architecture and programming of Intel family microprocessors and its interfacing.						
Course Outcomes							
CO 1	Introduction to Software and Requirement Analysis of Software						
CO 2	To implement Software project planning						
CO 3	To learn and analyze Software Design						
CO 4	Testing types and Maintenance of Software						

Unit-I

Introduction: Software Crisis-problem & causes, Software Processes, Development models: Waterfall, Prototype, Evolutionary & Spiral models, Quality Standards like ISO 9001, SEI-CMM.

Requirement Analysis: Structured Analysis, Behavioural & non-behavioural requirements, Software requirement specification: components & characteristics, Function point metric.

Unit-II

Software Project Planning: Cost estimation, static, Single & multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management, project scheduling, personnel planning, team structure, Software configuration management, quality assurance, project monitoring.

Unit-III

Software Design: Fundamentals, problem partitioning & abstraction, design methodology, Function Oriented Design, Cohesion, Coupling & their classification, User Interface Design, Detailed design, Information flow metric, Cyclomatic complexity.

Coding: Style, structured programming, Metrics: LOC, Knot count, live variable, Halstead's measures.

Unit-IV

Testing: Static & dynamic testing, Functional testing: Boundary Value Analysis, Equivalence class testing, Decision table testing, Cause effect graphing; Structural testing: Control-flow & data-flow based testing, loop testing, mutation testing; performance testing; testing strategies: unit & integration testing, System testing, Alpha & Beta testing, debugging.

Maintenance: Types & characteristics of maintenance, Reverse Engineering & Re-engineering.

Text Books:

1. Pressman R. S., "Software Engineering – A Practitioner's Approach", Tata McGraw Hill.
2. Jalote P., "An Integrated approach to Software Engineering", Narosa.

Reference Books:

1. Sommerville, "Software Engineering", Pearson Education.
2. Fairley R., "Software Engineering Concepts", Tata McGraw Hill.
3. James Peter, W Pedrycz, "Software Engineering", John Wiley & Sons.

EEE-309A	**MICROPROCESSOR**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	3	75	25	100	**3 Hour**
Purpose	To learn the architecture and programming of Intel family microprocessors and its interfacing.						
Course Outcomes							
CO 1	To study the Architecture of 8086 microprocessors						
CO 2	To implement the interfacing of memories to 8086 Microprocessor						
CO 3	To learn and analyze the instruction set of 8086 Microprocessor and implementation of assembly language programming of 8086 Microprocessor.						
CO 4	To design and implement the interfacing of interrupts, basic I/O and DMA with 8086 Microprocessor						

Unit I

8086 CPU ARCHITECTURE: 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

Unit-II

Main Memory System Design: Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS/PROMS. Interfacing and refreshing DRAMS.

Unit-III

8086 Instruction Set: Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives. 8086 Programming Techniques: Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions.

Unit-IV

Basic I/O Interface: Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086. ADCs and DACs, - types,operation and interfacing with 8086. Interfacing Keyboards, alphanumeric displays, multiplexed displays, andstepper motor, optical encoder with 8086. Interrupts and DMA: 8086 Interrupt mechanism; interrupt types and interrupt vector table.Applications of interrupts, Intel's 8259. DMA operation. Intel's 8237.

Suggested Books:

1. Barry B. Brey, "The Intel Microprocessor8086/8088, 80186", Pearson Education, Eighth Edition, 2009
2. D.V. Hall, Microprocessors and Interfacing, McGraw Hill 2nd ed.
3. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI,2005
4. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Cengage Learning,
5. Indian Edition, 2008
6. Kip Irvine, "Assembly language for IBM PC", PHI, 2nd Edition, 1993
7. Peter Abel, "Assembly language programming", Pearson Edu,5th Edition,2002
8. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.
9. Walter A Triebel and Avtar Singh; The 8088 and 8086 Microprocessors

EEE-315A	**MICROPROCESSOR LAB**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**1**	**40**	**60**	**100**	**3hrs**
Purpose	Demonstrate knowledge and apply engineering and management principles to manage projects and in multi-disciplinary environment and use research-based knowledge and research methods including design of experiments, analysis and interpretation of data for valid conclusions.						
Course Outcomes (CO)							
CO1	To understand the basic organization of 8086 Microprocessor						
CO2	To implement instruction set of 8086 and assembly directives						
CO3	To learn and analyze the instruction set of 8086 Microprocessor and implementation of assembly language programming of 8086 Microprocessor.						
CO4	Use standard test and measurement equipment to evaluate digital interfaces.						

List of Practical

1. Write the working of 8086 and basic architecture of 8086 along with small introduction.
2. Study the complete instruction set of 8086 and write the instructions with examples.
3. Write the note on assembly directives in 8086 with few examples.
4. Write an ALP for 16 bit arithmetic operations for 8086 (using various addressing modes)
5. Write an ALP of 8086 to take N numbers as input and arrange in ascending and descending order.
6. Write an ALP of 8086 to take N numbers as input and find max and minimum number.
7. Write an ALP of 8086 to take N numbers as input and find average.
8. Program for searching for a number or character in a string for 8086.
9. Program for digital clock design using 8086
10. Interfacing and programming of 8086 and to control stepper motor

PC- AI- 303A	**DESIGN AND ANALYSIS OF ALGORITHMS**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3.0**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data Structures and their analysis.						
CO2	To study the concept of Dynamic Programming and various advanced Data Structures.						
CO3	To introduce various Graph algorithms and concepts of Computational complexities.						
CO4	To study various Flow and Sorting Networks						

Unit-I

Review:-Elementary Data Structures, Algorithms and its complexity(Time and Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation:-Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

Unit-II

Dynamic programming:-Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Advanced data Structures:- Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

Unit-III

Review of graph algorithms:-Traversal Methods(Depth first and Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Computational Complexity:-Basic Concepts, Polynomial Vs Non-Polynomial Complexity, NP- hard and NP-complete classes.

Unit-IV

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, The zero- One principle, Bitonic sorting network, Merging networks

Suggested Books :

- Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
- Das Gupta :Algorithms, TMH.
- Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications
- Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
- R.B.Patel: Expert Data Structures with C, Khanna Publications , Delhi, India, 2nd Edition 2004, ISBN 81-87325-07-0.
- R.B.Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi , India, 2nd Edition 2004,ISBN 87522-03-8.

PC-AI-305A	THEORY OF COMPUTATION						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	3	75	25	100	**3 Hour**
Purpose	To understand the challenges for Theoretical Computer Science and its contribution to other sciences						
Course Outcomes							
CO 1	Students are able to explain and manipulate the different fundamental concepts in automata theory and formal languages.						
CO 2	Simplify automata and context-free grammars; Prove properties of languages, grammars and automata with rigorously formal mathematical methods, minimization.						
CO 3	Differentiate and manipulate formal descriptions of push down automata, its applications and transducer machines.						
CO 4	To understand basic properties of Turing machines and computing with Turing machine, the concepts of tractability and decidability.						

Unit - I

Introduction to Automata: Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata(DFA) and Non-Deterministic Finite Automata(NFA), Finite Automata with Epsilon (€) Transitions.

Regular Expression and Languages: Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws of Regular Expressions, Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

Unit-II

Context free Grammars and Languages: Parse Trees, Context Sensitive Grammar, Context Free Grammar,Regular Grammar, Applications of Context Free Grammars, Ambiguity in Grammars and Languages. Closure Properties of CFL, Chomsky Theorem, Chomsky Hierarchy, Normal forms of context free grammars: Chomsky Normal Form, Greibach Normal Form.

Pumping Lemma: Introduction to Pumping Lemma, pumping lemma for context free languages,Applications of Pumping Lemma, Minimization of Finite Automata, and Recursive Language.

Unit-III

Mealey and Moore Machines: Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing.

Push Down Automata: Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata, Designing of PDA, Applications of PDA.

Unit-IV

Introduction to Turing Machine: The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

Decidability: Post's Correspondence Problem (PCP), Rice's Theorem, Decidability and Undecidability properties,P-NP class and completeness.

Suggested Books:

- J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and
- computation", Pearson Education Asia , 2001.
- K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.
- Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa Publishing house , 2006.

- M.Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning, 1997.
- John.C.martin, "Introduction to the Languages and the Theory of Computation", Third edition, Tata McGrawHill, 2003.

PC-AI-307A	NEURAL NETWORKS AND DEEP LEARNING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To provide knowledge of various artificial neural networks and deep learning algorithms for optimization						
	Course Outcomes						
CO 1	To learn the basics of artificial neural networks concepts, various neural networks architecture						
CO 2	To explore knowledge of special types of Artificial neural networks						
CO 3	To understand the basics of Deep learning and its applications						
CO 4	To imprise about the different deep learning algorithms						

Unit-I

Artificial Neural Networks: Human brain,Model of an artificial neuron, Basic concepts of neural networks, fundamentals of biological neural network and artificial neural network, evolution of neural networks, Characteristics of Neural Networks, learning methods-supervised, unsupervised and reinforcement, taxonomy of neural network architectures, terminologies-weights, bias, threshold, learning rate, applications of Neural Networks.

Unit-II

Supervised and Unsupervised Neural Networks: Hebb network theory and training algorithm, perception networks architecture and training algorithms, Back Propagation networks architecture and Training Algorithms, Associative Memory network architecture and Training Algorithms, Hopfield networks architecture and Training Algorithms, Counter Propagation networks architecture and Training Algorithms, adaptive resonance theory networks architecture and Training Algorithms.

Unit-III

Advanced neural networks: Kohonan self organising feature, maps architecture and training algorithm, learning vector quantization architecture and training algorithm, boltzman machine, cognitron network, neocognitron network, optical neural networks electro-optical multipliers and holographic correlators.

Unit-IV

Deep learning: Machine learning basics, simple machine learning algorithms-linear regression, underfitting and overfitting challenges in machine learning, supervised learning approach for support vector machine, Deep Forward Networks, Convolutional networks, deep recurrent networks, deep boltzmann machine, applications in speech recognition and natural language processing.

Suggested Books:

- Li Min Fu, "Neural Networks in Computer Intelligence", McGraw-Hill, Inc. 2012.
- S N Sivanandam, "Neural Networks using MATLAB 6.0", TMH, 4th. Reprint 2015.
- S N Sivanandam, "Principles of Soft Computing", 2nd. Edition, Wiley, Reprint 2014.
- Freeman J.A. & D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, 2014.
- Deep Learning (Ian J. Goodfellow, Yoshua Bengio and Aaron Courville), MIT Press, 2016.
- Deep Learning with Python: A Hands-On Introduction by Ketkar, Apress

HTM-901A	UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY						
Lecture	**Tutorial**	**Practical**	**Credit**	**MajorTest**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2.0**	**75**	**25**	**100**	**3 Hours**
Purpose	Purpose and motivation for the course, recapitulation from Universal Human Values-I						
Course Outcomes (CO)							
CO 1	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.						
CO 2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.						
CO 3	Strengthening of self-reflection.						
CO 4	Development of commitment and courage to act.						

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? –Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking- disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuringhealth vs dealing with disease.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Suggested Books:

Text Book

- Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J CKumarappa
- Bharat Mein Angreji Raj - PanditSunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad

MC-904A	ENERGY RESOURCES & MANAGEMENT						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**0**	**-**	**100**	**100**	**3**
Purpose	To make the students conversant with the basics concepts and conversion of various form of Energy						
COURSE OUTCOMES							
CO1	An overview about Energy Resources, Conventional and Non-conventional sources						
CO2	Understand the Layout and working of Conventional Power Plants						
CO3	Understand the Layout and working of Non-Conventional Power Plants						
CO4	To understand the Energy Management, Audit and tariffs, Role of Energy in Economic development and Energy Scenario in India						

Unit-I

Introduction: Types of energy, Conversion of various forms of energy, Conventional and Non-conventional sources, Need for Non-Conventional Energy based power generation.

Unit-II

Conventional Energy sources: Types ofConventional Energy sources, Selection of site, working of Thermal, Hydro, Nuclear and Diesel power plants and their schematic diagrams & their comparative advantages/ disadvantages.

Unit-III

Non-Conventional Energy sources: Types ofNon-Conventional Energy sources , Basic principle, site selection of Solar energy power plant, photovoltaic technologies, PV Systems and their components, Wind energy power plant , Bio energy plants ,Geothermal energy plants and Tidal energy plants.

Unit-IV

Energy Management: General Principles of Energy Management, Energy Management Strategy, Modern trends and developments towards Computerizations of Power System.

Energy Audit: Need, Types, Methodology and Approach.

Energy Scenario: Lay out of power system, Role of Energy in Economic development, energy demand, availability and consumption, Indian energy scenario, long term energy scenario, energy sector reforms in India, energy strategy for the future.

References:

1. Energy Studies-Wiley Dream Tech India.
2. Non-conventional energy resources- Shobhnath Singh, Pearson.
3. Electrical Power Systems : Soni, Gupta, Bhatnagar – Dhanpat Rai & Sons
4. NEDCAP: Non Conventional Energy Guide Lines
5. Non conventional energy sources : G.D. Roy
6. Non Conventional energy resources :B H Khan - McGraw Hill
7. Applied Solar Energy : Meinel A B - Addison Wesley Publications
8. Direct Energy ConversionGeorge: Sutton -McGraw

PC-AI 309 LA	NEURAL NETWORK AND DEEP LEARNING LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3hrs**
Purpose	Demonstrate knowledge and apply engineering and management principles to manage projects and in multi-disciplinary environment and use research-based knowledge and research methods including design of experiments, analysis and interpretation of data for valid conclusions.						
Course Outcomes (CO)							
CO1	Apply learning algorithms on perceptron and apply back propagation learning on Neural Network.						
CO2	Apply Feedback NN and plot a Boltzmann machine and associative memory on various applications.						
CO3	Apply different types of auto encoders with dimensionality reduction and regularization.						
CO4	Design Convolutional Neural Network and classification using Convolutiona l Neural Network.						

List of Practicals

1. To write a program to implement Perception.
2. To write a program to implement AND OR gates using Perception.
3. To implement Crab Classification using pattern net Objective.
4. To write a program to implement Wine Classification using Back propagation.
5. Write a MatLab Script containing four functions Addition, Subtraction, Multiply and Divide functions.
6. Write a program to implement classification of linearly separable Data with a perception.
7. To study ImageNet, Google Net, ResNet convolutional Neural Networks.
8. To study Convolutional Neural Network and Recurrent Neural Network.

PC-AI- 302A	BIG DATA ANALYSIS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	This course is widely applicable in software and manufacturing industries to Improve productivity and quality.						
Course Outcomes (CO)							
CO1	Understand big data and big data analytics lifecycle;						
CO2	Introduction to NoSQL and its usage						
CO3	Learn HDFS and MapReduce analytics using Hadoop;						
CO4	Hbase data model and implementations						

Unit I

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

Unit II

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

Unit III

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures
Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of MapReduce job run, classic Mapreduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Unit IV

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Suggested Books:

1. Big Data and Analytics: The key concepts and practical applications of big data analytics Paperback by Jugnesh Kumar (Author), Anubhav Kumar (Author), Rinku Kumar (Author)
2. Big Data and Analytics, 2ed | IM | BS | e Paperback by Subhashini Chellappan Seema Acharya (Author).
3. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization | BS | e Paperback – 1 January 2016 by DT Editorial Services (Author)

PC-AI- 308 LA	BIG DATA ANALYSIS LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To understand and implement advanced Big Data operations in Hadoop architecture.						
Course Outcomes - At the end of this course students will be able to:							
CO1	**Big Data** Analytics and Hadoop Architecture						
CO2	**Understand** Map Reduce Paradigm and develop data applications using variety of systems.						
CO3	**Analyze** and perform different operations on data using Pig Latin scripts.						
CO4	**Illustrate** and apply different operations on relations and databases using hive.						

List of Practicals

1. To Study of Big Data Analytics and Hadoop Architecture.
2. Installation of Single Node Hadoop Cluster on Ubuntu
3. Hadoop Programming: Word Count MapReduce Program Using Eclipse
4. Implementing Matrix Multiplication Using One Map-Reduce Step.
5. Implementing Relational Algorithm on Pig.
6. Implementing database operations on Hive.
7. Implementing Bloom Filter using Map-Reduce
8. Implementing Frequent Item set algorithm using Map-Reduce.
9. Implementing Clustering algorithm using Map-Reduce
10. Implementing Page Rank algorithm using Map-Reduce
11. Mini Project: Few topics for Projects:
    1) Twitter data analysis
    2) Fraud Detection
    3) Text Mining
    4) Equity Analysis etc.

PC-AI- 304A	OPTIMIZATION TECHNIQUES in ML						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	This course is widely applicable in software and manufacturing industries to improve productivity and quality.						
Course Outcomes (CO)							
CO1	To formulate mathematical models of business problems.						
CO2	To learn effective project management and planning of resources.						
CO3	To make optimal utilization of resources.						
CO4	To understand formulation of optimal strategies in a conflict and competitive environment						

Unit 1

Linear Programming :Essentials of Linear Programming Model, Properties of Linear, Programming Model, Formulation of Linear Programming, General Linear Programming Model, Maximization & Minimization Models, Graphical Method for Solving Linear Programming problems, Unbounded LP Problem, Additional Variables Used In Solving LPP, Maximization Case, Minimization Problems, Big M Method, Degeneracy in LP Problems, Unbounded Solutions in LPP, Multiple Solutions in LPP.

Unit II

CPM/PERT:PERT/CPM Network Components, Rules in Constructing a Network, Scheduling of Activities: Earliest Time and Latest Time, Determination of Float and Slack Times, Critical Path method for project management, Project Evaluation Review Technique– PERT, Gantt chart (time chart). Terminology Sequencing: Types of Sequencing Problems, Algorithm for Solving Sequencing Problems, Processing n jobs through 2, 3, m machines. Processing 2 jobs through m machines.

Unit III

Transportation: General Mathematical model of transportation problem, The transportation algorithm, Method of finding initial solution: North west corner method, Least cost method, Vogel's Approximation method, Test for optimality: MODI method.

Unit IV

Variation in transportation problems Game Theory: Terminologies of game theory, Two-person-zero-sum-game, Game with pure strategy, Methods of solving game with mixed strategy, Dominance Property, Graphical method for 2xn and mx2 games. Linear Programming approach for games theory, Inventory Management: Inventory Control Models: Purchase model with instantaneous replenishment with and without shortages, calculate EOQ, classification of inventory like ABC-Always, Better, Control, FSN –Fast, Slow and non-Moving, VED -Vital, Essential, Desirable etc

Suggested Books:

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004
- Brian Fling, "Mobile Design and Development", First Edition , O Reilly Media Inc., 2009
- Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O Reilly, 2009.

PC-AI- 310LA	OPTIMIZATION TECHNIQUE IN ML LAB						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**4**	**2**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To understand and implement advanced Optimization Techniques in Machine Learning						
Course Outcomes - At the end of this course students will be able to:							
CO1	To solve Linear Programming Problems with Linear Programming						
CO2	Understand PERT/CPM/Gantt Chart for a given project						
CO3	Analyze and solve game theory problems using the linear programming approach.						
CO4	Illustrate and apply different operations on inventory items using ABC, FSN, and VED analysis						

LIST OF PRACTICALS:

1. Formulate and solve a linear programming problem for maximizing profit in a manufacturing scenario using the graphical method.
2. Implement the Big M method to solve a linear programming problem involving artificial variables.
3. Illustrate and solve a linear programming problem that demonstrates degeneracy. Provide an example of an unbounded solution in LPP and explain the results.
4. Solve a linear programming problem that has multiple optimal solutions and discuss the implications.
5. Construct a PERT/CPM network for a given project, identify the critical path, and calculate the earliest and latest start and finish times for all activities.
6. Create a Gantt chart for the project mentioned in the previous question and analyze the scheduling of activities.
7. Develop an algorithm to solve a sequencing problem involving processing 'n' jobs through 'm' machines. Implement and test the algorithm.
8. Use the North West Corner method, Least Cost method, and Vogel's Approximation method to find initial solutions for a transportation problem. Compare the results.
9. Implement the MODI method to test the optimality of the solutions obtained from the initial solution methods. Improve the solution if necessary.
10. Solve a transportation problem with supply and demand variations and discuss the impact on the solution.
11. Apply the dominance property to simplify and solve a game theory problem.
12. Calculate the Economic Order Quantity (EOQ) for an inventory management problem with instantaneous replenishment without shortages.
13. Classify a given set of inventory items using ABC, FSN, and VED analysis. Discuss the implications of each classification.

PE-AI-S306A	HUMAN AI INTERACTION						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Objective of this course is to learn the foundations of Human Computer Interaction and be familiar with the design technologies for individuals and persons with disabilities and mobile Human Computer interaction.						
Course Outcomes (CO)							
CO1	To develop the foundations of Human Computer Interaction						
CO2	To learn and apply the design technologies for individuals and persons with disabilities						
CO3	To Understand the structure of models and theories of human computer interaction and vision						
CO4	To Design an interactive web interface on the basis of models studied.						

Unit I

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

Unit II

Interactive Design basics – process – scenarios – navigation – screen design –Iteration and prototyping. HCI in software process – software life cycle –usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Unit III

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Unit IV

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Suggested Books:

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004
- Brian Fling, “Mobile Design and Development”, First Edition , O Reilly Media Inc., 2009
- Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O Reilly, 2009.

PE-CS-S310A	SIMULATION & MODELING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
PO	To introduce the principles and paradigms of Computer Modeling and Simulation for solving a wide variety of problems. And how to use simulator to simulate the live systems.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of System, System Modeling, types of Models, simulation and need of simulation.						
CO 2	To introduce the simulation of continuous and discrete systems with the help of different examples.						
CO 3	To introduce the concept of generation of uniformly and non-uniformly distributed random numbers.						
CO 4	To introduce the concept of simulation of live systems and PERT.						
CO5	To introduce the concept of simulation of inventory control systems and simulation languages.						

Unit-I

Modeling: System Concepts, continuous and discrete systems, system boundaries, system modeling, types of Models, model validation, Principles & Nature of Computer modeling. Simulation: Introduction, Basic nature of simulation, When to simulate, Pros and cons of simulation, concepts of simulation of continuous and discrete system with the help of example.

Unit-II

Continuous System Simulation: Analog vs. digital simulation, continuous simulation vs. numerical integration, simulation of a chemical reactor, simulation of a water reservoir system. Discrete system simulation: Fixed time-step vs. event-to-event model, Monte-Carlo computation vs. stochastic simulation, generation of random numbers, and generation of non- uniformly distributed random numbers.

Unit-III

Simulation of the live systems: Simulation of queuing Systems: basic concepts of queuing theory, simulation of single server, two server and more general queuing system.
Simulation of PERT network: Network model of a project, analysis of an activity network, critical path computation, uncertainties in activity durations, simulation of an activity network.

Unit-IV

Simulation of inventory control systems: Elements of inventory theory, inventory models, generation of Poisson and Erlang variates, simulator for complex inventory systems,
Variance reduction techniques and validation.
Simulation Languages: Continuous and discrete simulation languages, factors in selection of a discrete system simulation languages.

Suggested Books:

1. Gordon G.: Systemsimulation, Prentice-Hall of India Pvt. Ltd. New Delhi 1993
2. NarsinghDeo: SystemSimulation with Digital Computer, PHI New Delhi, 1993
3. Neelankavil Frances: Computer Simulation and Modelling, John Wiley & Sons, NewYork, 1987.
4. Payne, James A.: Introduction to simulation: Programming TechniquesandMethodsof Analysis, McGraw-Hill International Editions, Computer Science services, New York (1998).

PE-AI-S308A	BIOINFORMATICS						
Lecture	**Tutorial**	**Practical**	**Credit**	**MajorTest**	**MinorTest**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To familiarize the students with the concepts of bioinformatics.						
Course Outcomes							
CO 1	Explain concepts of bioinformatics and its significance in biological data analysis.						
CO 2	Apply various bioinformatics tools to manage different type of biological data.						
CO 3	Explain computational method and algorithms for biological data interpretation.						
CO 4	Classify different types of biological databases.						

Unit-I

Introduction to Bioinformatics: Introduction, outline of proteins, primary structure: the 20 amino acids – chemical structure & properties; polypeptide geometry: the folding chain, nomenclature, molecular graphics, Structure evolution and mutation genetic information- the triplet code; DNA structure Synthesis of proteins: cell biology background; transcription; RNA polymerase, introns, exons, splicing translation: ribosomes, strat/stop codons, post-translational processing

Unit-II

Computing evolution: Phylogenetic Analysis Sequence- based taxonomy: overview and assumptions, from Multiple Alignment to phylogeny Neighbor, Joining Maximum Likelyhood Vs. Parsimony, The molecular Clock, Computer Tools for patterns, mapping and phylogenetic analysis, Mathematical tools of proteins and nucleic acids, sequence- Function Relationships Sequence Homology and Conserved Regions , Conserved DNA Sequences.

Unit-III

Bioinformatics tools: Networks- WWW, CERN EMBnet; EMBL Database, SEQNET, GenBank, NLM , etc., Sequence Databases and Sequence Analysis: Genomic , CDNA EMBL database GenBank Protein sequence, Pattern recognition tools Similarity searching, secondary sources, genome databases, Molecular graphics software and other packages, To find sequences based on keywords & phrases, to grab individual sequences or whole groups of Sequences from a database.

Unit IV

Genomics: Introduction , genome scale sequencing , comparative and evolutionary genomics, microarrays, proteomics, pharmacogenomics, Development using computer tools for sequencing projects, PCR and restriction mapping practical and theoretical problems in sequencing. The challenges of whole genome sequencing, web based tools for restriction mapping, new technologies and new bioinformatics tools.

Suggested Books:

- Teresa K. Attwood, David J. Parry-Smith: Introduction to Bioinformatics, 1999, Longman Higher Education.
- S. eddy, a. Krogh, G. Mitchison, Richard Durbin: Biological sequence analysis: probabilistic models of proteins and nucleic acids, 1999, Cambridge University Press.
- Andreas Baxevanis , B.F. Francis Ouellette: Bioinformatics : a practical guide to the analysis of genes and proteins,1998,john Wiley & sons, inc
- James D. Tisdall: Beginning perl for Bioinformatics. 2001. O`reilly & Associates.
- Michael S. Wterman: Mathematical methods for DNA sequences, 1989, CRC Press.

OE-CS- 302A	SOFT SKILLS AND INTERPERSONAL COMMUNICATION						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3Hrs.**
	Course Outcomes (CO)						
CO1	Develop basic understanding of Communication.						
CO2	Understand the process of communication and speaking.						
CO3	Develop the Personality concepts and its implementation.						
CO4	Develop the basic of group Discussion and interview.						

Unit I

Communication: Introduction Verbal, Types of communication, extra personal communication, inter personal communication, intrapersonal communication, mass communication, Creativity in communication, Role of communication, flow of Communications and its need, Speaking Skills, Main features of speaking skills.

Unit II

Barriers in the way of communication, noise, inter personal barriers, intrapersonal barriers, organizational barriers, Extra personal barriers, Basics of communication: importance of communication, process of communication, objectives and characteristics of communication.

Unit III

Personality Development, what is personality? Role of personality, Heredity, Environment, situation, Basics of personality, Soft skills: Need and training. Activity in soft skills, Organizational skill: introduction and its need, basics principles for organization skills.

Unit IV

Group discussion: Group discussion, form of group discussion, strategy for group discussion, discussing problem and solution, Oral presentation, introduction, planning, Occasion, purpose, Modes of delivery, Resume making: Purpose of Resume, Resume design and structure, contents in Resume, types of Resume, job interview, introduction, objective of Interview, types of interview, stages of interview, Face to face interview and campus interview.

Suggested Books:

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication.
2. Personality Development and soft skills by Barun K. Mitra ,Oxford Publication.
3. Communication Skills For Engineers by C. Muralikrishna and Sunita Mishra , Pearson Pub.

OE-AI-304A	DATA MINING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To provide the knowledge of data mining and its techniques.**						
Course Outcomes (CO)							
CO1	To learn data mining concepts in details.						
CO2	Expose the criteria for data generalization.						
CO3	To explore knowledge of mining associations, correlations and classification.						
CO4	To evaluate various types of data mining.						

Unit 1

Need for data mining, data mining as the evolution of Information technology, data mining as a step in the process of knowledge discovery, Transactional database, Major issues in data mining, data preprocessing, data cleaning, data integration, data reduction, data transformation, data warehousing and Online Analytical Processing (OLAP).

Unit II

Data cube technology, multidimensional data mining, multi-dimensional data analysis, Mining Frequent Patterns, Associations and Correlations: Basic concepts and methods, market basket analysis example with rule of support and confidence, frequent item sets, closed item sets, and association rules, frequent itemset mining methods- A priori algorithm.

Unit III

Advanced pattern mining, mining multilevel patterns, multi-dimensional patterns, classification: basic concepts, decision tree induction, naive Bayesian classification methods, rule based classification, cluster analysis: basic concepts and methods, partitioning methods, hierarchical methods, density based methods, grid based methods.

Unit IV

Mining spatial data, mining spatiotemporal data, mining multimedia data, mining text data, mining web data, statistical data mining, data mining applications-data mining for financial data analysis, intrusion detection and prevention, retail and telecommunication industries, science and engineering, privacy, security and social impacts of data mining, data mining trends.

Suggested Books

- J.Han, M.Kamber, Data Mining: Concepts and Techniques, Academic Press, Morgan Kanfman Publishers, 2015.
- Pieter Adrians, DolfZantinge, Data Mining, Addison Wesley 2013.
- C.S.R. Prabhu, Data Ware housing: Concepts, Techniques, Products and Applications, Prentice Hall of India, 2014.
- Berry and Lin off, Mastering Data Mining: The Art and Science of Customer Relationship Management, John Wiley and Sons, 2012.
- Seidman, Data Mining with Microsoft SQL Server, Prentice Hall of India, 2016.

OE-AI-306A	SOFTWARE PROJECT MANAGEMENT						
Lecture	**Tutorial**	**Practical**	**Credit**	**MajorTest**	**MinorTest**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To familiarize the students with the concepts of bioinformatics.						
Course Outcomes							
CO 1	Understand the fundamental principles of Software Project management & will also have a good knowledge of responsibilities of project manager and how to handle these.						
CO 2	Be familiar with the different methods and techniques used for project management.						
CO 3	Will also be able to understand why majority of the software projects fails and how that failure probability can be reduced effectively.						
CO 4	Will be able to do the to do the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.						

Unit I

Project life cycle models-ISO 9001 model-Capability Maturity Model-Project Planning-Project racking-Project closure. Evolution of Software Economics – Software Management Process Framework: Phases, Artifacts, Workflows, Checkpoints – Software Management Disciplines: Planning / Project Organization and Responsibilities / Automation / Project Control– Modern Project Profiles.

Unit II

Problems in Software Estimation – Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – stimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card.

Unit III

Software Quality Factors – Software Quality Components – Software Quality Plan – Software Quality Metrics – Software Quality Costs – Software Quality Assurance Standard – certification – Assessment.

Software Configuration Management – Risk Management: Risk Assessment: Identification / Analysis / Prioritization. Risk Control: Planning / Resolution / Monitoring.

Software Metrics – Classification of Software Metrics: Product Metrics: Size Metrics, Complexity Metrics, Halstead's Product Metrics, Quality Metrics, and Process metrics

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Unit IV

Strategic Assessment–Technical Assessment–Cost Benefit Analysis–Cash Flow Forecasting–Cost Benefit Evaluation Technique–Risk Evaluation–Software Effort Estimation. Emerging Trends: Import of the internet on project Management – people Focused Process Models.

Suggestes Books:

- Software Project Management for AI and ML Projects" Author: Matthew Nelson, Publisher: Apress
- "Project Management for Artificial Intelligence and Machine Learning Projects" Author: John C. Thomson, Publisher: Springer

- "Software Project Management: A Real-World Guide to Success" Author: Joel Henry, Publisher: Addison-Wesley
- "Managing Software Projects with AI and Machine Learning" Author: Bryan Reese, Publisher: Packt Publishing
- "Agile Project Management for Artificial Intelligence" Author: Jeff Cohn, Publisher: Pearson
- Software Engineering: A Practitioner's Approach" (9th Edition) Author: Roger S. Pressman, Publisher: McGraw-Hill Education, ISBN: 978-1260548006

PE-AI-S310A	NATURAL LANGUAGE PROCESSING						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide an understanding of concepts and techniques for Natural Language Processing						
	Course Outcomes						
CO 1	To provide knowledge of Natural Language Processing						
CO 2	To understand the syntactic and statistical parsing used in Natural Language processing						
CO 3	To analyze the concept of discourse and dialogue analysis						
CO 4	To implement various NLP applications						

Unit 1

Introduction to Natural Language Processing (NLP): Definition, History, Applications of NLP, Goals of NLP.
Words and Phonetics: Regular expressions and Automata, Morphology and phonetics fundamentals, morphological diversity of Indian languages, morphology paradigms, finite state machine based morphology, Computational Phonology and Text-to-Speech, Probabilistic Models of Pronunciation and Spelling, N-grams, HMMs and Speech Recognition, Wordnet and linking.

Unit II

Parsing: Part-of Speech Tagging, theories of parsing, syntactic and statistical parsing, parsing algorithms, hybrid of rule based and probabilistic parsing, scope ambiguity and attachment ambiguity resolution, Tree banks.

Unit III

Discourse and dialogue: discourse and dialogue analysis, anaphora resolution, named entity resolution, event anaphora, Information extraction and retrieval.

Unit IV

Applications: sentiment analysis, text entailment, machine translation, automated speech recognition systems, question-answering based systems, shallow parsers.

References:-

1. Jurafsky, D. & J. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing Computational Linguistics, and Speech Recognition" Prentice Hall, 2000.

2. Grosz, B.J., Sparck Jones, K. & Webber, B.L. (eds) "Readings in natural language processing", Los Altos, CA. Morgan Kaufmann, 1986.

3. Allen, J., "Natural Language Understanding", Redwood City, CA: 1994. Benjamin/ Cummings.

4. Bharti, Akshar,Chaitanya Vineet, Sangal Rajeev, "Natural Language Processing", Prentice Hall

PE-AI-S312A	COMPUTER VISION TECHNIQUES						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	100	3 Hrs.
Purpose	To provide an understanding of concepts and techniques for computer vision						
	Course Outcomes						
CO 1	To develop the foundation of image formation, measurement, and analysis						
CO 2	To developed the practical skills necessary to build computer vision applications						
CO 3	The geometric relationships between 2D images and the 3D world.						
CO 4	To have gained exposure to object and scene recognition and categorization from images						

Unit 1

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.

Unit II

Edge detection, Edge detection performance, Hough transform, corner detection, Segmentation, Morphological filtering, Fourier transform.

Unit III

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre-processing.

Unit IV

Pattern Analysis; Clustering: K-Means, K-Medoids, Mixture of Gaussians.
Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised.
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

Suggested Books:

- Richard Szeliski, “Computer Vision: Algorithms and Applications”
- Goodfellow, Bengio, and Courville, “Deep Learning”
- Fisher et al., “Dictionary of Computer Vision and Image Processing”

PE-AI-S314 A	COMPUTER ARCHITECTURE						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Student will be able to understand the basic concepts of computer architecture and organization, and understand the key skills of constructing cost-effective computer systems.						
Course Outcomes (CO)							
CO1	Be familiar with the internal organization and operations of a computer.						
CO2	Be familiar with the design trade-offs in designing and constructing a computer processor.						
CO3	Be aware with the CPU design including the RISC/CISC architectures.						
CO4	Be acquainted with the basic knowledge of I/O devices and Select the appropriate interfacing standards for I/O devices.						

Unit I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, Von Neumann Architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Unit II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control s

organization, Control Memory, address sequencing, Micro program Example, micro instruction format, Horizontal Vs Vertical micro-programming, design of control Unit, microprogram sequencer, Hardwired v/s Micro-programmed Control Unit.

Unit III

Central Processing Unit: General register organization, stack organization, instruction formats (Zero, One, Two and Three Address Instruction), addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Flynn's taxonomy, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

Unit IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor , CPU-IOP communication, Serial communication.

Suggested Books:

- William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
- Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
- John P. Hayes, "Computer Architecture and Organization," 3/e, TMH, 1998.

- David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, Third Edition, Elsevier, 2005.
- V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson Education, 2004.
- Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.