

Department of Computer Science and Engineering

Curriculum Structure & Syllabus of 1st to 4th Semester of M.Tech under Autonomy Batch to be effective from 2016-2017

M.Tech. Computer Science & Engineering
Semester - 1

Sr. No:	Paper Code	Paper Name	Class Hours			Credit
Sr. No:	Paper Code	Theory	L	T	P	Cr. Pt.
1	PGCSE101	Advanced Engineering Mathematics [Compusory]	3	1	0	4
2	PGCSE102	Advanced Operating System [Compulsory]	4	0	0	4
3	PGCSE103	Advanced Computer Architecture [Compulsory]	4	0	0	4
4	PGCSE104	Advanced Algorithms [Compulsory]	4	0	0	4
5	PGCSE105	Elective - I A) Artificial Neural Networks B) Agent Based Intelligent Systems C) Advanced Soft Computing D) Object Oriented Information System Design E) Software Engineering & CASE tools F) Computer Graphics & Multimedia	4	0	0	4
		Total	19	1	0	20
		Practical				
6	PGCSE191	Operating System Laboratory [Compulsory]	0	0	3	2
7	PGCSE192	A) Advanced Programming Lab	0	0	3	2
		Total	0	0	6	4
		Seminar				
8	PGCSE193	Seminar – Based on literature survey	0	2	0	1
		Total	19	3	6	25

Semester - 2

Sr. No:	Paper Code	Paper Name	Class Hours			Credit
		Theory	L	T	P	
1	PGCSE201	Advanced DBMS [Compulsory]	4	0	0	4
2	PGCSE202	Advanced Computer Network & Security [Compulsory]	4	0	0	4
3	PGCSE203	Theory of Computation [Compulsory]	4	0	0	4

4	PGCSE204	Elective - I I A) Cluster, Grid and Cloud Computing B) Mobile Computing C) Advanced Web Technology D) Soft Computing E) Cryptography & Computer Security	4	0	0	4
---	----------	---	---	---	---	---

5	PGCSE205	Elective - III A) Image Processing B) Pattern Recognition C) Real-time Embedded Systems & Programming D) Complex Systems E) Distributed System Principle	4	0	0	4
		Total	20	0	0	20
		Practical				
6	PGCSE291	Part-I – Computer Networking & DBMS Laboratory [Compulsory]	0	0	3	2
		Total	0	0	3	2
		Seminar & Viva				
7	PGCSE292	Seminar – Term paper leading to project.	0	2	0	1
8						
		Total	20	2	6	23

Semester - 3

Sr. No:	Paper Code	Paper Name	Class Hours			Credit
		Theory	L	T	P	
1	PGCSE301 Management	A: Project Management & Entrepreneurship B: Teaching & Research Methodologies	4	0	0	4
2	PGCSE302	Elective - IV A) Human Computer Interaction B) Bioinformatics C) Data Mining & Data Ware Housing D) Compiler Construction E) VLSI Design	4	0	0	4
		Total	8	0	0	8
		Project				
3	PGCSE393	Project – Part 1 (Dissertation I + Defence of Project - I)	0	0	18	4+8=12
		Total	8	0	18	20

Semester - 4

Sr. No :	Paper Code	Paper Name	Class Hours			Credit
		Project	L	T	P	

1	PGCSE491	Project – Part 11 (Dissertation II + Defence of Project - II)	0	0	24	6+18=24
2	PGCSE481	Comprehensive Viva Voce				4
Total			0	0	24	28

Total credits = 96

PGCSE101: Advanced Engineering Mathematics

Compulsory]:

Course Outcomes:

CO1 To define stochastic process-based problems

CO2 To interpret the working of various optimization techniques and its applications

CO3 To explore knowledge of Finite and Infinite Fourier Transforms and applications

CO4 To extend the problems of probability and able to solve them

Module I

Numerical Analysis:

Introduction to Interpolation formulae: Stirling, Bessel's, Spline. **Solutions of system of linear and non-linear simultaneous equations:** SOR algorithm, Newton's method, (8 L)

Module II

Stochastic process:

Probability: review, random variables, random processes, Random walk, brownian motion, markov process, queues: (M/M/1) : (• /FIFO), (M/M/1) : (N/FIFO). (8 L)

Module III

Advanced linear algebra:

Vector spaces, linear transformations, eigenvalues, Eigenvectors, some applications of eigenvalue problems, symmetric, skew-symmetric And orthogonal matrices, similarity of matrices, basis of Eigen vectors, diagonalisation. (8L)

Module IV

Advanced Graph Theory:

Connectivity, Matching, Hamiltonian Cycles, Coloring Problems, Algorithms for searching an element in a data structure (DFS, BFS). (8 L)

Optional:

Module V

A: Complex Variables: Review of Complex variables, Conformal mapping and transformations, Functions of complex variables, Integration with respect to complex argument, Residues and basic theorems and applications of residues. (8L) **Module - V**

B: Combinatorics: Basic Combinatorial Numbers, Generating Functions and Recurrence Relations, InclusionExclusion Principles (8L)

Module V

C: Optimization Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimization, Elements of calculus of variation, Constrained Optimization, Lagrange multipliers, Gradient method, Dynamic programming. (8L)

Module – V

D: Fourier series and Transform: Revision of Fourier series, integrals and transforms and their properties. The 2dimensional fourier transform, convolution theorem, Parseval's formula, discrete fourier transform, fast fourier transform (8L) **Module V**

E: Z-transforms: sequence, representation of sequence, basic operations on Sequences, z-transforms, properties of ztransforms, change on scale, shifting Property, inverse z-transform, solution of difference equations, region of Convergence, bilinear (s to z) transform (8L)

Module V

F: Walsh function and hadamard transform: generating walsh functions of Order n, characteristics and applications of walsh function, hadamard Matrix, properties, fast hadamard transform, applications(4L) **Wavelet transform:** fundamentals, the fourier transform and the short term Fourier transform, resolution problems, multi-

resolution analysis, the Continuous wavelet transform, the discrete wavelet transform(4L)

References books:

1. Sen, M. K. and Malik, D. F.-Fundamental of Abstract Algebra, Mc. Graw Hill
2. Khanna, V. K. and Ghamdri, S. K.- Course of Abstract Algebra, Vikash Pub.
3. Halmos, T. R.-Naïve Set Theory, Van Nostrand
4. Scarborough, J. B.-Numerical Mathematical Analysis, Oxford University Press
5. Cone, S. D.-Elementary Numerical Analysis, Mc. Graw Hill.
6. Mukhopadhyay ,P.-Mathematical Statistics ,New Central Book Agency
7. Kapoor, V. K and Gupta, S.C.-Fundamental of Mathematical Statistics, Sultan Chand and Sons.
8. Uspensky, J. V.-Introduction to Mathematical Probability, Tata Mc. Graw Hill
9. Dreyfus, S. E.-The Art and Theory of Dynamic Programming –Theory and Applications, Academic Press.
10. Rao, S. S.-Optimisation Theory and Application, Wiley Eastern Ltd., New Delhi
11. Somasundaram, Discrete Mathematical structures, PHI
12. Kolman, Busby & Ross, Discrete Mathematical structures 5th ed, PHI
13. V. Krishnamurthy, Combinatorics, Theory and Applications, East-West Press, 1985.
14. N. Alon and J. Spenser, Probabilistic Methods, John Wiley and Sons, 2nd edition, 2000.
15. R. Diestel, Graph Theory, Springer-Verlag, 2nd edition, 2000.
16. I. N. Herstein, "Topics in Algebra", Vani Educational Books, India 1986
17. Kryszig, 'advanced engineering mathematics'
18. Numerical Methods for Engineers & Scientists by Joe D. Hoffman

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE101.1	3	3	3	3	2	2	1	3	2	3	3	3	2	1	2
PGCSE101.2	3	2	3	2	2	1	2	2	1	2	2	3	2	2	3
PGCSE101.3	2	2	2	2	2	1	2	3	2	2	1	3	2	3	-
PGCSE101.4	3	2	3	2	3	3	2	2	-	3	2	2	3	-	1
PGCSE101.5	2	3	1	3	1	2	3	3	3	-	1	3	2	2	2

PGCSE102: Advanced Operating System [Compulsory]

Course Outcomes:

CO1 To define how computing resources such as CPU, memory and I/O are managed by the operating system

CO2 To correlate kernel and user mode in an operating system

CO3 To adapt different CPU scheduling problem to achieve specific scheduling criteria

CO4 To determine the knowledge of process management, synchronization, deadlock to solve basic problems

CO5 To validate and test appropriate design choices when solving real-world problems

Module – I

Operating System Introduction, Structures - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating-System services, System Calls, Virtual Machines, System Design and Implementation. [~4L]

Process and CPU Scheduling - Process concepts and scheduling, Operation on processes, Cooperating Processes, Threads, and Interposes Communication Scheduling Criteria, Scheduling Algorithm, Multiple -Processor Scheduling, Real-Time Scheduling. [~5L] **Module – 2**

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation,

Paging, Segmentation, Segmentation with Paging, Demand Paging, Performance of Demanding Paging, Page Replacement, Page Replacement Algorithm, Allocation of Frames, Thrashing. [~6L]

File System Interface and Implementation -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management, Directory Management, Directory Implementation, Efficiency and Performance. [~6L] **Module 3**

Deadlocks - System Model, Dead locks Characterization, Methods for Handling Dead locks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock. [~4L]

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors. [~5L]

Module 4

Operating System Security Issues- Introduction to the topic of Security in Operating Systems, Principles of Information Security, Access Control Fundamentals, Generalized Security Architectures. [~5L]

Module 5

Introduction to Distributed systems: Goals of distributed system, hardware and software Concepts, design issues. [~2L]

Elementary introduction to the terminologies within Modern Oss: Parallel, Distributed, Embedded & Real Time, Mobile, Cloud and Other Operating System Models. [~3L]

Reference Books

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Distributed Operating System - Andrew. S. Tanenbaum, PHI
3. Operating System a Design Approach-Crowley, TMH.
4. Operating Systems – Internals and Design Principles Stallings, Fifth Edition–2005, Pearson Education/PHI
5. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI
6. Operating Systems, Dhamdhare, TMH
7. Tanenbaum, Modern Operating Systems, 2nd ed.
8. Silberschatz & Galvin, Operating System Concepts, 6th ed.
9. Saltzer & Kaashoek, Principles of Computer System Design, 2009
10. Coulouris et al., Distributed Systems: Concepts and Design, 3rd ed., - Lynch,
11. Distributed Algorithms, - Lynch et al., Atomic Transactions,
12. Casevant & Singhal, Readings in Distributed Computing Systems,
13. Ananda & Srinivasan, Distributed Computing Systems: Concepts and Structures Mullender, Distributed Systems
14. Filman & Friedman, Coordinated Computing: Tools and Techniques for Distributed Software, - Andrews, Concurrent Programming: Principles and Practice.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE102.1	3	3	3	3	2	2	1	3	2	3	3	3	2	1	2
PGCSE102.2	3	2	3	2	2	1	2	2	1	2	2	3	2	2	3
PGCSE102.3	2	2	2	2	2	1	2	3	2	2	1	3	2	3	-
PGCSE102.4	3	2	3	2	3	3	2	2	-	3	2	2	3	-	1
PGCSE102.5	2	3	1	3	1	2	3	3	3	-	1	3	2	2	2

PGCSE103: Advanced Computer Architecture [Compulsory]

Course Outcomes:

CO1 To bookmark the knowledge of parallelism and pipelining

CO2 To integrate knowledge of parallel processing

CO3 To examine the concept and design techniques of interconnection network

CO4 To assess the knowledge of shared memory architecture

CO5 To review the fundamentals of embedded system architecture

Module – 1: The evolution of modern Computer systems – from DEC PDP-11, IBM 360/370 family, CDC Cyber 6600, Intel X86 architecture, Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc. (4L)

Introduction to high performance Computing – Overview, Flynn’s classifications – SISD, SIMD, MISD, MIMD, Examples from Vector & Array Processors, Performance comparison of algorithms for Scalar, Vector and Array Processors, Fundamentals of UMA, NUMA, NORMA architectures, Performance measurement for parallel architectures – Flynn,s measure, Feng,s measure, Handler’s measure, Amadahl’s law of limitation for parallel processing, Gustafson’s law. (8L)

Module – 2: Pipelined processor design, Pipeline performance measurement parameters – speedup factor, efficiency, throughput of a linear pipeline, comparing performance of a N stage pipeline with a N processor architecture, Pipeline design principles – Uniform subcomputations, Identical computations, Independent computations, Examples from design of Arithmetic pipelines – Floating point Adders, Multipliers, Dividers etc.,Classifications of Unifunction, Multifunction & Dynamic pipelines, Scheduling in a pipelines with feedback , Pipeline hazards and their solutions(12L)

Module –3: RISC architecture, characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC, necessity of using optimizing compilers with RISC architecture, Examples from POWER PC and SPARC architectures , Superpipelining (MIPS architecture), Superscalar architecture , Diversified pipelines and out of order execution, VLIW architecture, Hardware multithreading (Coarse grained, fine grained & simultaneous multithreading. (12L)

Module – 4: Memory hierarchy – Techniques for improving Cache memory performance parameters,(reduce cache miss rate, reduce hit time, reduce miss penalty), Main memory performance enhancement – interleaved memory, improvement of memory bandwidth, use of TLB for performance enhancement. (6L)

References:

1. Computer Organization & Design – Patterson & Hennessy (Morgan Kaufmann)
2. Computer Architecture: A Quantitative Approach – Patterson & Hennessy (Elsevier)
3. Computer Architecture & Parallel Processing – Hwang & Briggs(TMh)
4. Computer organization and architecture, designing for performance – Stallings (PHI)
5. Modern Processor Design – Shen & Lipasti (TMH)
6. Advanced Computer Architecture – Hwang (TMH)
7. An Introduction to Intel family of Microprocessors – Antonakos (Pearson)
8. Computer Architecture – Flynn (Narosa)
9. Structured Computer Organization – Tanenbaum (PHI)
10. Computer Architecture & Organization – J P Hayes (McGraw Hill)
11. Computer Organization – Hamacher, Vranesic, Zaky(McGraw Hill)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE103.1	2	3	3	2	2	2	1	3	2	3	3	3	2	1	2
PGCSE103.2	3	2	3	2	2	1	2	2	1	2	2	3	2	2	3
PGCSE103.3	2	2	2	2	2	1	2	3	2	2	1	3	2	-	-
PGCSE103.4	3	1	3	2	3	3	2	2	-	3	2	2	3	-	1
PGCSE103.5	2	3	1	3	1	2	3	3	3	-	1	3	2	2	2

PGCSE104: Advanced Algorithms [Compulsory]

Course Outcomes:

CO1 To paraphrase the different problems in various classes according to their complexity

CO2 To implement an insight of recent activities in the field of the advanced data structure

CO3 To distinguish the complexity/performance of different algorithms

CO4 To measure the appropriate data structure for solving a particular set of problems

CO5 To blog and build solutions for a real world problem by applying relevant distributions

MODULE 1: [8L]

TIME AND SPACE COMPLEXITY. ASYMPTOTIC NOTATIONS. RECURRENCE FOR DIVIDE AND CONQUER AND ITS SOLUTION, THE SUBSTITUTION METHOD AND RECURSION-TREE METHOD FOR SOLVING RECURRENCES. THE MASTER METHOD: PROOF AND SOLVING RECURRENCE PROBLEMS, MERGE SORT, HEAP SORT, QUICK SORT AND THEIR COMPLEXITY ANALYSIS.

MODULE 2: [8L]

ADVANCED DATA STRUCTURE: ADT AND DATA STRUCTURE, LINEAR VS NON-LINEAR DATA

STRUCTURE. TREE: TREE AS AN ADT, DEFINITION AND TERMINOLOGIES, THREADED BINARY TREE, BST. AVL TREE, BALANCE MULTI WAY SEARCH TREE: 2-3 TREE, RED- BLACK TREE, B TREE, B+ TREE, TRIES, SPATIAL DATA REPRESENTATION USING K-D TREE, QUAD TREE

MODULE 3 [12L]

GRAPH: DEFINITION, COMPUTER REPRESENTATION OF GRAPHS, GRAPH TRAVERSALS: BFS & DFS, SPANNING TREE. GRAPH COLOURING-CHROMATIC NUMBER, ALGORITHM FOR TRANSITIVE CLOSURE, TOPOLOGICAL SORT, AND CRITICAL PATHS

DYNAMIC PROGRAMMING : MATRIX-CHAIN MULTIPLICATION, ALL PAIR SHORTEST PATHS, SINGLE SOURCE SHORTEST PATH, TRAVELLING SALESMAN PROBLEM, 0-1 KNAPSACK PROBLEM, LCS PROBLEM.

GREEDY METHOD : KNAPSACK PROBLEM, JOB SEQUENCING WITH DEADLINES, ACTIVITY – SELECTION, HUFFMAN CODES, MINIMUM SPANNING TREE BY PRIM'S AND KRUSKAL'S ALGORITHMS.

DISJOINT SET MANIPULATION : SET MANIPULATION ALGORITHM LIKE UNION-FIND, UNION BY RANK,

PATH COMPRESSION. TOPOLOGICAL SORTING

BACKTRACKING: USE IN SOLVING PROBLEM, 4 QUEEN AND 8-QUEEN PROBLEM, SUBSET SUM PROBLEM

BRANCH AND BOUND: BASIC METHOD, APPLICATIONS: THE 15-PUZZLE PROBLEM,

MODULE 4 [4L]

COMPUTATIONAL GEOMETRY: ROBUST GEOMETRIC PRIMITIVES, CONVEX HULL, TRIANGULATION, VORONOI DIAGRAMS, NEAREST NEIGHBOR SEARCH, RANGE SEARCH, POINT LOCATION, INTERSECTION DETECTION, BIN PACKING, MEDIAL-AXIS TRANSFORM, POLYGON partitioning, simplifying polygons, shape similarity, motion planning, maintaining line arrangements, minkowski sum.

MODULE 5 [8L]

SET AND STRING PROBLEMS: SET COVER, SET PACKING, STRING MATCHING, APPROXIMATE STRING MATCHING, TEXT COMPRESSION, CRYPTOGRAPHY, FINITE STATE MACHINE MINIMIZATION, LONGEST

COMMON SUBSTRING/SUBSEQUENCE, SHORTEST COMMON SUPERSTRING.

ADVANCED AREAS: NOTION OF NP-COMPLETENESS: P CLASS, NP-HARD CLASS, NP-COMPLETE CLASS,

CIRCUIT SATISFIABILITY PROBLEM. approximation algorithms, randomized algorithms, multithreaded ALGORITHMS, PARALLEL ALGORITHMS. AMORTIZED ANALYSIS AND ITS APPLICATIONS,

REFERENCE BOOKS:

1. A.AHO, J.HOPCROFT AND J.ULLMAN “THE DESIGN AND ANALYSIS OF ALGORITHMS”, PE.
2. T CORMEN, C LEISERSON AND R RIVEST “INTRODUCTION TO ALGORITHMS”, PHI.
3. FUNDAMENTALS OF ALGORITHMS- G.BRASSARD,P.BRATLAY, PHI.
4. HOROWITZ ELLIS, SAHANI SARTAZ, R. SANGUTHEVAR " FUNDAMENTALS OF COMPUTER ALGORITHMS".

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE104.1	3	3	2	3	2	1	1	1	1	1	1	1	3	1	1
PGCSE104.2	-	3	3	3	-	1	-	-	-	-	-	-	-	-	1
PGCSE104.3	2	-	-	3	-	-	-	-	-	-	-	-	-	-	1
PGCSE104.4	2	3	3	3	2	-	1	-	1	-	-	-	-	-	1
PGCSE104.5	2	2	3	3	2	1	1	1	1	1	1	1	3	1	1

Elective - I

PAPER NAME: ARTIFICIAL NEURAL NETWORK

PAPER CODE: PGCSE105A

Credit: 4,

Total Lectures:43

Course Outcomes:

CO1 To define the basic concepts in Neural Networks and Deep Learning and applications

CO2 To gather the concept of Shallow& Deep Neural Networks

CO3 To link the Convolutional Neural Network models to Image datasets

CO4 To examine the Recurrent Neural Network models for Sequence data

Introduction to artificial neural networks [5L]

Biological neural networks, Pattern analysis tasks: Classification, Regression, Clustering, Computational models of neurons, Structures of neural networks, Learning principles

Linear models for regression and classification [8L]

Polynomial curve fitting, Bayesian curve fitting, Linear basis function models, Bias-variance decomposition, Bayesian linear regression, Least squares for classification, Logistic regression for classification, Bayesian logistic regression for classification

Feedforward neural networks [8L]

Pattern classification using perceptron, Multilayer feedforward neural networks (MLFFNNs), Pattern classification and regression using MLFFNNs, Error backpropagation learning, Fast learning methods: Conjugate gradient method, Autoassociative neural networks, Bayesian neural networks.

Radial basis function networks [5L]

Regularization theory, RBF networks for function approximation, RBF networks for pattern classification,

Kernel methods for pattern analysis [8L]

Statistical learning theory, Support vector machines for pattern classification, Support vector regression for function approximation, Relevance vector machines for classification and regression,

Self-organizing maps [4L]

Pattern clustering, Topological mapping, Kohonen's self-organizing map

Feedback neural networks [5L]

Pattern storage and retrieval, Hopfield model, Boltzmann machine, Recurrent neural networks.

Text Books:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2003
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998
4. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE105A.1	3	1	3	3	2	2	1	3	2	3	3	3	2	1	2
PGCSE105A.2	3	2	3	2	1	1	2	2	1	2	2	2	2	2	3
PGCSE105A.3	-	2	2	2	2	1	-	3	2	2	1	3	1	3	-
PGCSE105A.4	2	2	3	2	3	3	2	2	-	3	2	2	3	-	1
PGCSE105A.5	2	3	1	3	1	2	3	3	3	-	1	3	2	2	2

PGCSE105E : Software Engg & Case Tools:

Course Outcomes:

CO1 To relate the basic concept of Software Engineering and mathematical knowledge in designing solution to engineering problem

CO2 To categorize, correlate and link software requirements through a productive working relationship with various stakeholders of the project

CO3 To determine applicable solutions in application domains using software engineering approaches

CO4: To build the code from the design and perform testing, quality management, and practice team work.

MODULE – 1: PRINCIPLES AND MOTIVATIONS: [8L]

DEFINITIONS AND NEED FOR ENGINEERED APPROACH TO SOFTWARE DEVELOPMENT; SOFTWARE DEVELOPMENT PROCESS MODELS FROM THE POINTS OF VIEW OF TECHNICAL DEVELOPMENT AND PROJECT MANAGEMENT: WATERFALL, RAPID PROTOTYPING, INCREMENTAL DEVELOPMENT, SPIRAL **MODULE – 2: MODELS, AND EMPHASIS ON COMPUTER-ASSISTED ENVIRONMENTS. [8L]**

INTRODUCTION TO MODELING TOOLS BASICS OF OBJECT-ORIENTED APPROACH, OBJECT-ORIENTED PROGRAMMING AND LANGUAGES, OMT, VISUAL MODELING, UML, RATIONAL ROSE TOOL.

MODULE – 3: SOFTWARE DEVELOPMENT METHODS [8L]

FORMAL, SEMI-FORMAL AND INFORMAL METHODS; REQUIREMENTS ELICITATION, REQUIREMENTS SPECIFICATION; DATA, FUNCTION, AND EVENT-BASED MODELING; SOME OF THE POPULAR METHODOLOGIES SUCH AS YOURDON'S SAD, SSADM ETC; CASE TOOLS-CLASSIFICATION, FEATURES, STRENGTHS AND WEAKNESSES; ICASE; CASE STANDARDS.

MODULE – 4: SOFTWARE PROJECT MANAGEMENT [8L]

PRINCIPLES OF SOFTWARE PROJECTS MANAGEMENT; ORGANIZATIONAL AND TEAM STRUCTURE; PROJECT PLANNING; PROJECT INITIATION AND PROJECT TERMINATION; TECHNICAL, QUALITY, AND MANAGEMENT PLANS; PROJECT CONTROL; COST ESTIMATION METHODS - FUNCTION POINTS AND COCOMO.

MODULE – 5: OBJECT MODELING AND DESIGN [8L]

CLASSES, OBJECTS, RELATIONSHIPS, KEY ABSTRACTIONS, COMMON MECHANISMS, DIAGRAMS, CLASS DIAGRAMS, ADVANCED CLASSES, ADVANCED RELATIONSHIPS, INTERFACES, TYPES, ROLES, PACKAGES, INSTANCES, OBJECT DIAGRAMS, INTERACTIONS, USE CASES, USE CASE DIAGRAMS, INTERACTION DIAGRAMS, ACTIVITY DIAGRAMS, EVENTS AND SIGNALS, STATE MACHINES, PROCESSES, THREADS, STATE CHART DIAGRAMS, COMPONENTS, DEPLOYMENT, COLLABORATIONS, PATTERNS AND FRAMEWORKS, COMPONENT DIAGRAMS, SYSTEMS AND MODELS, CODE GENERATION AND REVERSE ENGINEERING.

REFERENCES:

1. ROGER PRESSMAN; SOFTWARE ENGINEERING - A PRACTITIONER'S APPROACH, MCGRAW HILL, NEW YORK.
2. IAN SOMMERVILLE; SOFTWARE ENGINEERING, ADDISON-WESLEY PUBLISHING COMPANY, ENGLAND
3. PANKAJ JALOTE; AN INTEGRATED APPROACH TO SOFTWARE ENGINEERING, NAROSA PUBLISHING HOUSE, NEW DELHI.
4. GRADY BOOCH, JAMES RUMBAUGH, IVAR JACOBSON, THE UNIFIED MODELING LANGUAGE USER GUIDE, PEARSON EDUCATION, NEW YORK.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE105A.1	2	1	3	3	2	2	1	3	2	3	3	3	2	1	2
PGCSE105A.2	3	2	3	2	1	1	2	2	1	2	2	2	2	2	3
PGCSE105A.3	-	2	-	2	2	1	-	3	2	2	1	3	1	3	-
PGCSE105A.4	2	2	3	2	3	-	2	2	-	3	2	2	3	-	1
PGCSE105A.5	2	3	1	3	1	2	3	3	3	-	1	3	2	2	2

PGCSE105F:**Computer Graphics & Multimedia****Allotted Hrs:4**

Course Outcomes:

CO1 To gather the fundamental concept of Computer graphics and mathematical knowledge

CO2 To Experimenting different scan conversion, drawing, polygon filling, curves and surface drawing, clipping, surface removal algorithms using graphics tools

CO3: To exemplify the basic concept of graphics programming and implement clipping with the comprehension of windows

CO4: To organize and compare different algorithms, polygon filling algorithms, curves and surface drawing algorithms hidden surface illumination methods

CO5: Solving the problem of geometric models, mathematical and algorithmic approach necessary for programming computer graphics leading to lifelong learning

Module I

Introduction to computer graphics & graphics systems [6L]

Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion: [6L]

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II

2D transformation & viewing [8L]

Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear;

Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

3D transformation & viewing [7L]

3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Module III

Curves [3L]

Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces [3L]

Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color & shading models [2L]

Light & color model; interpolative shading model; Texture;

Module IV**Multimedia [10L]**

Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia; Image, video and audio standards. Audio: digital audio, MIDI, processing sound, sampling, compression. Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression. Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

Text Books:

1. Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education
2. Z. Xiang, R. Plastock – “Schaum's outlines Computer Graphics (2nd Ed.)” – TMH
3. D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH
4. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI
5. Sanhker, Multimedia –A Practical Approach, Jaico
6. Buford J. K. – “Multimedia Systems” – Pearson Education
7. Andleigh & Thakrar, Multimedia, PHI
8. Mukherjee Arup, Introduction to Computer Graphics, Vikas
9. Hill, Computer Graphics using open GL, Pearson Education

Reference Books:

- Foley, Vandam, Feiner, Hughes – “Computer Graphics principles (2nd Ed.) – Pearson Education.
- W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – TMH.
- Elsom Cook – “Principles of Interactive Multimedia” – McGraw Hill

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE105F.1	3	2	3	3	2	2	1	3	2	3	3	3	2	1	2
PGCSE105F.2	3	2	3	2	1	1	2	2	1	2	2	2	2	2	3
PGCSE105F.3	-	2	2	2	2	1	-	3	2	2	1	3	1	3	-
PGCSE105F.4	2	2	3	2	3	3	2	2	-	3	2	2	3	-	1
PGCSE105F.5	2	3	1	3	1	2	-	2	3	-	1	3	2	2	2

Practical**Advanced Operating System Lab****Code: PGCSE191****Contact: 3P****Credits: 2**

- 1. Preliminaries of Operating System [6P]:** managing users, managing systems, file managements, useful commands.
- 2. Shell scripting [9P]:** shell syntax, executing shell scripts.
- 3. Process [15P]:** creating new process, counting maximum number of processes a system can handle at a time, handling system calls; inter process communication through pipes and message passing, zombie process, orphan process.
- 4. Process Synchronization [6P]:** handling threads and semaphores to achieve synchronization among processes using POSIX standard functions.
- 5. Signal [6P]:** study of some POSIX signals (SIGINT, SIGILL, SIGFPE, SIGKILL, SIGHUP, SIGALRM, SIGABRT).

Semester – 2.**PGCSE201: Advanced DBMS [Compulsory]****Course Outcomes:**

- CO1** To summarize the basic concepts and utility of Database management system
CO2 To book mark an Entity Relationship (E-R) Diagram and relational model for an application.
CO3 To structure and illustrate the relational database based on normalization
CO4 To experiment whether the transaction satisfies the ACID properties.
CO5 To podcast and maintain the database of an organization

Module 1 [8L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Lossless Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF

Module 2 [5L]

Transaction processing, Concurrency control and Recovery Management, conflict and view serializability, lock base protocols, two phase locking. **Module 3 [9L]**

Distributed DBMS features and needs. Reference architecture. Levels of distribution transparency, replication.

Distributed database design - fragmentation, allocation criteria. Distributed deadlocks. Time based and quorum based protocols. Comparison. Reliability- non-blocking commitment protocols.

Module 4 [6L]

Partitioned networks. Checkpoints and cold starts. Management of distributed transactions- 2 phase unit protocols. Architectural aspects. Node and link failure recoveries. Distributed data dictionary management. Distributed database

administration. Heterogeneous databases-federated database, reference architecture, loosely and tightly coupled.

Module 5 [2L]

Introduction to Oracle RDBMS

Books:

1. *Leon & Leon, Essentials Of Dbms, Mc.Graw Hill*
2. *Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.*
3. [Saeed K. Rahimi, Frank S. Haug Distributed Database Management Systems: A Practical Approach, Willey](#)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE201.1	3	3	2	3	2	1	1	1	1	1	1	1	3	1	1
PGCSE201.2	3	3	3	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE201.3	2	3	2	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE201.4	2	3	3	3	2	1	1	1	1	1	1	1	3	1	1
PGCSE201.5	2	2	3	3	3	1	1	1	1	1	1	1	3	1	1

PGCSE202:Advanced Computer Network & Security [Compulsory]

Total Lecture Hours: 44

Course Outcomes:

CO1: Tagging the basic concepts in cryptography.

CO2: Articulate the determining of different encryption techniques to secure messages in transit across data networks.

CO3: Assessing various techniques used to assure Integrity and Authentication.

CO4: Breaking down diverse security measures and issues in practice.

1. INTRODUCTION TO INTERNETWORKING: HOW NETWORKS DIFFER, HOW NETWORKS CAN BE CONNECTED, CONNECTIONLESS INTERNETWORKING, TUNNELING, FRAGMENTATION, OVERVIEW OF UNDERLYING TECHNOLOGIES (ETHERNET, TOKEN RING, TOKEN BUS, FDDI, PPP).
[6 Lectures]
2. NETWORK LAYER PROTOCOLS: IPV4, IPV6, NAT, ARP, RARP, DHCP, ICMP, OSPF, BGP, IGMP, CIDR.
[4 Lectures]
3. TRANSPORT LAYER PROTOCOLS: UDP, REMOTE PROCEDURE CALL, RTP, TCP, TCP TAHOE, TCP RENO, TCP NEW RENO, TCP SACK.
[4 Lectures]
4. MOBILE TELEPHONE SYSTEMS: INTRODUCTION TO WIRELESS NETWORKS AND CELLULAR TECHNOLOGY, AMPS, D-AMPS, GSM, GPRS, CDMA, BLUETOOTH.
[4 Lectures]
5. WIRELESS NETWORKS: WLAN: INTRODUCTION, PROBLEMS AND SOLUTIONS, PROTOCOL STACK, ACCESS METHODS, SERVICES, WIMAX, WIFI, ZIGBEE.
[4 Lectures]
6. AD-HOC NETWORKS: INTRODUCTION, ROUTING CHALLENGES FOR AD-HOC NETWORKS, ROUTING PROTOCOLS (AODV, DSDV, DSR,), TRANSPORT PROTOCOLS (ATCP, TCP-F, TCP BUS).
[4 Lectures]
7. WIRELESS INTERNET: MIPV4, MIPV6, TCP PERFORMANCE, I-TCP, TCP SNOOP, FREEZE TCP, WWP, TCP REAL.
[4 Lectures]
8. CONGESTION CONTROL: GENERAL PRINCIPLES, CONGESTION PREVENTION POLICIES, CHOKE PACKET, RED, ECN, ELN, ELN-ACK.
[4 Lectures]
9. QOS PROVISIONING: DELAY GUARANTEES, NETWORK DELAY, DELAY JITTER, PLAY OUT DELAY,

ADMISSION CONTROL, QOS OBJECTIVES, THE RSVP APPROACH.

[4 Lectures]

10. SECURITY: INTRODUCTION TO CRYPTOGRAPHY, SYMMETRIC KEY AND PUBLIC KEY ALGORITHMS,

DIFFIE HELLMAN KEY EXCHANGE ALGORITHM, DIGITAL SIGNATURES, IPSEC, FIREWALL, VPN, VLAN, WIRELESS SECURITY, AUTHENTICATION PROTOCOLS.

[6 Lectures]

BOOKS

1. INTERNETWORKING WITH TCP/IP: PRINCIPLES, PROTOCOLS, AND ARCHITECTURE - DOUGLAS COMER.
2. COMPUTER NETWORKS –A.S.TANNENBAUM.
3. DATA AND COMPUTER COMMUNICATIONS – WILLIAM STALLINGS
4. WIMAX SECURITY & QOS-AN END-TO-END PERSPECTIVE: ISBN: 978-0-470-72197-1, WILEY PUBLICATION.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE202.1	3	3	2	3	2	1	1	1	1	1	1	1	3	1	1
PGCSE202.2	3	3	3	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE202.3	2	3	2	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE202.4	2	3	3	3	2	1	1	1	1	1	1	1	3	1	1
PGCSE202.5	2	2	3	3	3	1	1	1	1	1	1	1	3	1	1

PGCSE203: Theory of Computation [Compulsory]

Course Outcomes:

CO1: To tabulate the knowledge of the basics of state machines with or without output and its different classifications

CO2: To define synchronous sequential circuits as the foundation of digital system.

CO3: To articulate techniques of designing grammars and recognizers for several programming languages.

CO4: To illustrate Turing's Hypothesis as a foreword to algorithms.

CO5: To hypothesize the power and limitation of a computer.

Mathematical preliminaries.

Models of Computation

: Models of computation - classification, properties and equivalences.

Finite Automata

: Formal definition of a Finite Automata (FA) -Examples of FA, Designing FA, DFA and NFA, regular operations.

Equivalence of NFAs and DFAs. FA with Epsilon-Transitions, Epsilon-Closures, Eliminating epsilon -Transitions.

Applications of FAs. Mealy and Moore machine, Dead state, Minimization of FA, Incompletely specified machine. FA on infinite inputs.

Regular expression and Languages

: Definition of a Regular Expressions (RE), The Operators of RE – Building RE, Conversions DFA's to RE.

Equivalence of

RE and NFA with Epsilon-moves, - Application of REs. Equivalence of regular grammar and FA.; Properties of Regular

Languages (RL), Proving Languages not to be Regular, Pumping Lemma for RLs. Applications of the Pumping Lemma.

Closure Properties of RLs, Decision Properties of RLs

Context Free Languages

: Context free languages, Derivation and languages, Relationship between derivation and derivation trees, Leftmost and

Rightmost Derivations. Simplification of context free grammars – Normal forms for context free grammars, CNF, and GNF.

Applications of Context-Free Grammars. Non determinism vs. ambiguity in CFLs. Closure properties of CFLs. Algorithmic

properties about CFLs. Pumping Lemma for CFL.

Push Down Automata

: Definition, Acceptance by a Push Down Automata (PDA), DPDA & NPDA, example, Equivalence of PDA's and CFG's

(conversion : PDA's to CFG's and reverse). Multi stack PDA. Non-determinism adds power to PDAs.

Turing Machine

: Unsolvability Problems. Definition, notation and Example of Turing Machine (TM). Programming techniques Computable

languages and functions, Church Turing hypothesis, Universal TM, Random Access TM. Multitape TM, Equivalence of

One-Tape and Multitape TM's, Nondeterministic TMs. Conversion of RE to TM. Multi-stack PDA & TM.

Computability and Decidability: Church-Turing Thesis, Decision Problems, Decidability and undecidability, unsolvable problems; Halting Problem of

Turing Machines; Problem reduction (Turing and mapping reduction), Intractability (Hierarchy Theorems). Mapping reductions. More undecidable languages. Rice theorem. Reductions using controlled executions. RE Completeness.

Reductions using computation histories. Linear Bounded Automata. Unrestricted grammars.

Computational Complexity:

Resource-constrained computation. Time Complexity- notion of complexity classes, classes P NP, NP-complete, Boolean satisfiability, NP-Completeness of CSAT and 3SAT, NP-Hard, Cook • Levin Theorem. The concept of reduction, coNP, polynomial Hierarchy. Some natural NP-complete problems. Space Complexity-Savich's Theorem. The class PSPACE. Optimization, search, and decision problems. Approximate solutions to optimization problems.

Logic: Propositional and First-order logic and their applications to theorem proving and logic programming.

Advanced/Emerging areas: Elementary introductions to DNA Computing, Quantum Computing, Cellular Automata, Circuit complexity, Structural Complexity, Parallel Complexity, Algorithmic Information.

Course Guidelines: Large majority of the lectures would focus only on the core areas, with only elementary introduction to other remaining advanced areas.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE203.1	3	3	2	2	1	-	1	1	2	2	-	3	2	2	3
PGCSE203.2	2	3	2	3	2	-	3	2	-	1	1	2	2	3	2
PGCSE203.3	3	2	2	2	3	1	1	2	1	2	2	2	2	2	2
PGCSE203.4	2	2	3	2	3	2	2	-	3	1	1	2	3	3	2
PGCSE203.5	2	2	3	2	2	-	2	3	3	2	2	3	2	2	3

Elective – II

Cluster, Grid and Cloud Computing

Code: PGCSE204A

Contact: 4L

Credit: 4

Allotted Hrs: 44

Course Outcomes:

CO1: To articulate the business model concepts, architecture and infrastructure of cloud computing.

CO2: To choose and determine suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.

CO3: To correlate some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon

Web Services and other businesses cloud applications.

CO4: Searching the basic knowledge of Grid Computing and apply it in solving Complex Engineering Problem.

CO5: Inferring the limitation of cluster Computing and apply the knowledge to create and select appropriate techniques to solve complex engineering problem.

Cluster Computing [12L]

A general introduction to the concept of cluster based distributed computing.

Hardware technologies for cluster computing, including a survey of the possible node hardware and high-speed networking hardware and software.

Software and software architectures for cluster computing, including both shared memory (OpenMP) and message passing (MPI/PVM) models

MPI-2 extension, dynamic process creation, one-sided communication, parallel I/O.

Variants based on new low level protocols (MVAPICH), evaluation and tuning of system and software performance

Performance evaluation tools, HINT, netperf, netpipe, tcp, Iperf.

Grid Computing [16L]

The Grid - Past, Present, Future, A New Infrastructure for 21st Century Science

- The Evolution of the Grid - Grids and Grid Technologies, Programming models -

A Look at a Grid Enabled Server and Parallelization Techniques – Grid applications

The concept of virtual organizations – Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids

Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling, Setting up Grid, deployment of Grid software and tools, and application execution

Cloud Computing [16L]

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS

Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo.

Issues in cloud computing, Implementing real time application over cloud platform

Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.

Text Book:

- 1. Cluster Computing by Rajkumar Buyya, Clemens Szyperski
- 2. High Performance Cluster Computing: Architectures and systems by Rajkumar Buyya
- 3. Grid and Cluster Computing by C.S.R Prabhu
- 4. Fran Berman, Geoffrey Fox, Anthony Hey J.G., “Grid Computing: Making the Global Infrastructure a Reality”, Wiley, USA, 2003
- 5. Joshy Joseph, Craig Fallenstein, “Grid Computing”, Pearson Education, New Delhi, 2004,
- 6. Ian Foster, Carl Kesselman, “The Grid2: Blueprint for a New Computing Infrastructure”. Morgan Kaufman, New Delhi, 2004
- 7. Ahmar Abbas, “Grid Computing: Practical Guide to Technology and Applications”, Delmar Thomson Learning, USA, 2004,

- 8. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
- 9. Enterprise Cloud Computing by Gautam Shroff, Cambridge
- 10. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE204A.1	3	3	2	1	1	-	1	1	2	2	-	3	2	2	3
PGCSE204A.2	3	3	2	3	2	-	3	2	-	1	1	2	2	3	2
PGCSE204A.3	3	2	2	1	3	1	1	2	1	2	2	2	2	2	2
PGCSE204A.4	2	2	3	2	3	2	2	-	3	1	1	2	3	3	2
PGCSE204A.5	3	2	3	2	2	-	2	3	3	2	2	3	2	2	3

PGCSE 204(B): Mobile Computing
 (42 LECTURES)
Course Outcomes:

CO1: Deconstruct the concepts and working of modern communication technologies.

CO2: Measure the various routing algorithms for both infrastructure based and ad hoc networks.

CO3: Building mobility and bandwidth management in cellular network

CO4: Detect and devise an energy efficient and secure mobile computing environment using heterogeneous wireless technologies

CO5: Experimenting the technical issues related to recent mobile computing environment.

Fundamentals of Cellular Communications [8L]

Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Teletraffic Engineering, Radio Propagation and Propagation Path-Loss Models, Cellular Geometry, Interference in Cellular Systems, Frequency Management and Channel Assignment Issues, Multiple Access Techniques, GSM Logical Channels and Frame Structure, Privacy and Security in GSM, Mobility Management in Cellular Networks.

Wireless Transmission Fundamentals [8L]

Spread Spectrum (SS) and CDMA Systems, Wireless Medium Access Control, IEEE 802.11 Architecture and Protocols, Issues in Ad

Hoc Wireless Networks (Medium Access Scheme), Routing, Multicasting, Transport Layer Protocols, QoS Provisioning, Energy Management and Energy Consumption Models, Traffic Integration in Personal, Local, and Geographical Wireless Networks, Bluetooth, Technologies for High-Speed WLANs, Third-Generation Cellular Systems: UMTS.

Mobile Adhoc Networks [8L]

Introductory Concepts. Different models of operation, Various applications of MANET, Destination-Sequenced Distance Vector protocol - overview, Route Advertisement, Extending Base Station Coverage, Properties of DSDV protocol, Dynamic Source Routing protocol - overview and properties, DSR Route Discovery, Route Maintenance, Support for Heterogeneous Networks and Mobile IP, Multicast routing with DSR, Ad Hoc On-Demand Distance-Vector protocol - properties, Unicast Route Establishment, Multicast Route Establishment, Broadcast Optimizations and Enhancements, Link Reversal Routing - Gafni-Bertsekas Algorithm, lightweight mobile routing algorithm, Temporally Ordered Routing Algorithm, Preserving battery life of mobile nodes - Associativity Based Routing, Effects of beaconing on battery life.

Wireless Sensor Networks [8L]

Sensor networks overview: introduction, applications, design issues, requirements, Sensor node architecture, Network architecture: optimization goals, evaluation metrics, network design principles, Sensor network operating systems and brief introduction to sensor network Programming, Network protocols: MAC protocols and energy efficiency, Routing protocols: data centric, hierarchical, location-based, energy efficient routing etc, Sensor deployment, scheduling and

coverage issues, Self Configuration and Topology Control, Querying, data collection and processing, collaborative information processing and group connectivity, Target tracking, localization and identity management, Power management, Security and privacy.

Topology Control and Clustering in Adhoc Networks [5L]

Algorithms for Graphs Modeling Wireless Ad Hoc Networks, Clustering and Network Backbone, Dominating-Set-Based Routing in Ad Hoc Wireless Networks, Formation of a Connected Dominating Set, Backbone-Formation Heuristics.

Mobile, Distributed and Pervasive Computing [5L]

Pervasive Computing Applications, Architecture of Pervasive Computing Software, Indoor Wireless Environments, Challenges for the Future: Nomadic Computing.

Text Books:

- Sivaram Murthy, Manoj, "Adhoc Wireless and Sensor Networks: Architecture and Protocols", Pearson.
- Vijay Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers
- Gast, "802.11 Wireless Networks", Oreilly-SPD
- Theodore Rappaport, "Wireless Communications: Principles and Practice" TMH.
- J. Schiller, Pearson Education, "Mobile Communications", TMH.
- William C.Y Lee Cellular Mobile Telecommunications, TMH
- Garg and Wilkes, Principles and Applications of GSM, Pearson.

Reference Books

- Gabrilovska, Prasad, "Adhoc Networking Towards Seamless Communication", Springer.
- Azzedine Boukerche, "Handbook of Algorithms for Wireless Networking and Mobile Computing", Chapman and Hall/CRC, New York.
- Wagner, Wattenhofer (Eds.), "Algorithms for Adhoc and Sensor Networks: Advanced Lectures", Springer Lecture Notes in Computer Science.
- Mukherjee, Bandopadhyay, Saha, "Location Management and Routing in Mobile Wireless Networks", Artech House, London.
- Redl, S.M., Weber, M.K., Oliphant, M.W.: An Introduction to GSM. Artech House, London.
- Mehrotra, A.: GSM System Engineering. Artech House, London.
- Ivan Stojmenovic, "Handbook of Wireless Networking and Mobile Computing", Wiley Inc, New York.
- XiangYang Li, "Wireless Adhoc and Sensor Networks", Cambridge University Press.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE204B.1	3	3	2	2	1	-	1	1	2	2	-	3	2	2	3
PGCSE204B.2	2	3	2	3	2	-	3	2	-	1	1	2	2	3	2
PGCSE204B.3	3	2	2	2	3	1	1	2	1	2	2	2	2	2	2
PGCSE204B.4	2	2	3	2	3	2	2	-	3	1	1	2	3	3	2
PGCSE204B.5	2	2	3	2	2	-	2	3	3	2	2	3	2	2	3

ADVANCED WEB TECHNOLOGY

PGCSE204C

Contracts: 4L

Credits- 4

Total 40 lectures

Course Outcomes:

CO1: To highlight interactive web pages using HTML, DHTML, CSS and image map.

CO2: To moderate the knowledge of information interchange formats like XML, MySQL.

CO3: To reflect fields of web pages using scripting languages like Flash, Action Script.

CO4: To identify the server-side programming concepts using PHP.

Module I-6L (Internet & WWW)**Introduction (2L):**

Overview, Computer Network, Intranet, Extranet and Internet. Types of Networks (LAN, MAN, WAN), Network Topologies. Definition of Internet, Internet organization. Growth of Internet, Internet Application.

Review of TCP/IP (2L):

OSI Reference model, TCP/IP Model, IP addressing, Classful and Classless Addressing, Subnetting, Features and services of TCP/IP, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram. Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail-POP3, SMTP.

World Wide Web (2L):

Evolution of distributed computing. Core distributed computing technologies – Client/Server Architecture & its Characteristics, JAVA RMI.

Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services. Web Server Concept and Architecture. Definition of DNS (Domain Name System). Domain and Sub domain, Address Resolution, FTP & its usage, Telnet Concepts, Remote Logging, HTTP & HTTPs.

Module II-12L (Client Side Application Development)**HTML & CSS (3L):**

Introduction, Editors, Elements, Tags, Attributes, Heading, Paragraph. Formatting, Link, Image, Table, List, Block, Form, Frame Layout, DHTML, Basic Web Page Development, CSS- Create Class Styles, Create ID Styles, Span, Colors. HTML5 in brief.

Extensible Markup Language (XML) (3L):

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation, Tree, Syntax, Elements, Attributes, Validation, and Viewing. XHTML in brief.

JavaScript (6L):

Introduction, JavaScript in Web Pages, The Advantages of JavaScript Writing JavaScript into HTML; Building Up JavaScript Syntax; Basic Programming Techniques ; Operators and Expressions in JavaScript; JavaScript Programming Constructs; Conditional Checking Functions in JavaScript, Dialog Boxes, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Function, Errors, Validation. The JavaScript Document Object Model-Introduction (Instance, Hierarchy); The JavaScript Assisted Style Sheets DOM; Understanding Objects in HTML (Properties of HTML objects, Methods of HTML objects); Browser Objects, Handling Events Using JavaScript

Module III-16L (Server Side Programming with PHP & MySQL)**Installing and Configuring (2L) :**

Current and Future Versions of MySQL and PHP, How to Get MySQL, Installing MySQL on Windows, Trouble Shooting your Installation, Basic Security Guidelines, Building PHP on Windows with Apache, Windows, php.ini. Basics, The Basics of PHP scripts.

The Building blocks of PHP (3L):

Variables, Data Types, Operators and Expressions, Constants. Flow Control Functions in PHP: Switching Flow, Loops, Code Blocks and Browser

Output.

Functions (3L):

What is function? Calling functions, Defining Functions. Variable Scope, more about arguments. Working with Arrays and Some Array-Related Functions.

Working with Objects (2L):

Creating Objects, Object Instance Working with Strings, Dates and Time: Formatting strings with PHP, Investigating Strings with PHP, Manipulating Strings with PHP, Using Date and Time Functions in PHP.

Working with Forms (2L):

Creating Forms, Accessing Form Input with User defined Arrays, Combining HTML and PHP code on a single Page, Using Hidden Fields to save state, Redirecting the user, Sending Mail on Form Submission, and Working with File Uploads.

Learning basic SQL Commands (2L):

Learning the MySQL Data types, Learning the Table Creation Syntax, Using Insert Command, Using SELECT Command, Using WHERE in your Queries, Selecting from Multiple Tables, Using the UPDATE command to modify records, Using the DELETE Command, Frequently used string functions in MySQL, Using Date and Time Functions in MySQL.

Interacting with MySQL using PHP (2L):

MySQL Versus MySQLi Functions, Connecting to MySQL with PHP, Working with MySQL Data.

Module IV-6L(Multimedia for WEB)**Multimedia Application Development (4L):**

Pixel, Image Resolution, Image Editing using Photoshop, 2D & 3D Animation, Logo Design, Banner. Animated Component Preparation using Flash & Action script.

Multimedia Web Applications (2L):

Multimedia over IP: RTP, RTCP. Streaming media, Codec and Plugins, VoIP, Text and Voice Chat.

Books:

1. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.
2. Web Technology & Design, C.Xavier, New Age International Publication, Delhi
3. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
4. Sams Teach Yourself PHP in 24 Hours, Third Edition
5. Wrox, Beginning PHP, Apache, MySQL Web Development
6. Wrox, Beginning PHP
7. ULLMAN, LARRY, 'PHP AND MYSQL FOR DYNAMIC WEB SITES'
8. ULLMAN, LARRY, 'PHP ADVANCED FOR THE WORLD WIDE WEB'

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE204C.1	3	1	3	3	2	2	1	3	2	3	3	3	2	1	2
PGCSE204C.2	3	2	3	2	2	1	2	2	1	2	2	3	2	2	3
PGCSE204C.3	2	3	2	2	2	1	-	3	2	2	1	3	2	3	-
PGCSE204C.4	2	2	3	2	3	3	2	2	-	3	2	2	3	-	1
PGCSE204C.5	2	3	1	3	1	2	3	3	3	-	1	3	2	2	2

Soft Computing: PGCSE 204(D)

[40 LECTURES]**Course Outcomes:**

CO1: Contrast and express the basic concept of soft computing and apply them in designing solution to engineering problem.

CO2: Identify appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.

CO3: Examine fuzzy logic and reasoning to handle uncertainty and managing interdisciplinary engineering problems

CO4: Articulate genetic algorithms to combinatorial optimization problems and recognize the feasibility of applying a soft computing methodology for a particular problem.

CO5: To exemplify the concept and techniques of designing and implementing of soft computing methods in real world problem.

Introduction to Soft Computing [8L]

Evolution of Computing - Soft Computing Constituents – From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics.

Fuzzy Logic [8L]

Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets,

Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.

Artificial Neural Networks [8L]

Artificial Neural Network: Introduction, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

Genetic Algorithms [8L]

Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of Genetic Algorithm, Analysis of selection operations, Hypothesis of building blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.

Hybrid Systems [8L]

Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Books/References:

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.
3. S. Haykin, "Neural Networks", Pearson Education, 2ed, 2001.
4. S. Rajasekaran & G. A. V. Pai, Neural Networks, Fuzzy logic, and Genetic Algorithms, PHI.
5. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997
6. Rough Sets, Z. Pawlak, Kluwer Academic Publisher, 1991.
7. Neural Networks, Fuzzy logic, and Genetic Algorithms, S. Rajasekaran and G. A. V. Pai, PHI.
8. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE 204(D).1	3	2	2	2	2	1	1	1	1	1	1	1	3	1	1
PGCSE 204(D).2	3	3	3	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE 204(D).3	3	3	2	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE 204(D).4	2	3	3	3	2	3	1	1	1	1	1	3	3	1	1

PGCSE 204(D).5	2	2	3	3	3	3	1	1	1	1	1	3	3	1	1
----------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

PGCSE204E**Cryptography and Computer Security****Total Lectures: 34****Course Outcomes:****CO1:** Associate the basic concepts in cryptography.**CO2:** Examining the deployment of different encryption techniques to secure messages in transit across data networks.**CO3:** Grading various techniques used to assure Integrity and Authentication.**CO4:** Breaking down diverse security measures and issues in practice.**Introduction (4L)**

Linear algebra: non linearity, echelon form of matrix, Galois Field, vector space, Modular arithmetic

Coding Theory [4L]

- Elementary Concepts of Coding Theory;
- Applications of Algebraic Coding Theory to Cryptography
- Huffman coding
- Hamming coding

Primality Testing [3L]

- Primality Testing
- Fermat Primality Test
- AKS PRIMALITY TEST

Factorization [5L]

- Large prime variant
- Dixon's factorization method
- Quadratic-Sieve Factoring
- Pollard-Rho Method

Elliptic curves Cryptography [3L]

- Elliptic Curves
- Elliptic Curves(contd.) and Finite Fields
- Elliptic Curve Cryptography
- ECDLP
- Zero Knowledge Proof

Bilinear Pairings (3L)

- Basic concept
- Identity based encryption
- Analogous of pairing based cryptosystems

Communication Security (4L)

- Secret Sharing Schemes
- A Tutorial on Network Protocols, Kerberos
- IPsec: AH and ESP
- IPsec: IKE
- SSL/TLS
- Intruders and Viruses
- Firewalls

Electronic Mail Security (4L)

- Distribution lists
- Establishing keys

- Privacy, source authentication, message integrity, nonrepudiation, proof of submission, proof of delivery, message flow confidentiality, anonymity • Pretty Good Privacy (PGP)
- S/MIME

Secure Electronic Transaction [4L]

- SET
- Millicent protocol
- Micropayment system
- Smart-card authentication

Text Books:

1. Public-key Cryptography: Theory and Practice by Abhijit Das and C E Veni Madhavan, First Edition, Publisher (Pearson Education)
2. Cryptography and Network security: Principles and Practice by W. Stallings, Pearson Education
3. Cryptography & Network Security, by B. A. Forouzan and D. Mukhopadhyay, Tata Mc Graw Hill
4. Cryptography Theory and Practice, by Douglas Stinson, 2nd Edition, Chapman & Hall/CRC
5. A Course in Number Theory and Cryptography by Neal Koblitz, Springer-Verlag, New York Inc
6. Information theory, coding and cryptography by Ranjan Bose; TMH.
7. Information and Coding by N Abramson; McGraw Hill.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE204E.1	2	2	2	2	2	1	1	1	1	1	1	1	3	1	1
PGCSE204E.2	3	3	3	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE204E.3	3	3	2	3	3	1	1	1	1	1	1	1	3	1	1
PGCSE204E.4	3	3	3	3	2	3	1	1	1	1	1	3	3	1	1
PGCSE204E.5	2	2	3	3	3	3	1	1	1	1	1	3	3	1	1

Elective - III

Image Processing

Code: PGCSE205A

Contact: 4L

Credit: 4

Allotted Hrs: 40

Course Outcomes:

CO1: To search the knowledge of basic preprocessing techniques in monochrome and color images.

CO2: To retrieve skill in concepts of image enhancement like linear and non linear spatial filters using MATLAB.

CO3: To annotate the concept and techniques of simple image processing projects using different methods of restoration.

CO4: To bookmark the knowledge of the various segmentation algorithms for practical applications.

CO5: To deduce the performance of Lossless and Lossy compression techniques in images

Introduction [5L]

Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation [6L]

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries [7L]

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

Image Enhancement [8L]

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Image Restoration [7L]

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation – Spatial Transformation, Gray Level Interpolation.

Image Segmentation [7L]

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Books:

1. Digital Image Processing, Gonzalves, Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis, Chanda & Majumder, PHI
4. Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE205A.1	3	3	2	1	1	-	1	1	2	2	-	3	2	2	3
PGCSE205A.2	3	3	2	3	2	-	3	2	-	1	1	2	2	3	2
PGCSE205A.3	3	2	2	1	3	1	1	2	1	2	2	2	2	2	2
PGCSE205A.4	2	2	3	2	3	2	2	-	3	1	1	2	3	3	2
PGCSE205A.5	3	2	3	2	2	-	2	3	3	2	2	3	2	2	3

Elective - III

Paper Name: Pattern Recognition

Paper Code: PGCSE205B

Contact: 4L

Credit: 4

Allotted Hrs: 38

Course Outcomes:

CO1: Illustrate and compare a variety of pattern classification methods.

CO2: Break down different clustering and classification problem and solve using different pattern recognition technique.

CO3: Acting out performance evaluation methods for pattern recognition, and can do comparisons of techniques

CO4: Choosing pattern recognition techniques to real-world problems such as document analysis and recognition.

CO5: Composing simple pattern classifiers, classifier combinations, and structural pattern recognizers.

INTRODUCTION TO PATTERN RECOGNITION

6

Basic concepts- Definitions, data sets for Pattern Recognition, Structure of a typical pattern recognition system. Different Paradigms of Pattern Recognition. Representations of Patterns and Classes. Metric and non-metric proximity measures

FEATURES SELECTION

5

Feature vectors - Feature spaces - Different approaches to Feature Selection-Branch and Bound Schemes. Sequential Feature Selection.

FEATURES EXTRACTION

4

Principal Component Analysis (PCA), Kernel PCA

PATTERN CLASSIFICATION**12**

Pattern classification using Statistical classifiers - Bayes' classifier - Classification performance measures – Risk and error probabilities. Linear Discriminant Function, Mahalanobis Distance, K-NN Classifier, Fisher's LDA, Single Layer Perceptron, Multi-layer Perceptron, Training set, test set; standardization and normalization

CLUSTERING**8**

Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Different distance functions and similarity measures. K-means algorithm, K-medoids, DBSCAN

RECENT ADVANCES IN PATTERN RECOGNITION**3**

Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real life examples.

BOOKS:

1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
3. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
4. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE205B.1	3	3	2	2	1	-	1	1	2	2	-	3	2	2	3
PGCSE205B.2	2	3	2	3	2	-	3	2	-	1	1	2	2	3	2
PGCSE205B.3	3	2	2	2	3	1	1	2	1	2	2	2	2	2	2
PGCSE205B.4	2	2	3	2	3	2	2	-	3	1	1	2	3	3	2
PGCSE205B.5	2	2	3	2	2	-	2	3	3	2	2	3	2	2	3

PGCSE205E:**Distributed System Principle**

Allotted Hrs: 36

Contact: 4L

Credit: 4

Course Outcomes:

CO1 Sketching and experimenting design issues of distributed system's principle.

CO2 Structure the design aspects and issues of distributed operating systems.

CO3 Estimating of different architectures used in Distributed System.

CO4 Illustrating of different architectures used in Multiprocessor Operating System.

Distributed**Systems****[9L]**

Computer architecture : CICS, RISC, Multi-core Computer networking : ISO/OSI Model Evolution of operating systems Introduction to distributed computing systems. DCS design goals, Transparencies, Fundamental issues

Distributed**Coordination****[7L]**

Temporal ordering of events, Lamport's logical clocks, Vector clocks; Ordering of messages, Physical clocks, Global state detection

Process synchronization [6L]

Distributed mutual exclusion algorithms, Performance matrix

Inter-process communication [6L]

Message passing communication, Remote procedure call, Transaction communication, Group communication; Broadcast atomic protocols

Distributed**file****systems****[6L]**

Deadlocks in distributed systems and Load scheduling and balancing techniques**Books:**

1. Distributed Systems Concepts and Design, G. Coulouris, J. Dollimore, Addison Wesley
2. Advanced Operating Systems, M. Singhal, N.G. Shivarathri, McGraw Hill
3. Distributed Operating Systems and Algorithms, Randy Chow, T. Johnson, Addison Wesley
4. Distributed Operating Systems, A.S. Tanenbaum, Prentice Hall
5. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez, Prentice Hall International
6. Tanenbaum, A. S. Distributed Operating Systems, (ISBN 0-131-439-340), Prentice Hall 1995.
7. Tanenbaum, A. S. Modern Operating Systems, 2nd Edition (ISBN 0-13-031358-0), Prentice Hall 2001.
8. Bacon, J., Concurrent Systems, 2nd Edition, (ISBN 0-201-177-676), Addison Wesley 1998.
9. Silberschatz, A., Galvin, P. and Gagne, G., Applied Operating Systems Concepts, 1st Edition, (ISBN 0-471-36508-4), Wiley 2000.
10. Coulouris, G. et al, Distributed Systems: Concepts and Design, 3rd Edition, (ISBN 0-201-61918-0), Addison Wesley 2001.
11. Galli, D.L., Distributed Operating Systems: Concepts and Practice (ISBN 0-13-079843-6), Prentice-Hall 2000.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE205E.1	3	2	2	2	1	-	1	1	2	2	-	3	2	2	3
PGCSE205E.2	2	3	2	3	2	-	3	2	-	1	1	2	2	3	2
PGCSE205E.3	3	2	2	2	3	1	1	2	1	2	2	2	2	2	2
PGCSE205E.4	2	2	3	2	3	2	2	-	3	1	1	2	3	3	2
PGCSE205E.5	2	3	3	2	2	-	2	3	3	2	2	3	2	2	3

Semester 3**PGCSE301A: PROJECT MANAGEMENT & ENTREPRENEURSHIP****Course Outcomes:**

CO1: Prepare theories, models and concepts within project organization and the implementation of projects.

CO2: Build, plan and implement projects.

CO3: Structuring the conditions for entrepreneurship and how a business plan is drawn up.

CO4: Post on the importance of cooperation and leadership within a project group.

CO5: Building account for scientific literature within the fields of project management, strategy, entrepreneurship and organizational theory.

COURSE DESCRIPTION

THIS COURSE IS INTENDED TO BE AN INTRODUCTION TO THE FIELD OF PROJECT MANAGEMENT. THE PRIMARY OBJECTIVE OF THIS COURSE IS TO ACQUAINT STUDENTS WITH A BROAD BASIC OVERVIEW OF PROJECT MANAGEMENT, AND THE ROLE OF A PROJECT MANAGER THROUGHOUT THE FIVE PRIMARY PROCESSES OF MANAGING PROJECTS. THE OTHER THREE REQUIRED CORE COURSES WILL PROVIDE A MORE COMPREHENSIVE COVERAGE. THIS IS A 15-HOUR COURSE.

SYLLABUS:

Module – 1: WHAT “PROJECT MANAGEMENT” MEANS. ABOUT THE CONTEXT OF MODERN PROJECT MANAGEMENT. HOW TO MANAGE PROJECTS THROUGHOUT THE FIVE MAJOR PROCESS GROUPS. HOW THE TRIPLE CONSTRAINT AFFECTS THE PROJECT MANAGER. HOW TO DEVELOP AN EFFECTIVE PROJECT PLAN. HOW TO GAIN COMMITMENT TO THE PROJECT PLAN. HOW TO EFFICIENTLY EXECUTE THE PROJECT PLAN. HOW TO MINIMIZE OR ELIMINATE SCOPE CREEP. HOW TO ORGANIZE AND DEVELOP SUCCESSFUL PROJECT TEAMS. HOW TO DEVELOP AN EFFECTIVE PROJECT CONTROL SYSTEM. HOW TO DEVELOP REALISTIC PROJECT SCHEDULES. HOW TO EFFICIENTLY CLOSE OUT A PROJECT.

OBJECTIVES:

TO DEVELOP AN APPRECIATION FOR THE EVOLUTION OF ENTREPRENEURSHIP AS AN ACADEMIC DISCIPLINE. TO GAIN UNDERSTANDING OF THE ENTREPRENEURIAL PROCESS THROUGH ANALYSIS OF VARIOUS SITUATIONS. TO LEARN DIVERSE RESEARCH THEMES IN THE AREA OF ENTREPRENEURSHIP COURSE FORMAT:

SYLLABUS

Module -2: ENTREPRENEURSHIP IS AN INTENSIVE COURSE INVOLVING THE STUDY OF JOURNALS ARTICLES, ANALYSIS OF CASES, TO EVOLVE PERSPECTIVE ON ENTREPRENEURSHIP AS AN ACADEMIC DISCIPLINE

Module -3: ENTREPRENEURSHIP: AN INTRODUCTION, NEW VENTURE CREATION, FINANCING ENTREPRENEURIAL VENTURES AND THE BUSINESS PLAN, FAMILY BUSINESS MANAGEMENT, MANAGING A GROWING BUSINESS, VENTURE GROWTH STRATEGIES, ENTREPRENEURIAL SKILLS AND STRATEGIES, ENTREPRENEURIAL SKILLS AND STRATEGIES, INTRAPRENEURSHIP: ENTREPRENEURIAL VENTURES IN A CORPORATE SETTING, ENTREPRENEUR AS CHANGE AGENT, SUSTAINABLE INNOVATION AND ENTREPRENEURSHIP, SOCIAL ENTREPRENEURSHIP

REFERENCE BOOKS:

1. M. Y. YOSHINO AND U. S. RANGAN, STRATEGIC ALLIANCES: AN ENTREPRENEURIAL APPROACH TO GLOBALIZATION, HBS PRESS, 1995.
2. FOSTER, RICHARD N., INNOVATION: THE ATTACKER'S ADVANTAGE, LONDON, MACMILLAN, 1986.
3. HOWARD H. STEVENSON, MICHAEL J. ROBERTS, AMAR BHIDE, WILLIAM A. SAHLMAN (EDITOR), THE ENTREPRENEURIAL VENTURE (THE PRACTICE OF MANAGEMENT SERIES).
4. UDAYAN GUPTA (EDITOR), DONE DEALS: VENTURE CAPITALISTS TELL THEIR STORIES.
5. STEVE KEMPER, CODE NAME GINGER: THE STORY BEHIND SEGWAY AND DEAN KAMEN'S QUEST TO INVENT A NEW WORLD.
6. PAUL A. GOMPERS AND JOSH LERNER, THE MONEY OF INVENTION: HOW VENTURE CAPITAL CREATES NEW WEALTH.
7. LARRY BOSSIDY, RAM CHARAN AND CHARLES BURCK, EXECUTION: THE DISCIPLINE OF GETTING THINGS DONE.
8. JEFFRY TIMMONS AND STEPHEN SPINELLI, NEW VENTURE CREATION: ENTREPRENEURSHIP FOR THE 21ST CENTURY WITH POWERWEB AND NEW BUSINESS MENTOR CD.
9. THE ENTREPRENEUR'S GUIDE TO BUSINESS LAW, CONSTANCE E. BAGLEY AND CRAIG E. DAUCHY, WEST EDUCATIONAL PUBLISHING, 1998.
10. MARY COULTER, ENTREPRENEURSHIP IN ACTION, PRENTICE-HALL, 2001.
11. TRACY KIDDER, THE SOUL OF A NEW MACHINE, AVON BOOKS, 1990.
12. H. L. MORGAN, A. KALLIANPUR, AND L. M. LODISH, ENTREPRENEURIAL MARKETING: LESSONS FROM WHARTON'S PIONEERING MBA COURSE, JOHN WILEY & SONS, 2001.
13. RITA GUNTHER MCGRATH AND IAN MACMILLAN, THE ENTREPRENEURIAL MINDSET.
14. JAMES COLLINS, WILLIAM C. LAZIER, BEYOND ENTREPRENEURSHIP: TURNING YOUR BUSINESS INTO AN ENDURING GREAT COMPANY.

REFERENCE (LIST OF) CASES:

1. KODAK (A), HBS CASE # 703503
2. COMMERCE BANK, HBS CASE # 603080
3. HAUSSER FOOD PRODUCTS CO., HBS CASE: 402055
4. E INK IN 2005, HBS CASE # 705506
5. WHOLE FOODS MARKET, INC., HBS CASE # 705476
6. DISCIPLINED ENTREPRENEURSHIP, HBS CASE # SMR156

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE301A.1	3	3	3	3	2	2	1	3	2	3	3	2	2	2	2
PGCSE301A.2	3	2	2	2	3	1	2	3	1	2	2	3	2	2	3
PGCSE301A.3	2	2	2	2	2	1	2	3	2	2	1	2	2	-	-
PGCSE301A.4	2	3	2	2	2	3	3	2	-	3	2	3	3	3	2

PGCSE301A.5	1	3	2	3	1	2	3	3	3	-	1	3	2	2	1
-------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

PGCSE301B: Teaching & Research Methodology**Total Lecture Hours: 44****Course Outcomes:****CO1:**Mind-mapping qualitative and quantitative data, and explain how evidence gathered supports or refutes an initial hypothesis.**CO2:**Validate critically the quality of research by others**CO3:**Compose research questions designed to test, refine, and build theories**CO4:**Select and demonstrate facility in research designs and data collection strategies that are most appropriate to a particular research project**CO5:**Podcast a complete and logical plan and draw appropriate conclusions.**MODULE A: TEACHING METHODOLOGY [16 Lectures]****Unit 1 Instruction:**Introduction to content, Elements of instruction, Learning objectives, Roles of the teacher and the learner in instruction.
[4 Lectures]**Unit 2 Teaching and Learning:**Application of theories of learning to teaching and learning, Sequence of learning and Strategies of learning, Teaching methods, their merits and demerits, Use of ICT in teaching & learning, Classroom management, Individual differences.
[4 Lectures]**Unit 3 Planning for teaching and learning**: Understanding the syllabus, Preparation of a scheme of work, Lesson plan preparation, Micro teaching.
[4 Lectures]**Unit 4 Assessment and Evaluation**

: Define measurement, assessment, test, evaluation, Purpose of assessment and evaluation, Types of tests, Grading and reporting the results assessment, Evaluating teaching and learning. [4 Lectures]

MODULE B: RESEARCH METHODOLOGY [28 Lectures]**Unit 1 Definition and explanation of research:** Types and Paradigms of Research, History and Philosophy of Research (esp. Philosophical evolution, pathways to major discoveries & inventions), Research Process decision, planning, conducting, Classification of Research Methods; Reflective Thinking, Scientific Thinking.**Research problem formulation:** Literature review- need, objective, principles, sources, functions & its documentation, problem formulation esp. sources, considerations & steps, Criteria of a good research problem, Defining and evaluating the research problem, Variables esp. types & conversion of concepts to variables. Research design esp. Causality, algorithmic, quantitative and qualitative designs, Various types of designs. Characteristics of a good research design, problems and issues in research design; Hypotheses: Construction, testing, types, errors; Design of experiments especially classification of designs and types of errors. [8 lectures]**Unit 2 Problem solving**

: Understanding the problem- unknowns, data & conditions, conditions - satisfiability, sufficiency, redundancy & contradiction, separation of parts of the problem and conditions, notations; devising a plan- connection between data and unknown, similar/related problems, reuse of previous solutions, rephrasing/transforming the problem, solving partial or related problem, transforming data and unknowns; carrying out the plan- esp. correctness of each step in multiple ways; evaluation of solution and method- checking correctness of solution, different derivations, utility of the solution. [5 lectures]

Unit 3 Theoretical methods of research

: Algorithmic methods including probabilistic, soft computing, and numerical methods; Modeling and Simulation; Engineering Design & Optimization (techniques); Statistical methods in research: Central tendency, Dispersions, Skewness, Moments, Kurtosis, esp. Distributions, Time series, Overview of Non-parametric tests & Multivariate analysis; Emerging techniques in discrete mathematics, algorithms, probability-statistics, internet technology and

software engineering, and their application to research in computer science and information technology. [8 lectures]

Unit 4 Foundation of Hypothesis: Meaning of assumption, postulate and hypothesis, nature of hypothesis, function and importance of hypothesis, Characteristics of good hypothesis, formulating hypothesis. [2 Lectures]

Unit 5 Data & Reports: Infrastructural setups for research; Methods of data collection esp. validity and reliability, Sampling; Data processing and Visualization especially Classification; Ethical issues especially. bias, Misuse of statistical methods, Common fallacies in reasoning. Research Funding & Intellectual Property; Research reports: Research Proposal & Report writing esp. Study objectives, study design, problems and limitations; Prototype microproject report implementing a major part of all the above (compulsory assignment) [5 lectures]

Course guidelines:

Faculty member will introduce the elementary ideas of most of the topics with emphasis on 3-5 topics preferably from those that are highlighted.

Books:

1. Teaching Methodology, Caroline W. Ndirangu, African Virtual University.
2. R. Paneerselvan: Research Methodology, Prentice-Hall India
3. G. Polya, How to Solve It, Princeton University Press
4. Fundamental of Research Methodology and Statistics, Yogesh Kumar Singh, New Age International Publishers.
5. Research Methodology Methods and Techniques (Second Revised Edition), C.R.Kothari, New Age International Publishers.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE301B.1	3	3	3	3	2	2	1	3	2	3	3	2	2	2	2
PGCSE301B.2	3	2	2	2	3	1	2	3	1	2	2	3	2	2	3
PGCSE301B.3	2	2	2	2	2	1	2	3	2	2	1	2	2	-	-
PGCSE301B.4	2	3	2	2	2	3	3	2	-	3	2	3	3	3	2
PGCSE301B.5	1	3	2	3	1	2	3	3	3	-	1	3	2	2	1

Electives - IV.

Bio-Informatics

Allotted Hrs:35

Code: PGCSE302B

Contact: 4L

Credit: 4

Course Outcomes:

CO1 To find the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications

CO2 To build idea in MOLECULAR BIOLOGY

CO3 To predict the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks

CO4 To tabulate the knowledge of the DNA SEQUENCE ANALYSIS

CO5 To explain the performance of different types of Probabilistic models used in Computational Biology.

INTRODUCTION TO MOLECULAR BIOLOGY [5L]

Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles.

Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept.

Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA.

Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Metabolic Pathways.

Sequence Databases [2L]

Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;

DNA SEQUENCE ANALYSIS [14L]

DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules.

DeBruijn Graph.

Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.

Introduction Probabilistic models used in Computational Biology [8L]

Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.

Biological Data Classification and Clustering [6L]

Assigning protein function and predicting splice sites: Decision Tree

Gene Expression Clustering. K Means Algorithm.

Books:

1. Vavid W. Mount: Bioinformatics:Sequenc and Genome analysis
2. Arther M. Leok: Introduction to Bioinformatics, Oxford
3. Rastogi et.al.:Bioinformatics-Methods and applications-enomics, Proteomics and Drug Discovery, Prentice Hall.
4. Dan Gasfield: Algorithms on Strings, Trees and Sequences, Computer Science and Computational Biology, Cambridge University Press
5. M. S. Waterman: Introduction to Computational Biology: Maps, Sequences and Genomes, 1995.
6. Gibas, Jambeck: Developing Bio-informatics Computer Skills, SPD

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE302B.1	1	1	-	2	-	1	-	1	1	1	-	2	2	-	1
PGCSE302B.2	2	2	1	-	3	-	1	-	2	1	1	-	3	3	3
PGCSE302B.3	1	1	1	2	2	1	2	1	-	-	1	3	1	3	1
PGCSE302B.4	2	-	2	2	3	2	1	2	2	1	2	1	1	3	3
PGCSE302B.5	1	1	2	2	2	1	1	1	3	2	1	3	2	2	3

Data Mining & Data Ware Housing

PGCS302C

Course Outcomes:

CO1: Infer and structure the fundamental concepts of the evolving technologies in Data Mining (such as Mining Frequent Patterns and Data Streams, Associations, Supervised and Unsupervised Learning, Graph Mining, Web Mining etc.) and Data Warehousing

(such as Data Cube and OLAP) recognizing their utilitarian importance in current technological context for further exploration leading towards lifelong learning.

CO2: Search and build an engineering problem within the scope of Data Mining and Data Warehousing paradigm.

CO3: Illustrate relevant literature and apply the concepts of Data Mining and Data Warehousing to solve problems of making automated decisions dealing with huge amount of data.

CO4: Build ideas for proposing solutions to the challenging problems of Data Mining and Data Warehousing.

CO5: Reflect ideas of Data Mining and Data Warehousing through developing feasible algorithms or frameworks and investigate their effectiveness by analyzing the performances in solving the relevant problems.

36L

UNIT-I

4 L

Introduction: Basics of Data Mining . Data Mining Functionalities, Classification of Data Mining Systems, Data Mining Issues, Data Mining Goals. Stages of the Data Mining Process.

UNIT-II

5 L

Data Warehouse and OLAP: Data Warehouse concepts, Data Warehouse Architecture, OLAP technology, DBMS , OLTPVS. Data Warehouse Environment, Multidimensional data model Data marts.

UNIT-III

6 L

Data Mining Techniques: Statistics, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms.

UNIT-IV

9 L

Mining Association Rules : Basic Algorithms, Parallel and Distributed algorithms, Comparative study, Incremental Rules, Advanced Association Rule Technique, Apriori Algorithm, Partition Algorithm, Dynamic Item set Counting Algorithm, FP tree growth Algorithm, Boarder Algorithm.

UNIT-V

5 L

Clustering Techniques: Partitioning Algorithms-K- means Algorithm, CLARA, CLARANS, Hierarchical algorithms DBSCAN, ROCK.

UNIT-VI

4 L

Classification Techniques: Statistical-based, Distance-based, Decision Tree- based Decision tree.

UNIT-VII

3 L

Applications and Trends in Data Mining: Applications, Advanced Techniques - Web Mining, Web Content Mining, Structure Mining.

Text Books:

1. Roiger & Geatz, Data Mining, Pearson Education
2. A.K.Pujari, Data Mining, University Press
3. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education.
- 4 J. Han and M. Kamber. Data Mining: Concepts and Techniques. Morgan Kaufman.

References Books:

- 1) I. H. Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann.
- 2) D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE302C.1	1	1	-	2	-	1	-	1	1	1	-	2	2	-	1
PGCSE302C.2	2	2	1	-	3	-	1	-	2	1	1	-	3	3	3
PGCSE302C.3	2	1	1	2	2	1	2	1	-	-	1	3	1	3	1
PGCSE302C.4	2	-	2	2	3	2	1	2	2	1	2	1	1	3	3
PGCSE302C.5	3	1	2	2	2	1	1	1	3	2	1	3	2	2	3

VLSI Design

PGCSE302E

Contact: 3L+1T

Credit:4

Course Outcomes:

CO1: Highlight the various IC fabrication methods.

CO2: Sketch the Layout of simple MOS circuit using Lambda based design rules.

CO3: Examine the Lambda based design rules for subsystem design

CO4: Reenact various FPGA architectures.

CO5: Prepare an application using Verilog HDL.

CO6: Building of modeling a digital system using Hardware Description Language.

Introduction: Overview of VLSI design Methodologies, VLSI Design flow, Design Hierarchy, Concept of Regularity,

Modularity, and Locality, VLSI design styles

[3L]

Fabrication of MOSFETs: Fabrication Process flow: basic steps, Fabrication of NMOS Transistor, the CMOS n-Well Process, Layout Design Rules, Full- Custom mask Layout design, CMOS Inverter Layout Design

[4L]

MOS Transistor: The MOS Structure, Structure and operation of MOSFET, The MOS System under External Bias, The Threshold Voltage, MOSFET Current–Voltage Characteristics, Channel Length Modulation, Substrate Bias Effect, MOSFET Scaling and Small Geometry Effects, Short Channel Effects, Narrow Channel Effects, Limitation Imposed by Small Device Geometries, MOSFET Capacitances

[6L]

MOS Inverters: Static Characteristics: CMOS Inverters, Circuit operation, Voltage transfer characteristics of CMOS

Inverter, Calculation of V_{IL} , Calculation of V_{IH} , Calculation of inverter threshold voltage, Noise Margin.

[5L]

MOS Inverters: Switching Characteristics: Delay Time Definitions, Calculation of Delay Times, Inverter Design with delay constraints, Estimation of Interconnect Parasitic, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters

[6L]

Combinational MOS Logic Circuits: CMOS Logic Circuits, Layout of simple logic gates, Complex Logic Circuits, Layout of Complex Logic Gates, AOI and OAI Gates, CMOS Transmission Gates (pass gates), Complementary Pass Transistor Logic

[4L]

Sequential MOS Logic Circuits: Behavior of Bitable element, SR Latch Circuits, Clocked Latch and Flip flop Circuits, CMOS D-Latch and Edge Triggered Flip flop, Clocked JK Latch, Master slave Flip flop

[4L]

Semiconductor Memories: Dynamic Random Access Memory, DRAM Configuration, Historical Evaluation of DRAM Cell, DRAM Cell Types, operation of one transistor DRAM Cell, DRAM Operation Modes, Static Random Access Memory, Full custom SRAM Cell, CMOS SRAM Design Strategy, Operation of SRAM, Flash Memory NOR Flash Memory Cell, NAND Flash Memory Cell, Flash Memory Circuit

[4L]

Design for Testability: Fault Types and Models, Ad Hoc Testable Design Techniques, Scan –based Techniques, Built-In Self Test Techniques.

[4L]

REFERENCE BOOKS:

1. S. M. Kang and Y. Leblebici, *CMOS Digital Integrated Circuits : Analysis and Design*, Third Edition, MH, 2002.
2. W. Wolf, *Modern VLSI Design : System on Chip*, Third Edition, PH/Pearson, 2002.
3. N. Weste, K. Eshraghian and M. J. S. Smith, *Principles of CMOS VLSI Design : A Systems Perspective*, Second Edition (Expanded), AW/Pearson, 2001.
4. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, *Digital Integrated Circuits : A Design Perspective*, Second Edition, PH/Pearson, 2003.
5. D. A. Pucknell and K. Eshraghian, *Basic VLSI Design : Systems and Circuits*, Third Edition, PHI, 1994.
6. J. P. Uyemura, *CMOS Logic Circuit Design*, Kluwer, 1999.
7. J. P. Uyemura, *Introduction to VLSI Circuits and System*, Wiley, 2002.
8. R. J. Baker, H. W. Li and D. E. Boyce, *CMOS Circuit Design, Layout and Simulation*, PH, 1997.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PGCSE302E.1	3	1	-	2	-	1	-	1	1	1	-	2	2	-	1
PGCSE302E.2	2	2	1	-	3	-	1	-	2	1	1	-	3	3	3
PGCSE302E.3	3	1	1	2	2	1	2	1	-	-	1	3	1	3	1
PGCSE302E.4	2	-	2	2	3	2	1	2	2	1	2	1	1	3	3
PGCSE302E.5	3	1	2	2	2	1	1	1	3	2	1	3	2	2	3