THE UNIVERSITY OF BURDWAN

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS FOR M. SC. (COMPUTER SCIENCE & APPLICATION) COURSE

(EFFECTIVE FROM ACADEMIC SESSION: 2015 – 2017)

1) Duration		**:Two Years (Four Semesters)**
2) Total Marks	**:**	1250 (300 + 300 + 300 +350)
3) Total Credit Points	**:**	90 (22 + 22 + 20 + 26)
4) Number of Papers	**:**	Total **Twenty Four,** out of which, **fourteen** are Theoretical, **eight** Practical, **One** Term Paper, **One** Project Work including Social Outreach Programme.
5) Distribution of Marks	**:**	All **Theoretical** and **Practical** papers are of full marks 50, out of which, 40 marks for **University Exam.** & 10 marks for **Sessional**. Sessional marks of theoretical papers will come from **two mid – term** examinations of 10 marks each. For **Term Paper** 50 marks will be of **University Exam**. For **Project Work** paper, full marks is 100, out of which, 20 marks for **social outreach program** will be of University exam.
6) Duration of Univ. Exam.	**:**	**Two Hours** for Theoretical Papers and **three Hours** for Practical Papers.
7) Instruction Period	**:**	In L-T-P pattern, **'L'** lectures, **'T'** tutorials, and, **'2xP'** practical hours per week are needed for each paper. Unless otherwise specified, credit point of a paper will be: L + T + P. At least 50 hours are needed for each theory and practical paper. **Two hours per week** will be given for **remedial** purpose.
8) **Semester Duration**	**:**	16 Weeks.

Semester-I

Courses	**(L-T-P) Credits**
MCSA- 101: Advanced Programming and Data Structures	(3-1-0) 4
MCSA -102: Database Management Systems	(3-1-0) 4
MCSA -103: Mathematics for Computing	(4-0-0) 4
MCSA -104: Computer Organization & Architectures	(4-0-0) 4
MCSA –105: Lab I	(0-0-3) 3
MCSA -106: Lab II	(0-0-3) 3
Semester Credits	22

Semester-II

Courses	**Credits**
MCSA- 201: Design and Analysis of Algorithms	(4-0-0) 4
MCSA- 202: Advanced Operating Systems	(3-1-0) 4
MCSA-203: Advanced Computer Network	(3-1-0) 4
MCSA- 204: Software Engineering	(4-0-0) 4
MCSA- 205: Lab III	(0-0-3) 3
MCSA-206: Lab IV	(0-0-3) 3
Semester Credits	22

Semester – III

Courses	**Credits**
MCSA-301: Theory Of Computing	(4-0-0) 4
MCSA-302: Computer Graphics	(3-1-0) 4
MCSA-MIE-303 (Java for Scientific Computing)	(2-0-0) 2
MCSA 304: Term Paper	(4-0-0) 4
MCSA-305: Lab V	(0-0-3) 3
MCSA-306: Lab VI	(0-0-3) 3
Semester Credits	20

Semester – IV

Courses		Credits
MCSA-401: Compiler Design	(4-0-0)	4
MCSA-402: Elective I	(4-0-0)	4
MCSA-403: Elective II	(4-0-0)	4
MCSA-404: Project	(0-0-8)	8
MCSA-405: Lab VII	(0-0-3)	3
MCSA-406: Lab VIII	(0-0-3)	3
Semester Credits		26
Cumulative Credits		90

Elective I

1. Artificial Intelligence & Application
2. Natural Language Processing
3. Advanced DBMS
4. Pattern Recognition

Elective II

1. Cryptography & Network Security
2. Mobile Computing
3. Image Processing
4. Advanced Java

MCSA-101: Advanced Programming and Data Structures

Advanced Programming

Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models.

Modeling Language Properties: Formal Properties of Languages, Language Semantics.

Imperative programming: Key concepts, Pragmatics, Case study: C.

Object-Oriented Programming: Key concepts, Pragmatics, Case study: C++/Java.

Concurrent Programming: Key concepts, Pragmatics, Case study, Java.

Functional Programming: Key concepts, Pragmatics, Case study.

Logic Programming: Key concepts, Pragmatics, Case study: Prolog. [30%]

Data Structures

A. **Overview of Linear Data Structures:** Arrays, Strings, Stacks, Queues, Dequeues, Priority Queues and their applications, introduction to singly, doubly and circular linked lists, operations on linked lists, application of linked lists. [5%]

B. **Trees:** Introduction to tree, forest, binary tree, applications, binary search tree, insertion and deletion of nodes in a tree, tree traversals, operations on BST, threaded binary trees, querying a BST, application of BST, introduction to balanced trees, height balanced and weight balanced trees, different methods of balancing, advantage of tree balancing, complexities of different operations. [10%]

C. **Graph:** Introduction to graph, different representations, graph traversals, like, BFS, DFS, applications of BFS and DFS, transitivity and Warshall's algorithm, spanning trees, minimum spanning trees, Prim's and Kruskal's algorithms, single source shortest paths, all-pair shortest paths, operations on graphs, querying a graph, applications of graphs in computer science. [25%]

D. **Sorting and Searching:** Concept of space and time complexity, different sorting techniques (like, bubble, insertion, selection, merge, quick, bucket, shell, topological, shaker), their performance analysis, and efficiency comparisons, lower and upper bound of sorting algorithms, different searching algorithms and their applicability & performance analysis.

[15%]

E. Advanced Topics: Sets, B-Tree, B^+ Tree, Skip Lists, amortized analysis, augmenting data structures, Heap, Hashing, performance of hashing, rehashing and other hashing techniques. [15%]

REFERENCE BOOKS:

1. *Introduction to Algorithms, 3rd Edition:* Cormen, Liserson, Rivest, Stein, MIT Press.
2. *Fundamentals of Data Structure:* Horowitz, Sahani, Galgotia Publication.
3. *Data Structures & Algorithm, 1st Edition:* Aho, Hopcroft, Ullman, Pearson
4. *Algorithms in C++: Fundamentals, Data Structures, Sorting, Searching (Part 1 – 4), 3rd Edition:* Robert Sedgewick, Pearson.

MCSA-102 DATABASE MANAGEMENT SYSTEM

A. **ER Model**: Review of ER constructs, Advanced ER constructs, Object Oriented Data Modelling. [5%]

B. **ER Modelling in Logical Database Design**: Introduction, Requirements analysis and ER Modelling, View Integration, Entity clustering. [10%]

C. **Normalization and DB design**: Fundamentals of Normalization, Design of Normalised Tables, Normalization of Candidate Tables derived from ER diagram, Determining the minimum set of 3NF tables, Fourth & Fifth normal forms.
Requirements specification, Logical Design, Physical Design. [15%]

D. **Access Methods**: Sequential Access Methods, Random Access Methods, Secondary Indexes, Denormalization, Join Strategies. [10%]

E. **Transaction Processing and Concurrency Control:** Review of basic concepts, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL
Concurrency Control Techniques, Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking, Using Locks for Concurrency Control in Indexes, Other Concurrency Control Issues
Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Recovery in Multidatabase Systems, Database Backup and Recovery from Catastrophic Failures. [20%]

F. **Distributed Data Allocation**: Introduction, Distributed & Multi database Design, General Data Allocation problem, Data allocation strategies. Query processing in distributed database. [15%]

G. **Data Warehousing, OLAP and Data Mining**: Overview of Data warehousing, Logical Design, Physical Design, OLAP, Data Mining. [10%]

H. **Advanced Database Technology**: Architecture for advanced technology, Object-oriented & Object – Relational Database, Spatial and Geographic Databases, Multimedia Databases [15%]

Reference Books :

1. A.Silberchatz et.al. – Database System Concepts 3rd Edn. McGraw Hill Inc., 1997.
2. R.Elmasri et.al. – Fundamentals of Database Systems, Addison Wesley, Indian Reprint,New Delhi, 2000.
3. R.Rama Krishnan – Database Management Systems, McGraw Hill International Edn., New York, 1998.
4. T.J.Teorey - Database Modeling & Design, 3rd edition, Harcourt Asia Pte. Ltd., New Delhi, 2002

MCSA – 103: MATHEMATICS FOR COMPUTING:

A) Mathematical Logic: Introduction to propositional calculus, declarative sentence / statement / proposition, semantical paradoxes, law of excluded middle and law of contradiction, propositional variables and constants; compound statements, connectives (negation, disjunction, conjunction, conditional / implication, bi – conditional / equivalence) and derived connectives (NAND, NOR, XOR, inhibition); truth tables; premise / antecedent / hypothesis, consequent / conclusion, implication vs. "causal" relationship; inverse, converse and contrapositive of an implication; tautology, contradiction / absurdity, contingency; adequate set of connectives (three / two / one); algebra of propositions; rules of inference (addition, conjunction, simplification, modus ponens / rule of detachment, modus tollens / rule of contraposition, hypothetical syllogism, disjunctive syllogism, constructive dilemma, destructive dilemma), fallacies (affirming the consequent, denying the antecedent, non sequitur); well formed formula; normal / canonical forms (CNF, DNF); introduction to predicate calculus; predicate, free & bound variables, existential & universal quantifiers, multiple quantifiers, negation; rules of inference (universal / existential generalization / instantiation, universal modus ponens & modus tollens), clausal form, skolem function. [10%]

B) Number Theory and Combinatorics: Introduction, divisibility theory, GCD, LCM, Euclidean algorithm, prime factorization, primality testing; congruence, arithmetic of congruence and residue classes, simultaneous linear congruence, solution, Chinese remainder theorem, Fermat's little theorem, application of congruence; binomial theorem, Pascal's triangle, combinatorial identities; generating functions, recurrence relation, solving recurrence relation using generating functions. [10%]

C) Graph Theory: Concepts of graphs; terminologies; types; sub – graphs; isomorphism; path, cycle, connectivity; operations; trees, properties of trees; graph / tree traversals; spanning trees;

Eulerian, Hamiltonian, planar graph; distance in graph; graph colouring; matching, factorization; directed graph, representation of graph. [20%]

D) NUMERICAL COMPUTING

Computer Arithmetic: Floating Point Numbers – Operations, Normalization and their consequences **Iterative Methods:** Zeros of Transcendental Equations and Zeros of Polynomials using Bisection, Newton –Raphson etc. Convergence of solution.

Solution of Simultaneous Linear Equations: Gauss Elimination Method and Pivoting, Ill-Conditioned Equations and Refinement of Solutions, Gauss-Siedal Iterative Method.

Interpolation and approximation: Difference Table, Polynomial Interpolation, Newton, Lagrange etc, Piecewise Polynomial and Spline Interpolation; Approximation of Functions by Taylor Series And Chebyshev Polynomials.**Numerical Differentiation and Integration of Functions:** classical formula for Equality Spaced Abscissa, Simpson's 1/3 Rule, Trapezoidal Rule with interval Halving Techniques, Romberg Integration, Gauss Quadrature, Monte-Carlo Method for Multidimensional Integrals. [

Solution of Differential Equations: Ordinary first order differential equations. Difference equation, Single and Multistape Methods, Runge-Kutta Method, Predictor Corrector Methods, Automatic Error Monitoring, and Stability of Solutions. [30%]

E) STATISTICAL COMPUTING

Graphical Representation of Statistical Data, Frequency Distribution, Measures of Central Tendency and Dispersion, Random variable and it's expectation and Variance. Probability models – Binomial, Poission and Normal.

Bivariate Frequency Distributions. Scatter Diagram, Product Moment, Correlation Coefficient and its properties (statements only) Regression Lines, Correlation Index and Correlation Ratio, Spearman Rank Correlation.

Multiple Linear Regression, Multiple Correlation, Partial Correlation (without Derivation).

Random Sampling (with replacement and without replacement), Expectations and Standard error of Sampling Mean (without Derivation). Expectation and standard error of Sampling Proportions. [10%]

Point of Estimation of Parameters. Maximum likelihood estimation, interval estimation of parameters, test of significance based on t, F, and CHI square distribution.

Arge sample tests, Tests based on Pearsonian Frequency CHI-square. [30%]

REFERENCE BOOKS:

1) *Higher Algebra (Classical), Revised 7th Edition (2003)***:** S. K. Mapa, Sarat Book House
2) *Foundations of Discrete Mathematics, 2nd Edition, 2014***:** K. D. Joshi, New Age International
3) *A Text Book of Discrete Mathematics*: Swapan Kumar Sarkar, S. Chand
4) *Discrete Mathematics:* S. K. Chakraborty & B. K. Sarkar, Oxford University Press
5) *Discrete Mathematical Structures:* B. Kolman, R. C. Busby & S. Ross, PHI
6) *Discrete Mathematics for Computer Scientists & Mathematicians:* Joe L. Mott, Abraham Kandel & Theodore P. Baker, PHI
7) *Graph Theory With Applications To Engineering And Computer Science, New Edition, 2009***:** Narsingh Deo, PHI
8) *Graph Theory***:** Frank Harary, Narosa Publishing House
9) *Fundamentals of Abstract Algebra (International Series in Pure and Applied Mathematics):* D. S. Malik, John M. Mordeson , M. K. Sen, McGraw Hill
10) *Elements of Discrete Mathematics, 3rd Edition, 2008:* Liu, Tata McGraw Hill
11) *Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, 7th Edition, 2011:* Kenneth H. Rosen, Tata McGraw Hill
12) Numerical Recipes in C – The art of Scientific computing – William H. Pras et al. Cambridge Univ. Press, 1988 reprint.
13) C Language and Numerical Methods – C Xavier, New Age International.
14) Numerical Methods, Software and analysis – John R. Rice, McGrew Hill International Edn. 3rd Printing, 1987
15) Computer Assisted Statistics – F. Scalzo
16) Fundamentals of Statistics – Goon, Gupta and Dasgupta
17) Statistical Programs in FORTRAN – Schwartz and Basso, Reston publ. co.

MCSA-104: COMPUTER ORGANIZATION & ARCHITECTURE:

COMPUTER ORGANIZATION [50%]

A) Basics of Computer Organization: Stored Programme Organization, Common Bus System, Timing and Control, Instruction Cycles, Memory reference instructions and I/O reference instructions, Interrupt, Interrupt Cycle, Design of basic Computer, Control Unit. [10%]

B) Memory Organization: Introduction to Memory Organizations, memory hierarchy, classification of memory, associative memory, cache memory, main memory, auxiliary memory, memory interleaving, virtual memory, memory management hardware, instruction cache. [10%]

C) I/O Organization: Introduction to I/O organization, addressing of I/O devices, modes of I/O transfer, I/O using interrupts, DMA, Different bus organizations, I/O controllers.[15%]

D) CPU Organization: General register based & stack based organization, instruction formats, addressing modes, instruction execution cycles, micro-programming concepts: horizontal, vertical and diagonal microinstruction formats, microprogramming with multiple formats, speed mismatch between CPU & memory and methods of alleviating it, internal bus organization, ALU organization, ALU design, Control units: hardwared control, Wilkes control, micro programmed control. [15%]

A. **COMPUTER ARCHITECTURE**

Introduction: Computer Architecture & Organization. Basic Parallel Processing Architecture, Taxonomy- SISD. MISD, SIMD, MIMD structures, Serial, Parallel &Concurrent Computation, CISC Vs RISC, Structure of Instruction of instruction sets and Desirable Attributes. [5%]

B. **Pipelining:** Basic Concepts of pipelining, Instruction Pipelining. Hazards, Reservation Tables, Collision, Latency, Dynamic pipeline, Vector processing & Vector processors. [5%]

C. **Memory Systems:** Cache Memory & Virtual Memory: Structure, Analysis & Design. [10%]

D. **I/O Systems:** Design Issues, Performances Measures. [5%]

E. **Multiprocessor Architecture:** Loosely Coupled & Tightly Coupled Systems, Concurrency & Synchronization, Scalability, Models of Consistency, Application of SIMD Structure. [5%]

F. **Interconnection Network:** Definition. Types of Interconnected Networks; Baselines, Shuffle- Exchange, Omega, Cuba, Comparison & Application. [5%]

G. **Systolic Architecture:** Mapping Algorithm to array structures, Systolic processors. Mapping design & Optimization, Wave Front Array processor. [5%]

H. **Data Flow Architecture:** Data Flow Graphs, Petri nets, Static & Dynamic DFA. [5%]

I. **Programming Environment:** Different Models, Languages, Compilers, dependency Analysis. Message Passing, Program mapping to Multiprocessors, Synchronization. [5%]

REFERENCE BOOKS:

1) *Digital Logic and Computer Design*: M. M. Mano, PHI
2) *Digital Logic Design Principles*: Bradley Carlson, Norman Balabanian, Wiley India
3) *Structured Computer Organization*: A. S. Tanenbaum, PHI
4) *Computer System Architecture:* M. M. Mano, PHI
5) *Digital Logic Design:* Holdsworth, Elsevier India
6) *Digital Logic Design:* Guy Even, Moti Medina, Cambridge University Press
7) *Digital Design Principles and Practices:* John F. Wakerly, Pearson Education
8) *Fundamentals of Digital Logic with VHDL Design:* Stephen Brown, Zvonko Vranesic, Tata McGraw Hill

MCSA- 105 LAB- I (Data structure and Numerical algorithm Lab)

Writing programs for solving Numerical algorithms
Writing programs using different data structures

MCSA- 106 LAB- II (DBMS Lab)

DBMS Lab.: Detailed study of Oracle DBMS, interacting with SQL and PL/SQL.

MCSA – 201: DESIGN AND ANALYSIS OF ALGORITHMS:

A) Basic Concepts: Solving problem using computer, general problem solving approach – STAIR, reduction to known problem, meaning of algorithm, steps in development of algorithm, evolution of algorithms, design by analysis, design by synthesis, algorithm design patterns and frameworks (divide – and – conquer, branch and bound, backtracking, greedy algorithm, dynamic programming, approximation algorithms, randomized algorithms, distribute and parallel algorithms, external memory algorithms, on – line algorithms, natural algorithms like, genetic algorithm, simulated annealing, artificial neural network, tabu search); formal specification, languages, EBNF, VDM, Z; algebraic formal specification (pattern matching, unification). [15%]

B) Analysis of Algorithms: Correctness of an algorithm; concept of space and time complexity; asymptotic analysis, amortization, randomization and experimental analysis; best, worst and average case, order of growth, asymptotic notations, upper and lower bounds; analysing rate of growth of a function with that of known functions, comparing algorithms w. r. t. order of growth; applying algorithm analysis concepts for complexity analysis of different sorting techniques. [10%]

C) Divide and Conquer: Introduction to top – down approach, divide – and – conquer approach, identifying problems where divide – and – conquer suits / is unsuitable, analysis of divide and conquer algorithms, recurrences, the master method for solving recurrences. [10%]

D) Dynamic Programming : Principle of optimality, bottom – up approach to problem solving, comparison with top – down approach, application of dynamic programming to solve problems using optimal sequence of decisions, comparison with brute – force method for finding optimal solution, possibility of multiple sequences in dynamic programming, overlapping sub – problems and optimal substructures, avoiding further exploration of sub –

optimal decisions using memoizations, examples of problems; correctness of dynamic programming; analysis of dynamic programming. [15%]

E) Greedy Algorithms: Another approach to find optimal solution by generating only one decision sequence (locally best choice when all available choices are exhausted), optimal substructure and greedy choice; greedy algorithms vs. dynamic programming; examples of problems; analysis of greedy algorithm; matroids; correctness of the greedy algorithm on matroids. [15%]

F) Backtracking and Branch – and – Bound: Nature of problems where backtracking or branch – and – bound fits; examples of problems; analysis of them; relation of these algorithms with optimization. [10%]

G) Approximate Algorithms: P, NP, NP – complete, NP – hard problems, is P = NP?, trade off between efficiency and accuracy, concept of near optimal solutions, nature of problems where approximate algorithm is suitable, analysis of approximate algorithms, inapproximability, ε – approximation; probabilistically good algorithms. [15%]

H) Parallel / Concurrent Algorithms: Identifying problems that can be solved using parallel algorithms, inherently serial problems; computational models for parallel algorithms, shared memory, message passing / fixed connection, PRAM (parallel random access machines), Mesh / Hypercube / Butterfly interconnections; importance of communication, load balancing (in addition to space and time complexity) in performance analysis of parallel algorithms, asymptotic linear / super – linear speedup, work – optimal parallel algorithm; analysis of parallel algorithms; examples of problems; distributed algorithms. [10%]

REFERENCE BOOKS:

1) *Introduction to Algorithms – A Creative Approach*: Udi Manber, Addison – Wesley Professional
2) *Introduction to Algorithms:* Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, MIT
3) *Alorithms:* Richard Johnsonbaugh, Marcus Schaefer, Pearson
4) *Fundamentals of Computer Algorithms:* Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, University Press
5) *Design and Analysis of Algorithms:* Parag Himanshu Dave, Himanshu Bhalchandra Dave, Pearson
6) *Algorithm Design:* Jon Kleinberg, Éva Tardos, Pearson Education
7) *Randomized Algorithms*: Rajeev Motwani, Prabhakar Raghavan, Cambridge University Press
8) *Analysis of Algorithms: Computational Methods & Mathematical Tools:* Micha Hofri, Oxford University Press, USA

9) *Parallel Computers Architecture and Programming*: V. Rajaraman, C. Shiv Ram Murthy, PHI
10) *Parallel Programming in C with MPI and OpenMP*: Michael J. Quinn, Tata McGraw Hill

MCSA-202: ADVANCED OPERATING SYSTEMS:

A) **Introduction**: Introduction of operating system fundamentals, evolution of modern operating systems, centralized operating system, OS kernel structures – microkernel, monolithic kernel – characteristics and privileged, Process Synchronization Management, operations, Threads, Events and Scheduling, Device Drivers – Concepts-Design and Implementation, Network operating system, Distributed operating system, cooperative autonomous systems. [5%]

B) **Distributed System concepts and Architectures:** Introduction of Distributed Systems, goals, transparency, services, Distributed System Architectures, communication network Architectures, issues in distributed operating systems, communication networks, communication primitives, inherent limitations of a distributed system. [10%]

C) **Concurrent processes and programming:** processes and threads, thread application, user space thread implementation, kernel space thread implementation, physical clocks, lamp ports logical clocks , vector clocks, matrix logical clocks, language mechanism for synchronization, object model resource servers, concurrent programming languages, distributed and network programming. [10%]

D) **Inter Process Communication and Coordination**: Inter process Communication – Remote Processor Call – overview and implementation , basic communication primitives-message synchronization and buffering-pipe and socket API – secure sockets - group communication and multicast, Request / reply communication – RPC operations – RPC Exception and failure handling – secure RPC, transaction communication, name and directory services, Distributed Mutual Exclusion, the classification of mutual exclusion and associated algorithms – a comparative performance analysis, distributed computing environment, complete topology, logical ring topology, tree topologies. [10%]

E) **Distributed Process Scheduling:** Static process scheduling-precedence process model-communication process model, dynamic load sharing and balancing- sender initiated algorithm-receiver initiated algorithm, distributed process implementation-remote service-remote execution-process migration, real time scheduling-rate monotonic-deadline monotonic-earliest deadline first-real time synchronization-priority ceiling protocol. [7%]

F) **Distributed Deadlock**: Introduction of Distributed Deadlock, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution , control organizations for

distributed deadlock detection , centralized and distributed deadlock detection algorithms,- hierarchical deadlock detection algorithms, Agreement protocols – introduction and the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. [7%]

G) **Advanced File Systems:** introduction to Advanced File Systems ,Caching, Unix FFS, Log-based File System, Single Address space system – Opal, Operating System Organization, Distributed Shared Memory, introduction of distributed file systems(DFS), DFS design and implementation-files and file systems-services and servers, file mounting and server registration-stateful and stateless file servers-file access and semantics of sharing-version control, transaction and concurrency control, data and file replication. [10%]

H) **Distributed shared memory**: Introduction of Distributed shared memory, Architecture – algorithms for implementing DSM, memory coherence and protocols, design issues, introduction of Distributed Scheduling, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues, introduction of Failure Recovery and Fault tolerance, classification of failures, backward and forward error recovery, backward error recovery – recovery in concurrent systems – consistent set of check points – synchronous and asynchronous check pointing and recovery – check pointing for distributed database systems – recovery in replicated distributed databases. [7%]

I) **Protection and security** - Introduction of Protection and security, the access matrix model and its implementations, safety in matrix model- advanced models of protection, Data security, Model of cryptography, conventional cryptography, modern cryptography, private key cryptography, data encryption standard, public key cryptography , multiple encryption, authentication in distributed systems. [8%]

J) **Multiprocessor operating systems** - Introduction of Multiprocessor operating systems, inter connection networks for multiprocessor systems , caching , hypercube architecture, structures of multiprocessor operating system, threads, process synchronization and scheduling. [8%]

K) **Database Operating systems** : Introduction of Database Operating systems, requirements of a database operating system, Concurrency control, a concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms, concurrency control algorithms, data replication. [8%]

L) **Detailed Case Studies:** Unix, Linux, Open Solaris, Windows NT/XP (at least any two), Real-time OS – Characteristics an example. [10%]

REFERENCE BOOKS:

1) Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems -Mukesh Singhal, Niranjan G.Shivaratri- TMH, 2001.
2) Modern operating system -Andrew S.Tanenbaum- PHI, 2003.
3) Distributed operating systems and algorithm analysis-Randy chow,Theodore Johnson-Pearson,2011.
4) Distributed operating system Concepts and design -Pradeep K.Sinha- PHI, 2003
5) Distributed operating system -Andrew S.Tanenbaum- Pearson education, 2003
6) Distributed Systems Concepts and Design -G Coulouris, J Dollimore and T Kindberg- Third Edition, Pearson Education.

MCSA-203: Advanced Computer Network:

Overview of computer networks, Spanning Tree algorithm (Transparent Bridges) & Source Routing Bridge , Virtual LAN, Inter VLAN communication. [10%]

Error detection and Correction methods: Checksum, CRC polynomial codes, error detection capabilities of polynomial codes, Linear codes- Hamming Code. [10%]

Gigabit Ethernet, IEEE 802.11, Bluetooth, Cellular telephony, Satellite networks, Virtual Circuit Switching, Frame Relay, ATM. [10%]

Advanced IP Addressing (Classless Inter-Domain Routing, variable length Subnet masking and Super-netting), Classless Routing [10%]

Different Routing Process, Details of Routing Protocols (RIP / IGRP / EIGRP / OSPF / BGP) [10%]

Network Flow Control (Open-Loop & Closed-Loop Control) [10%]

Standard Router configuration, Implementation of Routing protocols using CISCO Routers, IPv6 (Frame format, Network Addressing, Extension Headers) [10%]

Firewall, Access Control List, Proxy servers (Squid / Win Proxy), Static & Dynamic Network Address Translation (NAT), Port Address Translation (PAT) [10%]

DNS and DHCP in LINUX and Windows platform, Windows & Linux inter-networking using SAMBA [10%]

Network File System (NFS), Network Information System (NIS) in Linux. [10%]

Text/Reference Books:

1. Leon Garcia- Computer Network Communication – TMH
2. Kirch – " Linux network Administrator's guide (2nd Ed.)" – O'Rielly
3. Maxwell – "Unix system administration" - TMH
4. Limoncelli –"The Practice of System & Network Administration"-Pearson

MCSA – 204: SOFTWARE ENGINEERING:

Software characteristics, components & applications, software engineering - a layered technology, Software Process.

Introduction to software engineering models, linear sequential waterfall model, prototype & RAD model, evolutionary software process model, incremental model and spiral model

Basics of software project management, project management concepts, people, problem & process.

Notion of project metrics, metrics in the process & project domains, software measurement, size oriented, function oriented metrics, extended function. [20%]

Idea of software project planning, scope of planning, project estimation, project decomposition techniques, empirical estimation models.

Introduction to software analysis, requirement analysis, communication techniques, analysis principles, software prototyping, specifications.

Elements of the analysis modeling, data modeling, functional modeling & information flow, behavioral modeling, data dictionary. [20%]

Design process, design concepts, design principles, effective modular design.

Different design methods, architectural design process, transform mapping & transaction mapping, internal external design, human computer interface design, interface design guidelines, procedural design, object oriented design. [15%]

Introduction to software quality, quality concepts, metrics for software quality, quality movement,

S/W Q A, S/W review, formal approaches to software quality assurance, S/W reliability, ISO standards. [10%]

Fundamentals of software testing, test case design, white and black box testing, basic path testing, control structures.

Strategic approach to software testing, unit testing, integration testing, validation testing, system testing, alpha testing, beta testing, debugging. [15%]

Software reusability, reuse process, building reusable components, classified & retrieving components, economics behind software reusability. [10%]

Introduction to computer aided software engineering (CASE),, building block for CASE, taxonomy of CASE tools, integrating CASE environment, integrating architecture, CASE repository. [10%]

REFERENCE BOOKS:

5. 1. R.S.Pressman, ***Software Engineering***
6. 2. Pankaj Jalote, ***An Integrated Approach To Software Engineering***
7. 3. Rajib Mall, **Fundamentals of Software Engineering**, PHI

MCSA-205 Lab -III (Algorithm and OS Lab)

A) **Algorithm Lab.:** Implementations of following algorithms: sorting (quick sort, heap sort, merge sort), dynamic programming (matrix chain multiplication, LCS), greedy algorithm (activity – selection – method, Huffman code, matroid), backtracking, graph algorithms (DFS, BFS, Prim's, Kruskal's, Warshall's, Floyd's, Dijkstra's) [50%]

Operating System Lab.: Unix commands, shell programming (bash shell), system call; demonstration of process / thread synchronization by writing codes (C / C++ / Java), simulation of CPU scheduling, page replacement, disk scheduling algorithms. [50%]

MCSA-206 Lab-IV(Network and software engineering Lab)

A) Network Lab.: Implementation of different algorithms encountered in networking; hands – on experiencing with networking. [50%]

B) Software Engineering Lab: Simulating and testing different SE principles. [50%]

MCSA – 301: THEORY OF COMPUTING:

A) Introduction: Concepts of alphabet, language, grammar, automata; different proof techniques, introduction to contemporary automata theories. [5%]

B) Regular Language: FA, DFA, NFA, language accepted by FAs, equivalence of DFA & NFA, state minimization of FAs, Meally machine & Moore machine and conversions from one to another, regular expressions, application of REs, laws of algebra of REs, regular grammar, equivalence of FA, RE and RG, conversion between one representation of regular language to another, Arden's theorem, closure properties of regular languages, decision properties of regular languages, equivalence of regular languages, pumping lemma for regularity, application of regular languages. [30%]

C) Context – Free Languages: Introduction and formal definition of Context Free Language, Context Free Grammar and Push – Down Automata; determinism and non – determinism; different ways of designing PDAs as language acceptor, equivalence of them; equivalence of CFG and PDAs; properties of CFGs – null production, unit production, useless production, ambiguity, inherent ambiguity; introduction to parsing, parse trees, derivations, recursive inferences; normal forms of CFGs, conversion of CFGs to different normal forms; closure properties of CFLs, decision properties of CFLs, pumping lemma for CFLs, undecidable problems of CFLs; DPDA. [25%]

D) LBA and Turing Machines: Introduction to Turing machine, language accepted by Turing machine, Turing machine as an accepter or a transducer, different variants of Turing machines, universal Turing machine, Turing machine and halting, LBA, context sensitive grammar, context sensitive language, classification and hierarchies of languages. [20%]

E) Computability and Complexity: Church – Turing thesis, undecidability problems, recursive & recursively enumerable languages and their properties, Rice's theorem, Post's correspondence problem, primitive recursive function, problem reducibility, concepts of P, NP, NP – Complete, NP – Hard problems, PSPACE. [20%]

REFERENCE BOOKS:

1. *Introduction to Automata Theory, Languages and Computation, 1st Edition*: J. E. Hopcroft, J. D. Ullman, Narosa
2. *Introduction to Automata Theory, Languages and Computation, 2nd Edition*: J. E. Hopcroft, R. Motwani, J. D. Ullman, Pearson
3. *An Introduction to Formal Languages and Automata:* Peter Linz, Narosa
4. *Theory of Computer Science (Automata, Languages and Computation):* K. L. P. Mishra & N. Chandrasekaran, PHI
5. *Elements of the Theory of Computation:* H. R. Lewis and C. H. Papadimitriou

MCSA – 302: COMPUTER GRAPHICS:

A) Introduction: Multisensory perception of human (sight, hearing, touch, smell, taste); meaning of multimedia; contemporary elements of multimedia: text, rich text, hypertext, pictures (images / graphics), video (motion pictures, motion video), animation, sound, braille; advantages of using multimedia in computer; recent advances in exploration of multisensory perception; application of computer graphics & multimedia: science, engineering, medical, business, journalism, industry, government, management, communication, art, entertainment, AI, games, advertising, education and training. [5%]

B) Interactive Graphics System: Raster vs. vector graphics, video display unit / monitor (CRT, LCD, TFT, LED, Plasma – gas, electroluminescent (EL), vacuum fluorescent); types, construction and specification of display devices; non – linear nature of CRT monitor (to gray scale) and corresponding gamma correction; architecture of a raster graphics system, video adapter card, display standards, frame buffer, Video RAM, graphics controller and processor, MCA / PCI / AGP / PCIE interfaces, VGA / DVI / S – Video / HDMI interfaces, DAC, Video BIOS; 3D viewing devices, stereoscopic and virtual reality systems, random scan display and system; hard copy devices; types, construction and specification of different printers and plotters; logical interactive functions, physical interactive input devices (keyboard, mouse, trackball, space ball, joystick, data glove, touch panel, control dial, function switches, light pen, voice input), data generation / digitizer devices (scanner, digital camera, 3D digitizer, motion capture); input modes (request, sample, event); graphics functions; graphics standards; different contemporary graphics software, typical elements of GUI of a multimedia computer ;Human Computer Interaction (HCI). [15%]

C) Colours in Graphics: Spectrum of visible light, spectral colours, colour of light source vs. visible object, human sensation to light / colour; hue / colour / dominant frequency / dominant wavelength, brightness / luminance / gray scale, purity / saturation, chromacity / chrominance (hue + saturation); intuitive description (pure colour, shade, tint, tone); concept of primary colours, non – availability of finite set of primary colours, colour matching experiments, standard primaries, CIE XYZ colour space and chromacity diagram, problem with 500 nm range colours; need for colour model and gamut; RGB model and colour cube (tri – stimulus theory of vision, chromacity coordinates of R, G, and B in NTSC standard / CIE model / colour monitors), concept of splitted vs. composite signal: NTSC YIQ, PAL YUV, SECAM models; subtractive colour model in hardcopy devices: CMYK model and colour cube; device independent / other models: Ostwald, Munsell, HSV, HLS, CIE Lab, CIE Luv, Pantone; comparison and conversion between different colour models; indexed colour: colour look – up table; tone of graphics: continuous tone, bi – tone, half – tone. [15%]

D) 2D Raster Graphics Generation: Concept of point, line (straight / curved) and area, shape drawing vs. area filling, Cartesian vs. polar coordinate system, non – parametric (implicit / explicit) vs. parametric representation, modelling objects using Euclidean geometry / fractal geometry / graftals / others, sequential vs. parallel algorithms, properties of conic sections (straight line, circle, ellipse, parabola, hyperbola), spirals, graphs of polynomial, trigonometric, exponential, non – linear regression, probability distribution functions, splines (interpolation and approximation), Bézier curves; difference between real object (dimensionless point based) and raster graphics (2D pixel based), basic object drawing (scan conversion) algorithms (DDA / Bresenham's midpoint line drawing, midpoint circle / ellipse drawing); maintenance of object geometry in raster graphics; area within a polygon / curved boundary; methods of polygon filling: scan – line (parity scan, ordered edge fill, edge fill, edge flag), seed fill (boundary, flood, soft, tint fill); dealing with inside / outside region of a complex polygon (odd – even rule, exterior rule, non – zero winding rule); simple antialiasing techniques for achieving realistic appearance; drawing attributes. [35%]

E) Graphics Transformations: Concept of transformation, transformations before and after scan conversion (object space and image space) or both; types of transformations: geometric transformation (translation, rotation, scaling, reflection, shear), viewing transformation (windowing, clipping against rectangle / arbitrary convex polygon, scissoring, zooming, panning), coordinate transformation (affine), projection transformation (parallel / perspective projections, projection / isometric view), modelling transformation, composite transformation , image transformations (cropping, half – toning / dithering, masking, filtering, morphing, effects);

2D & 3D homogeneous coordinates; transformation matrix for 2D & 3D simple & composite geometric, projection, coordinate & dithering transformations; clipping algorithms: line clipping (Cohen – Sutherland, Cyrus – Beck, Liang – Barsky, Nicholl – Lee – Nichole), polygon clipping (Sutherland – Hodgeman, Weiler – Atherton), circle and ellipse clipping. [15%]

F) 3D Graphics Specialties: Modelling and representation of natural 3D surface, solid, particles, clouds; hidden surface (line) elimination / visible surface (line) detection techniques in object space / image space: sorting and coherence; floating horizon, haloed line, Z – buffer, A – buffer, scan – line, depth sorting, BSP, area subdivision, octree, wireframe methods; concept of illumination; concept of 3D surface rendering: transparency, shading, shadows, texture, ray tracing, radiocity. [15%]

REFERENCE BOOKS:

1) *Computer Graphics (C version):* Donald Hearn, M. Pauline Baker, Pearson
2) *Procedural Elements for Computer Graphics*: David F. Rogers, Tata McGraw Hill
3) *Computer Graphics Principles & Practice, 2nd Edition in C:* J. D. Foley, A. van Dam, S. K. Feiner, J. F. Hughes, Pearson
4) *Principles of Interactive Computer Graphics, 2nd Edition*: William M. Newman, Robert F. Sproull, Tata McGraw Hill
5) *Fundamentals of Multimedia*: Ze – Nian Li and Mark S. Drew, Prentice Hall
6) *Principles of Multimedia, 2nd Edition, 2012:* Ranjan Parekh, Tata McGraw Hill

MCSA-MIE-303: (Java for Scientific Computing)

A) Java program structure, tokens, statements, java virtual machine, constants, variables and data types, flow control statements, input output statements, arrays implementation of object oriented concepts , packages 50%

B) General scientific programs 20%

C) Programming numerical methods, zeros of functions integration, regression and curve filling 30%

MCSA-304 (Term Paper)

A real life minor project: problem on current topics in the field of Computer Science and / or Information Technology involving reasonable size program development (which is not possible in practical classes) will be assigned to every student and the student has to

present the problem in form of seminar (at the end of 5th semester) in presence of departmental teacher(s) and external expert(s). Student will carry on his / her project work in guidance of one departmental teacher.

MCSA-305 Lab V (Graphics Lab)

Drawing, modifying, transforming, changing attributes, managing, rendering 2D & 3D graphics using AutoCAD; implementation of different computer graphics algorithms using C / C++ / Java / VB.

MCSA-306 Lab VI (Application should be developed using java)

Implementation of the following features: multithreaded programming, Applet, event handling, abstract window toolkit, Java Servlet, Java Server Pages, Java Database Connectivity (JDBC), object serialization and Remote Method Invocation (RMI).

MCSA – 401: COMPILER DESIGN:

A) **Introduction:** Evolution of programming languages; language processors; interpreters, compilers, assemblers, pre – processors, linker / loader, virtual machine. [10%]

B) **Overview of Compiler:** Overview of a compiler; structure, phases and passes of compiler; problems of compiler design; application of compiler design technology; inter – dependencies between compiler and computer architecture. [10%]

C) **Formal Languages:** Elements of formal language theory [10%]

D) **Regular Languages:** Regular grammars, regular expressions, finite state automata; conversions; state minimization. [10%]

E) **Lexical Analysis:** Lexical analysis vs. parsing; tokens, patterns, lexemes; input buffering; specification and recognition of tokens; lexical analyzer. [10%]

F) **Syntax Analysis / Parsing:** Context free grammar; parse trees and derivations; ambiguity; elimination of left recursion and left factoring; top – down parsing: recursive – descent parsing, predictive parsing, LL(1) parsers; bottom – up parsing: shift – reduce parsing, conflicts; LR parsing (simple, canonical, look ahead); operator precedence. [25%]

G) Intermediate Code Generation: Intermediate code generation, symbol tables, syntax trees; type checking, control flow statements, back – patching; code optimization; code generation; flow graphs. [20%]

H) Error Detection And Recovery: Error detection and recovery. [5%]

REFERENCE BOOKS:

1) *Compilers – Principles, Techniques & Tools*: Aho, Sethi & Ullman, Addison Wesley
2) *Compiler Design in C:* Holub, PHI
3) *Compiler Design*: Dhamdhere
4) *Principles of Compiler Design:* Alfred V. Aho & Jeffrey D. Ullman, Narosa

MCSA-402 Elective I

MCSA-403 Elective II

MCSA -404 Project:

PROJECT WORK:

Students should complete their project work preferably in the department under the **guidance of a teacher of the department**. Duration of the project in the department should be about 5 months.

After completion of the project work, student should prepare a report and present a seminar in front of departmental teachers as well as external expert(s).

MCSA- 405 Lab VII (Compiler Design)

Compiler Design Lab.: Implementation of different compiler design principles.

MCSA 406 Lab VIII (Elective Lab)

The application should be developed using different algorithms based on MCSA-402 & MCSA-403

Elective-I

E-I.1: ARTIFICIAL INTELLIGENCE & APPLICATION

Introduction: Importance of Artificial Intelligence (AI), problem solving using AI approach. [5%]

Knowledge: Its representation, Organisation, Manipulation and Acquisition. [5%]

Predicate Logic in AI: First Order Predicate Logic and its use in knowledge representation, Resolution Principle. Use of Resolution in reasoning and question answering. [10%]

AI Programming Languages: Introduction to PROLOG and LISP. [20%]

Production Systems and Search Strategies: Production System and its variants, Search Methods, Heuristic Search Methods , AND/OR Graphs and AO* Algorithm, Searching Game Trees. [15%]

Soft Computing and Uncertainty Management: Introduction to Fuzzy Logic, NN and GA; Bayesian inferencing, Dempster-Shafer theory of Beliefs. [15%]

Structured Representation of Knowledge and reasoning: Semantic Networks, Frames, Scripts, and Conceptual Dependency. [8%]

Expert Systems(ES): Rule Based Expert System Architecture, Non-production System Architecture, Neural Network based ES, Knowledge Acquisition Methods, Explanation Methods, Case study: Mycin; Expert System Shells. [12%]

Introduction to Pattern Recognition, Natural Language Processing, Planning**,** etc. [10%]

BOOKS:

1. Introduction to Artificial Intelligence & Expert System by D.W. Patterson, PHI.
2. Introduction to Artificial Intelligence by Rich & Knight
3. Principle of Artificial Intelligence by N.J. Nilson, Narosa.

E-I.2: NATURAL LANGUAGE PROCESSING:

A) **Introduction, Origins and History:** Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, knowledge representation, Introduction to semantics. [10%]

B) Machine Translation: Word-based alignment and translation - *n*-gram language models**;** Phrase-based translation **–** Maximum entropy; Minimum error – rate training. Perceptron; Subword translation **–** Transliteration; Integrating traditional translation rules. Integrating morphology into translation; Syntax-based translation **–** Hierarchical and syntax-based MT. CKY decoding, Syntax-based language models. [30%]

C) Computational Linguistics: Relationship between linguistics and NLP, computational models for phonology, unphology, lexicography, syntax, semantics and discourse. [20%]

D) **Information Retrieval (IR):** Definition of information retrieval system, Objectives of information retrieval system, Function overview**,** Database file structures, Boolean retrieval systems, Vector retrieval system, Probability Retrieval System. [40%]

REFERENCE BOOKS:

1) *Natural Language Processing and Information Retrieval:* U. S. Tiwary, Tanveer Siddiqui
2) *Statistical Machine Translation*: Philipp Koehn
3) *Computational Linguistics:* R., Grishman, Cambridge University Press
4) *Introduction to Information Retrieval:* Manning, C.D., Raghavan, P. and Schütze

E-I.3: ADVANCED DBMS:

A) **Overview:** Introduction to database system concept and architecture, network model overview, hierarchical model overview. [2%]

B) **Transaction processing and concurrency control:** Introduction of Transaction Processing, Transaction Execution and problems, Transaction properties, concurrent executions, serializability, recoverability, implementation of isolation, Transaction support in sql, Testing for serializability, problems of Concurrency Control – Locks, Optimistic Concurrency Control, Timestamping Concurrency Control, transaction processing monitors, transactional workflows, main memory data-bases, real-time transaction systems, transaction management in multidatabases . [15%]

C) **Database Recovery Techniques:** failure classification, recovery concept, log-based recovery, recovery with concurrent transaction, buffer management, other recovery techniques. [10%]

D) **Advance relational database design:** Multi valued dependencies, join dependencies, 4NF, 5NF, domain-key normal form. [10%]

E) **Advance SQL:** Integrity constraints, authorization, embedded sql, dynamic sql, recursive queries, advance sql features. [10%]

F) Object-based databases and XML: introduction, complex data types, structured types and inheritance in SQL, table inheritance, array and multi – set types in SQL, object –identity and reference types in SQL, implementing O – R features, introduction to XML, Structure of XML data, XML document schema, querying and transformation, application program interfaces to XML, storage of XML data, XML application. [15%]

G) Object oriented databases: introduction, notion of abstract data type, object oriented systems, object oriented db design. [5%]

H) Expert data bases: use of rules of deduction in data bases, recursive rules. [5%]

I) Fuzzy data bases: fuzzy set & fuzzy logic, use of fuzzy techniques to define inexact and incomplete data bases. [5%]

J) Distributed Databases: Distributed versus Centralized Databases, Principles of Distributed Databases, types of distributed database systems, query processing in distributed databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design, The Management of Distributed Transactions, Concurrency Control and recovery in Distributed databases, an overview of client-server architecture and its relationship to distributed databases ,distributed databases in oracle. [15%]

K) **Data warehousing and Data Mining**: brief overview, data analysis and OLAP, Architecture, Data flows, Tools & Technologies, Data Marts, Online Analytical Processing. [5%]

L) **Mobile & Multimedia databases:** introduction and overview. [3%]

REFERENCE BOOKS:

1) *Modern Database Systems:* W. Kim*,* Addison Wesley Pub. Co., 1995
2) *Introduction to Object Oriented Databases*: W. Kim, MIT Press, 1992.
3) *Principles of Database and Knowledge Base Systems*, Vol I & II: J. D. Ullman, *Computer* Science Press, 1988.
4) *Foundation of Deductive Databases and Logic Programming:* J. Minker (Editor)

5) *Distributed Databases Principles & Systems*, Stefano Ceri, Giuseppe Pelagatti, TMH
6) *Principles of Distributed Database Systems*, M. Tamer Ozsu, Patrick Valduriez, Pearson Education, 2nd Edition
7) *Distributed Database Systems*, Chhanda Ray, Pearson.

E-I.4: PATTERN RECOGNITION

Introduction to pattern recognition, idea of pattern, machine perception, pattern recognition systems, design cycle, learning and adaptation.

Bayesian decision theory, continuous features. [20%]

Maximum-likelihood, estimation of maximum likelihood, Bayesian estimation, Bayesian parameter estimation, Gaussian case and general theory, problems of dimensionality, Markov model, hidden Markov model

Idea of nonparametric models, density estimation, parzen windows, k-nearest- neighbor estimation, nearest-neighbor rule, nearest-neighbor classification. [20%]

Linear discriminant functions, decision surfaces, generalized linear discriminant functions, 2-category linearly separable case, minimizing the perceptron criterion function, relaxation procedure, non-separable behavior, minimum squared error procedure, Ho-Kashyap procedures, multi-category generalizations

Introduction to nonmetric methods, decision tree, cart, ID3, C4.5 [20%]

Algorithm independent machine learning, lack of inherent superiority of any classifier, bias and variance, resampling for estimating statistic, resampling for classifier design, estimating and comparing classifiers, combining classifiers. [15%]

Introduction to clustering, unsupervised learning, aspects of clustering, mixture densities and identifiability, maximum-likelihood estimations, application to normal mixtures, unsupervised bayesian learning, data description and clustering criterion function for clustering, different types of clustering, clustering algorithms. [25%]

Reference Books:

1. Duda, Hart, and Stock, ***Pattern Classification***, John Wiley and Sons.

2. Gose, Johnsonbaugh and Jost, ***Pattern Recognition and Image analysis***, PHI

Elective-II

E-II.1: CRYPTOGRAPHY & NETWORK SECURITY

UNIT–I
[20%]

Introduction to security, attacks, services, mechanisms, security attacks, security services, model for network security, internet standards

UNIT–II
[20%]

Conventional encryption principles, conventional encryption algorithms, message confidentiality, cipher block modes of operations, location of encryption devices, key distribution

UNIT–III
[20%]

Introduction to public key cryptography, approaches to message authentication, secure hash functions, HMAC, public key cryptography principles, public key cryptography algorithms, digital signatures, key management

UNIT–IV
[20%]

Authentication, e mail security, Kerberos, x.509 directory authentication services, PGP, S/MIME.

Overview of IP security, IP security architecture, authentication header, encapsulating security pay load, combing security associations, key management.

UNIT–V
[20%]

Introduction to web security, web security requirements, SSL & transport layer security, SET network management security.

Basics of system security, intruders, viruses-related threats, firewalls, design principles, trusted systems

REFERENCE BOOKS:

1. William Stallings, ***Network Security Essentials Applications and Standards***, Pearson Education

2. Kaufman, ***Network Security: Private Communication in a Public World***, Pearson Education
3. William Stallings, ***Cryptography and Network Security***, Pearson Education.

E-II.2: MOBILE COMPUTING

UNIT–I
[20%]

Introduction to personal communications services (PCS), PCS architecture, mobility management, networks signaling.

Overview of Global system for mobile communication (GSM) system, GSM architecture, mobility management, network signaling.

Overview of general packet radio services (GPRS), GPRS architecture, GPRS network nodes.

Basics of mobile data communication, WLAN (wireless LAN) IEEE 802.11 standard, mobile IP.

UNIT–II
[20%]

Wireless application protocol (WAP), mobile internet standard, WAP gateway & protocols, wireless mark up languages (WML), WML script.

Introduction to wireless local loop(WLL), WLL architecture, wireless local loop technologies.

UNIT–III
[20%]

Basics of third generation (3G) mobile services, introduction to international mobile telecommunications 2000 (IMT 2000) vision, wideband code division multiple access (W-CDMA), and CDMA 2000, quality of services in 3G.

UNIT–IV
[20%]

Global mobile satellite systems, case studies of the IRIDIUM & GLOBALSTAR systems.

Wireless enterprise networks, introduction to virtual networks, blue tooth technology, blue tooth protocols.

UNIT–V
[20%]

Support for mobility, file system consistency, world wide web, hypertext transfer protocol, hypertext markup language, some approaches that might help wireless access, system architectures, wireless application protocol & its architecture, wireless datagram protocol, wireless transport layer security, wireless transaction protocol, wireless session protocol, wireless application environment, wireless telephony application, examples stacks with WAP, mobile databases, mobile agents

Reference Books:

1. Jochen Schiller, ***Mobile Communications***, Addison wisely

2. Wiiliam Stallings, ***Wireless Communications and Networks***.

3. Rappaort, ***Wireless Communications Principals and Practices***.

E-II. 3: IMAGE PROCESSING

UNIT–I
[20%]

Image acquisition, image model, sampling, quantization, relationship between pixels, distance measures, connectivity, image geometry, photographic film.

Basics of histogram, decision of contrast basing on histogram, histogram based operations, histogram equalization.

Fourier transform, DFT, FFT, properties, Walsh transform, WFT, Hadamard transform.

UNIT–II
[20%]

Arithmetic & logical operations, operations on pixel, smoothing filters, mean, median, mode filters.

Edge enhancement filters, contrast based edge enhancement techniques, low pass filters, high pass filters, sharpening filters, comparative study.

Design of low pass, high pass, edge enhancement, smoothening filters in frequency domain.

Basics of color image processing.

UNIT–III
[20%]

Introduction to image compression, run length encoding, contour coding, Huffman code, compression due to change in domain, compression due to quantization compression at the time of image transmission, image compression standards.

UNIT–IV
[20%]

Introduction to image segmentation, characteristics of segmentation, detection of discontinuities, thresholding, pixel based segmentation method, region based segmentation methods, segmentation by pixel aggregation, segmentation by sub region aggregation, histogram based segmentation, spilt and merge technique, use of motion in segmentation.

UNIT–IV
[20%]

Introduction to morphology, dilation, erosion, opening, closing, hit-and-miss transform, boundary extraction, region filling, connected components, thinning, thickening, skeletons, pruning, applications of morphology in ip.

Reference Book:

1. Gonzalez & Woods, ***Digital Image Processing*** , Addision Wesley
2. Arthur Weeks, ***Fundamentals of Electronic Image Processing***, PHI

E- II.4: ADVANCED JAVA

Introduction: Java as Object Oriented Language, Internet Language. Review of Object Oriented Program. [5%]

Multithreaded Programming: Overview of Threads, Creating Threads, Synchronization,

Deadlock, Thread Communication. [8%]

Java Applet: Overview, Life cycle of Applet, Applet – Graphics Class, Colours, Displaying Text, Applet Dimensions, Applet in web page, Applet Class, Appletcontext Class, using Threads and Images. [7%]

Introduction to Event Handling: Event Model, Event Class, Event Listeners, Adapter Class, Inner Class. [10%]

Abstract Window Toolkit: Labels, Buttons, Canvases, Check Boxes, Choices, Text field and Text Areas, Lists, Scroll bars, Layout Manger, Panels, Frame, Menu Bar, Dialog Box. [20%]

Java Servlet: Introduction, The Three-tier application architecture, Working of a Web Server, Basic, Servlet Structure, Servlet Life Cycle, Servlet API and the anatomy of a Servlet – Servlet Interface, GenericServlet Class, HttpServlet Class. [20%]

Java Server Page: Introduction, Architecture of JSP, JSP API, Life Cycle of JSP. Interaction with Database using JSP, JSP to Servlet Interaction. [15%]

Java Database Connectivity (JDBC): Introduction, PreparedStatement Interface, CallableStatement Interface, DatabaseMetadata Interface – Getting Driver Information, Working with Tables, Stored Procedures; Working with ResultsetMetadata Object, Using Trandsactions, Using Java.sql with Applets, Session. [10%]

Object Serialization and Remote Method Invocation (RMI): Introcution, Distributed Object Model; RMI – Architecture, Stub and Skeleton, Layer, Remore Reference Layer, Transport Layer, Remote Registry; Package of RMI; Implementing RMI – The Server, The Client. [5%]

BOOKS:

1. Core Java-2 Volume I & Volume II – Cay S. Horstmann, Gray Cornell, Pearson Education
2. Teach Yourself Java - Joseph O'Neil, Heb Schildt, TMH