Course Structure and Syllabus for M.Tech(Information Technology) in Software Engineering, JIS College of Engineering (Under West Bengal University of Technology)

Semester 1

Paper Code	Paper Name	Weekly Contact Period (WCP)				Credit	Marks
		Lecture	Tutorial	Practical	Total		
	Theoretical:						
MSE101	Data Structure & Algorithm	4	0	0	4	4	100
MSE102	DBMS	4	0	0	4	4	100
MSE103	Software Engineering	4	0	0	4	4	100
MSE104	Discrete Structure	4	0	0	4	4	100
MSE105	Object Oriented Programming	4	0	0	4	4	100
	Practical:						
MSE191	Data Structure Laboratory	0	0	3	3	3	100
MSE192	DBMS Laboratory	0	0	3	3	3	100
MSE195	Object Oriented Prog. Laboratory (C++)	0	0	3	3	3	100
Total Credit: 29 Total Marks: 800							

Semester 2

Paper Code	Paper Name	Weekly Contact Period (WCP)				Credit	Marks
		Lecture	Tutorial	Practical	Total		
	Theoretical:						
MSE201	Operating Systems	4	0	0	4	4	100
MSE202	Software Project Management & TQM	4	0	0	4	4	100
MSE203	Object Oriented Software Engineering & UML	4	0	0	4	4	100
MSE204	Computer Network	4	0	0	4	4	100
	Practical:						
MSE291	Object Tech. Laboratory	0	0	3	3	3	100
MSE292	SPM Laboratory	0	0	3	3	3	100
Total Credit: 22 Total Marks: 600							

Semester 3

Paper Code	Paper Name	Weekly Contact Period (WCP)				Credit	Marks
		Lecture	Tutorial	Practical	Total		
	Theoretical:						
MSE301	Web Technology	4	0	0	4	4	100
MSE302	Elective I*	4	0	0	3	4	100
MSE303	Elective II*	4	0	0	3	4	100
	Practical:						
MSE391	Web Technology Lab	0	0	3	3	3	100
MSE395	Assigned Project (minor)	0	0	6	6	4	100
Total Credit: 17 Total Marks: 500							

Semester 4

Paper Code	Paper Name	Weekly Contact Period (WCP)				Credit	Marks
		Lecture	Tutorial	Practical	Total		
	Theoretical: none						
	Practical:						
MSE 491	Seminar	0	0	3	3	2	100
MSE495	Assigned Project (major)	0	0	12	12	8	100
Total Credit: 10 Total Marks: 200							

* Electives to be selected from the following list
** Assigned Project is to be done throughout the final two semesters of study; Entire Design with DFD/ Use Case/ Production System is to be submitted as Minor (MSE395) and completed in all aspect including testing and implementation is to be submitted as Major (MSE495)
*** Seminar should be presented on a very recent topic on any technological domain.

	Elective I MSE302	**Elective II** MSE303
A.	Formal Language & Automata Theory	Compiler Design
B.	Artificial Intelligence	Soft Computing
C.	Computer Graphics and Multimedia	Image Processing and Pattern Recognition
D.	Real Time & Embedded Systems	Mobile Communication
E.	BioInformatics	Data Encryption and Compression
F.	Data Mining & Data Warehousing	Remote Sensing and GIS
G	Mechatronics	Design and Analysis of Algorithm

Total Course Credit: 80

1st Semester

Data Structures and Algorithms
Code: MSE101
Weekly Contact Hour: 4L
Credit: 4

Introduction [4L]
Time and Space analysis of Algorithms - Order Notations.

Linear Data Structure [14L]
Linear Data Structures - Sequential representations - Arrays and Lists, Stacks, Queues and Dequeues, strings, Application.
Linear Data Structures, Link Representation - Linear linked lists, circularly linked lists. Doubly linked lists, application.

Recursion [2L]
Recursion - Design of recursive algorithms, Tail Recursion, When not to use recursion, Removal of recursion

Linear Data Structure [12L]
Non-linear Data Structure: Trees - Binary Trees, Traversals and Threads, Binary Search Trees, Insertion and Deletion algorithms, Height-balanced and weight-balanced trees, B-trees, B+ -trees, Application of trees; Graphs - Representations, Breadth-first and Depth-first Search.

Sorting & Searching [8L]
Sorting and Searching Algorithms- Bubble sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and Radix Sort; Linear Search and Binary Search.
Hashing - Hashing Functions, collision Resolution Techniques.

Files [4]
File Structures - Sequential and Direct Access. Relative Files, Indexed Files - B+ tree as index. Multi-indexed Files, Inverted Files, Hashed Files.
Text book :

1. Tanenbaum, A. S., "Data Structures using 'C'", PHI

References :

2. Weiss Mark Allen, "Algorithms, Data Structures, and Problem Solving with C++", Addison Wesley, Pearson.
3. Horowitz Ellis & Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Pub.
4. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", Addison Wesley
5. Drozdek- Data Structures and Algorithms, Vikas

Database Management System Concept
Code: MSE102
Weekly Contact Hour: 4L
Credit: 4

Introduction [4L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5L]
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints [8L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Relational Database Design [9L]
Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF

Internals of RDBMS [7L]
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures [6L]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Text Book:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.

References:

2. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, “Transaction Processing: Concepts and Techniques”, Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.
7. Ullman JD., “Principles of Database Systems”, Galgottia Publication.

Software Engineering
Code: MSE103
Weekly Contact Hour: 4L
Credit: 4

System Analysis and Design [10L]

Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.

Design related issues [10L]
System Requirement Specification – DFD, Data Dictionary, ER diagram, Process Organization & Interactions. System Design – Problem Partitioning, Top-Down And Bottop-Up design ;Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

Coding & Documentation [12]
Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.

User Interface [5L]
Module Introduction, Objectives of Usability, How to Approach Usability, Designing with Usability in mind, Measuring Usability, Guidelines for User Interface Design, User Interface Elements.

Software Project Management [8L]
Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.

Text Book:

1. R. G. Pressman – Software Engineering, TMH

References:

1. IEEE Standards on Software Engineering. Kane, Software Defect Prevention, SPD
2. Behforooz, Software Engineering Fundamentals,OUP
3. Ghezzi, Software Engineering, PHI
4. Object Oriented & Classical Software Engineering(Fifth Edition), SCHACH,TMH
5. Vans Vlet, Software Engineering, SPD
6. Uma, Essentials of Software Engineering, Jaico
7. Sommerville, Ian – Software Engineering, Pearson Education
8. Benmenachen, Software Quality, Vikas

Discrete Structure
Code: MSE104
Weekly Contact Hour: 4L
Credits: 4

Sets and functions [12L]

Groups, Semi groups and monoids, Cyclic semi groups and submonoids, Subgroups and Cosets, Congruence relations on Semi groups. Morphisms, Normal subgroups. Structure of cyclic groups, permutation groups, dihedral groups. Elementary applications in coding theory.

Rings and Boolean Algebra [10L]
Rings, Subrings, morphism of rings, ideals and quotient rings. Euclidean domains. Integral domains and fields. Boolean Algebra - direct product, Morphisms. Boolean sub-algebra. Boolean Rings. Applications of Boolean algebra in logic circuits and switching functions.

Recursion and Recurrence Relation [5L]
Basic idea, Sequence and discrete function. Generating functions and applications.

Graph Theory [18L]
Graphs, Digraphs, Isomorphism, Walks, Paths, Circuits, Shortest Path Problem, Dijkstra's Algorithm, Trees, Properties of Trees, Cotrees and Fundamental Circuits, Shortest Spanning Trees - Kruskal's Algorithm, Prims' Algorithm, DFS, BFS, Cut Sets, Fundamental Cut Sets and Cut Vertices, Planar and Dual Graphs, Metric Representation of Graphs, Networks, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow.

Text Book:

1. Kolmann, Busby and Ross, "Discrete mathematical structures", 3/ed, Pearson Ed.

References:

2. Liu C. L., "Introduction to combinatorial mathematics", McGraw Hill, 1968.
3. Mott J. L., Kandel A. and Baker T. P., "Discrete mathematics for Computer Scientists and Mathematicians", PH, 1986.
4. Rosen—Discrete Mathematics, 2/e, TMH
5. S.K. Mapa—Higher Algebra (Abstract & Modern)

6. Robert J. McElice, Robert B. Ash & Carol Ash, "Introduction to discrete Mathematics", Tata McGraw Hill
7. Deo N., "Graph Theory with Applications to Engineering and Computer Science", PHI, 1980
8. Tremblay and Manohar, "Discrete mathematical structures with applications to computer science", McGraw Hill, 1975

Object Oriented Programming

Code: MSE105
Weekly Contact Hour: 4L
Credit: 4

OOP preliminaries [4L]

Contrast with Structured Programming; basic concepts of objects, classes, abstraction, encapsulation, polymorphism, inheritance, dynamic binding & message communication.

C++ preliminaries [6L]

Tokens, Keywords, Variable, scope of variables, Data type, pointers, generic pointers, operators-scope resolution, member de-referencing operators, memory management operators, manipulators, type cast operators;
Symbolic constants, Type compatibility, Dynamic initialization, Flexible declaration, Reference variable, Call by reference.

Objects & Classes [9L]

abstract & declaration syntax, visibility label-private, public, protected, Inline concept, Static data member & member function, Array of objects, Pointer to objects & members, Array of pointers to objects.

Functions [4L]

Declaration & definition, exploring arrays & strings, function overloading, const function, Passing & returning object through function, The Friend function.

Constructors & Destructors [4L]

Default constructors, default argument constructor, parameterized constructor, Copy constructor, Destructor.

Inheritance and Polymorphism [10L]

Visibility modes, Single Inheritance, Multi-level Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual base class, abstract class.
Function Overloading, Operator overloading, overloading unary, binary, string manipulation using operators. Run time - Virtual function, pointer to object, this pointer, pure virtual function.

Files & advanced features [7L]

C++ file streams, stream classes, detecting end-of-file, file pointers & their manipulations;
Managing console I/O, Templates & Exception handling, class templates, templates function.

Text Book:

1. Object Oriented Programming using C++, Robert Lafore, Pearson

References:

2. Waite Groups C++ Primer Plus, Stephen Prata, Techmedia.
3. C++ Primer, Lippman & Lajoie, Pearson.
4. The C++ Programming Language, B.J. Stroustrup, Pearson.
5. C++ Complete Reference, Shield, MGH
6. Object Oriented Programming using C++, Balagurusamy, TMGH

2nd Semester

Operating System
Code: MSE201
Weekly Contact Hour: 4L
Credits: 4

Introduction [4L]
Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure [3L]
Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management [17L]

Processes [3L]: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.
Threads [2L]: overview, benefits of threads, user and kernel threads.
CPU scheduling [3L]: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.
Process Synchronization [5L]: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks [4L]: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management [19L]

Memory Management [5L]: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.
Virtual Memory [3L]: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.
File Systems [4L]: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.
I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.
Disk Management [3L]: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Protection & Security [4L]
Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Text Book:

1. Silberschatz A. and Galvin: “Operating System Concepts”, Wiley.

References:

1. Milankovic M., “Operating System : Concept & Design”, McGraw Hill.
2. Tanenbaum A.S., “Operating System Design & Implementation”, Practice Hall NJ.
3. Dhamdhere: Operating System TMH

4. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
5. Dietel H, N., "An Introduction to Operating Systems", Addison Wesley.

Software Project Management & TQM

Code: MSE202
Weekly Contact Hour: 4L
Credit: 4

Introduction to SPM [6L]
Introduction, Management Approaches, Team Approaches, Critical Practices, Capability maturity Model, Personal Software Process, Earned value Analysis, Error tracking, Riviews.

Software Project Planning [4L]
Project Planning, Work Breakdown Structure, PERT-Program Evaluation and Review Technique, Software Cost Estimation.

Software Metrics [4L]
Software Measurement Theory, Product Metrics, Process Metrics, The GQM approach

Risk Analysis [4L]
Risk Identification, Risk estimation, Exposure, Mitigation, Management Plans

Project Management Issues [12L]
Issues in Project Management, Management Functions, Software Project Management Plan, Software Management Structure, Personnel Productivity, Software Project Complexity, Software Metrics – Basic Consideration, Size Oriented and Function Point Oriented; Software Cost Estimation Techniques, Algorithmic Cost Modeling, The COCOMO Model, Project Scheduling, Software Project Planning, Scheduling Risk Management.

Quality Assurance [4L]
Introduction, Formal Inspection and technical reviews, Software Reliability, Statistical Quality Assurance

Object-oriented Development [6L]
Objects identification and association, Object oriented metrics, Object Oriented Testing, Formal notation, Object Constraint Language.

CASE TOOLS: Concepts, use and application. [5L]

Text Books:

1. Software Engineering, W.S.Jawadekar, TMH, 2006

Reference:

2. Software Engineering, Rogers G. Pressman, MH
3. Classical and Object Oriented Software Engineering, Schach, TMH
4. Software Engineering: Principles & Practice,Van Vliet, SPD/JOHN WILEY
5. Software Engineering, K.K.Aggarwal & Yogesh Singh, New Age International
6. Software Engineering, Leon, VIKAS
7. Software Testing Fundamentals: Methods& Metrices, Marmie Hutcheson, And Wiley Dreamtech
8. Managing for Total Quality,Logothetis,PHI
9. TQM,J.Kiron,EPH

Object Oriented Software Engineering & UML

Code: MSE 203
Weekly Contact Hour: 4L
Credit: 4

Introduction [6 L]
Why object orientation, History and development of Object Oriented Programming language, concepts of object oriented programming language.

Object oriented analysis [4L]
Usecase diagram; Major and minor elements, Object, Class.

Object oriented design [10 L]
Relationships among objects, aggregation, links, relationships among classes- association, aggregation, using, instantiation, meta-class, grouping constructs.

Basic concepts of object oriented programming using Java [15 L]
Object, class, message passing, encapsulation, polymorphism, aggregation, threading, applet programming, difference between OOP and other conventional programming-advantages and disadvantages.

Fundamentals of Object Oriented design in UML [12 L]
Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, statechart diagram, activity diagram, implementation diagram, UML extensibility- model constraints and comments, Note, Stereotype.

Text Books:

1. Ali Bahrami, - "Object –Oriented System Development" - Mc Graw Hill.
2. Rambaugh, James Michael, Blaha - "Object Oriented Modelling and Design" - Prentice Hall India/ Pearson Education
3. Bruce, Foundations of Object Oriented Languages, PHI
4. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" - TMH
5. Priestley – " Practical Object Oriented Design using UML" - TMH
6. Jana, C++ & Object Oriented Programming, PHI
7. Alhir, learning UML, SPD/O'Reily

Reference Books:

1. Page Jones, Meiler - "Fundamentals of object oriented design in UML"
2. Roff: UML: A Beginner's Guide TMH
3. Mahapatra: Introduction to System Dynamic Modelling, Universities Press
4. Muller : Instant UML, Shroff Publishers / Wrox
5. Srimathi, Object Oriented Analysis & Design Using UML, Scitech
6. Alhir : UML in a Nutshell, Shroff Publishers / O'reilly

Data Communications And Networking
Code: MSE 204
Weekly Contact Hour: 4L
Credit: 4

Overview of Data Communications and Networking [2L]
Introduction, Network Models

Physical Layer [8L]
Signals, Digital Transmission, Analog Transmission, Multiplexing, Transmission Media, Circuit Switching and Telephone Network.

Data Link Layer [9L]
Error Detection and Correction, Data Link Control and Protocol, Point to Point Access: PPP, Multiple Access, Local Area Networks: Ethernet, Wireless Lans, Connecting Lans, Backbone Networks, Virtual Lans, Cellular Telephone and Satellite Networks, Virtual Circuit Switching.

Network Layer [8L]
Host-to-Host Delivery :Internetworking, Addressing and Routing, Network Layer Protocols: ARP, IPv4, ICMP, IPv6, and ICMPv6, Unicast and Multicast Routing: Routing Protocols.

Transport Layer [5L]
Process-to-Process Delivery: UDP and TCP, Congestion Control and Quality of Service.

Application Layer [9L]
Client-Server Model: Socket Interface, Domain Name System (DNS), Electronic Mail (SMTP), and File Transfer (FTP), HTTP and WWW, Multimedia.

Security [4L]
Cryptography, Message Security, User Authentication, and Key Management, Security Protocols in the Internet.

Text Books:
1. B A Forouzan: Data Communications and Networking, TMH, 2003

Reference:
1. A S Tanenbaum: Computer Networks, PHI, 2004
2. W Stallings: Data and Computer Communications, PHI/Pearson
3. Comer, Computer Network, 2005, PHI

3rd Semester

Web Technology
Code: MSE 301
Weekly Contact Hour: 4L
Credit: 4

Static Web Pages [6L]
Web Pages - types and issues, tiers; comparisons of Microsoft and java technologies, WWW-Basic concepts, web client and web server, http protocol (frame format), universal resource locator (url), HTML-different tags, sections, image & pictures, listings, tables, frame, frameset, form.

Java Script [4L]
Data types, variables, operators, conditional statements, array object, date object, string object, Dynamic Positioning and front end validation, Event Handling

Dynamic Web Pages [4L]
The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation.

J2SE 1.4: Concepts and Prerequisites [7L]
Data Types, Arrays, Type Casting, Classes and Objects, Inheritance, Interfaces, Exception Handling, Multi Threading

J2EE Architecture [2L]
J2EE as a framework, Client Server Traditional model, Comparison amongst 2-tier, 3-tier and N-tier architectures, Thin and Thick Clients

Java Servlet [8L]
Brief origin and advantages over CGI, J2EE Servlet 2.x Specification, Writing small Servlet Programs, Deployment Descriptor, Inter Servlet Collaboration, Session: Definition, State on web, Different ways to track sessions,

JSP [14L]
Concept of MVC Architecture and the role of JSP, JSP life cycle, Syntax: Declarations, Scriptlets, Expression Language, Declaration, Directives, Action Tags

Text Books:

1. World Wide Web & Internetworking--- Dietel Dietel Nieto

Reference:

1. Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Professional Java Server Programming --- Allamaraju et al WROX
3. Java Server Programming Black Book
4. J2EE Guide---- Hunt, Loftus SPD
5. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers.

Elective Papers

Formal Language and Automata Theory
Code: MSE 302A
Weekly Contact Hour: 4L
Credit: 4

Finite State Machines [5L]
Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and liner sequential machines.

Finite State Models [5L]
Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information loss less & inverse machines: testing table & testing graph.

Structure of Sequential Machines [5L]
Concept of partitions, closed partitions, lattice of closed partitions, decomposition: serial & parallel.

Finite Automation [5L]
Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with e-moves, regular sets & regular expressions : equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata.

Closure Properties of Regular Sets [5L]
Pumping lemma & its application, closure properties minimization of finite automata: minimization by distinguishable pair, Myhill-Nerode theorem.

Context Free Grammars [5L]
Introduction, definition, derivation trees, simplification, CNF & GNF.

Pushdown Automata [5L]

Definition, moves, Instantaneous Descriptions, language recognized by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL.

Closure Properties of CFLs [5L]
Pumping lemma & its applications, Ogden's lemma, closure properties, decision algorithms.
Introduction to Z. Regular language properties and their grammars. Context sensitive languages.

Textbooks:

1. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
2. Linz Peter, "An Introduction to Formal Languages and Automata", Narosa Pub. House

References:

1. Kohavi ZVI, "Switching & Finite Automata", 2nd Ed., Tata McGraw Hill.
2. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
3. Kain, "Theory of Automata & Formal Language", McGraw Hill
4. "Introduction to Formal Languages", Tata McGraw Hill, 1983.

Artificial Intelligence
Code: MSE 302B
Weekly Contact Hour: 4L
Credit: 4

Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents [2]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving [2]
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques [5]
Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bi-directional search, comparing uniform search strategies.

Heuristic search strategies [5]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning [3]
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [2]
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [3]
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [4]
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning [2]
Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Natural Language processing [2]
Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning [2]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems [2]
Representing and using domain knowledge, expert system shells, knowledge acquisition.

Basic knowledge of programming language like Prolog & Lisp. [6]

Textbooks:

1. Artificial Intelligence, Ritch & Knight, TMH

References:

2. Artificial Intelligence A Modern Approach, Stuart Russell & Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Artificial Intelligence A new Synthesis, Neil J. Nilsson, Morgan Kaufman
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Artificial Intelligence, John. F. Lugar, Pearson Ed.
7. Artificial Intelligence, Winston, Pearson Ed.
8. Artificial Intelligence and Intelligent Systems – N.P. Padhy, Oxford Univ. Press

Computer Graphics & Multimedia
Code: MSE 302C
Weekly Contact Hour: 4L
Credit: 4

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.

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 view port 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, view port clipping, 3D viewing.

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 Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color & shading models [2L]
Light & color model; interpolative shading model; Texture;

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. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.) – Pearson Education.
3. D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

References:

1. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
2. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – TMH.

3. Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill
4. Buford J. K. – "Multimedia Systems" – Pearson Education
5. Andleigh & Thakrar, Multimedia, PHI
6. Hill, Computer Graphics using open GL, Pearson Education

Real Time & Embedded System

Code: MSE 302D
Weekly Contact Hour: 4L
Credit: 4

Introduction [6L]
Defining Real time systems, Designing and Developing Real-time Systems, Embedded Real Time Systems, Special Characteristics of real time systems, a brief evolutionary history.

Hardware Architectures of Real Time systems [10L]
Real-Time Devices, Event driven activities, Timers and Real-time Facilities, I/O Devices and Buses, Serial devices and parallel devices, Peripheral serial buses

Software architectures [7L]
Interrupts and Exceptions, Concepts of interrupt driven activation, need for real time monitor, pseudo parallelism, meeting of dead lines & real time constraints

Implementation model [10L]
Overview of WARD & MELLOR Methodology: Ward & Mellor Life Cycle, the essential model step, the, real time extensions of DFD

Real time languages: overview of ADA/Java Extension [4L]

Real time Operating Systems [4L]
Multitasking in Real-Time Systems, Scheduling, Synchronization, Inter-task communication
Networking, Embedded devices and networks

System Development Methodologies [4L]

Textbooks:

1. "Embedded System Design" Frank Vahid & Tony Givargis; John Wiley & sons, Inc.
2. "Real – Time Systems and software"Alan C. Shaw; John Wiley & Sons Inc
3. "Fundamentals of embedded Software", Daniel W. Lewis, Pearson
4. "Real time Systems", J. W. S. Liu, Pearson
5. "Embedded Real-time System Programming", S. V. Iyer and P. Gupta, TMH

References:

1. "An Embedded System Primer" David E. Simon; Addison-Wesley Pub
2. "Embedded System Design" Steve Heath; Butterworth-Heinemann Pub.
3."Embedded System Computer Architecture" Graham Wilson, Butterworth-Heinemann,

Bio Informatics

Code: MSE 302E
Weekly Contact Hour: 4L
Credit: 4

Introduction to Genomic data and Data Organization [12L]

Sequence Data Banks - Introduction to sequence date banks - protein sequence data bank. NBFR-PIR, SWISSPROT, Signal peptide data bank, Nucleic acid sequence data bank - GenBank, EMBL nucleotide sequence data bank, AIDS virus sequence data bank. RRNA data bank, structural data banks - protein Data

Bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank - Metabolic pathway data : Microbial and Cellular Data Banks.

Introduction to MSDN (Microbial Strain Data Network) [12L]

Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; other important Data banks in the area of Biotechnology/life sciences/biodiversity.

Sequence analysis: Analysis Tools for Sequence Data Banks; Pair wise alignment -NEEDLEMAN and Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data: Sequence patterns motifs and profiles.

Secondary Structure predictions [11L]

Prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking. Tertiary Structure predictions; prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Applications in Biotechnology [10L]

Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions: Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling & Dynamics, Drug Designing.

Textbooks:

1. Introduction to Bioinformatics, Atwood, Pearson Education

References

1. Lesk, Introduction to Bio Informatics, Lesk, OUP
2. Bioinformatics Computing, Bergeron, Pearson Ed.
3. Developing Bioinformatics Computer Skills, Cynthia Gibas and Per Jambeck, 2001 SPD
4. Beginning Perl for Bio-informatics, Tisdall, SPD
5. Biocomputing: Informatics and Genome Project, Smith, D.W., 1994, Academic Press, NY
6. Bioinformatics: A practical Guide to the Analysis of Genes and Proteins, Baxevanis, A.D., Quellette, B.F.F., John Wiely & Sons.
7. Murty CSV, Bioinfornmatics, Himalaya

Data Mining and Data Warehousing

Code: MSE 302F
Weekly Contact Hour: 4L
Credit: 4

Introduction [2L]

Data warehousing – definitions and characteristics, Multi-dimensional data model, Warehouse schema.

Data Marts [4L]

Data marts, types of data marts, loading a data mart, metadata, data model, maintenance, nature of data, software components; external data, reference data, performance issues, monitoring requirements and security in a data mart.

Online Analytical Processing [4L]

OLTP and OLAP systems, Data Modeling, LAP tools, State of the market, Arbor Essbase web, Micro strategy DSS web, Brio Technology, star schema for multi dimensional view, snowflake schema; OLAP tools.

Developing a Data Warehousing [4L]

Building of a Data Warehousing, Architectural strategies & organizational issues, design considerations, data content, distribution of data, Tools for Data Warehousing

Data Mining [4L]
Definitions; KDD (Knowledge Discovery database) versus Data Mining; DBMS versus Data Mining, Data Mining Techniques; Issues and challenges; Applications of Data Warehousing & Data mining in Government.

Association Rules [4L]
A priori algorithm, Partition algorithm, Dynamic inset counting algorithm, FP – tree growth algorithm; generalized association rule.

Clustering Techniques [4L]
Clustering paradigm, Partition algorithms, CLARA, CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; Categorical clustering, STIRR, ROCK, CACTUS.

Decision Trees [4L]
Tree construction principle, Best split, Splitting indices, Splitting criteria, Decision tree construction with presorting.

Web Mining [4L]
Web content Mining, Web structure Mining, Web usage Mining, Text Mining.

Temporal and Spatial Data Mining [5L]
Basic concepts of temporal data Mining, The GSP algorithm, SPADE, SPIRIT, WUM.

Textbooks:

1. Data Mining, Han & Kamber, Morgan Kaufman

References:

1. Data Warehousing –Concepts, Techniques, products, application; Prabhu; PHI.
2. Data Mining Techniques; A. K. Pujari; Universities Press.
3. Data Warehousing, Data Mining and OLAP; Alex Berson and Stephen J Smith; TMH.
4. Data Warehousing in the real world; Anahory; Pearson Education.
5. Data Mining Introductory & Advanced Topic; Dunham; Pearson Education.

Mechatronics
Code: MSE 302G
Weekly Contact Hour: 4L
Credit: 4

Introduction to Mechatronics [4L]
Mechatronics key elements, Mechatronics design process, approaches in Mechatronics

Modeling and Simulation of Physical System [6L]
Simulation and Block Diagrams, Analogies and Impedance Diagrams, Electrical Systems, Mechanical Translation systems, Mechanical rotational system, Electromechanical coupling, Fluid systems

Sensors and Transducers [7L]
Introduction to Sensors and transducers, Sensors for motion and position Measurement, force, torque, and Tactile sensors, flow sensors, Temperature – sensing devices, Ultrasonic sensors, range sensors, active vibration control Using magnetostrictive transducers, Fiber optic devices in Mechatronics.

Actuating Devices [7L]
Direct current motor, permanent magnet stepper motor, fluid power actuation, Fluid power design elements, Piezoelectric Actuators.

Hardware components for Mechatronics [4L]

Transducer signal conditioning and devices for data conversion, programmable Controllers.

Signals, systems and controls [4L]
Introduction to signals, systems, and controls, system representation, Linearization of Nonlinear systems, time delays, measures of system Performance, root locus and bode plots

Real- Time Interfacing [4L]
Introduction, Elements of a Data Acquisition and Control system, overview of the I/O process, Installation of the I/O card and software, installation of the Application software, examples of interfacing

Closed Loop controllers [5L]
Continuous and discrete processes, control modes, two step mode, proportional mode, derivative control, integral control, PID controller, digital controllers, control system performance, controller tuning, velocity control and Adaptive control

Advanced applications in Mechatronics [4L]
Sensors for condition monitoring, Mechatronics control in automated Manufacturing, artificial intelligence in Mechatronics, Fuzzy logic applications in Mechatronics, Micro sensors in Mechatronics

Text Books:

1. Mechatronics system design, Devdas Shetty and Richard.A.Kolk, Thomson sia Pte. Ltd. Second reprint, 2001
2. Bolton, Mechatronics, Pearson Education Asia, Third Indian Reprint 2001

References:

1. David G Alciatore and Michael.B.Histand, Introduction to Mechatronics and Measurement systems, Tata McGraw hill, Second Edition, 2003.

Compiler Design
Code: MSE 303A
Weekly Contact Hour: 4L
Credit: 4

Introduction to Compiling [3L]
Compilers, Analysis of the source program, the phases of the compiler, Analysis Synthesis Phase

Lexical Analysis [6L]
The role of the lexical analyzer**,** Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Syntax Analysis [9L]
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation [5L]
Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Type checking [4L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments [5L]

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Intermediate code generation [4L]
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization [5L]
Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations [4L]
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Textbooks:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI

References:

8. Programming Language Pragmatics – Scott, Morgan Kauffman

Soft Computing
Code: MSE 303B
Weekly Contact Hour: 4L
Credit: 4

Artificial Neural Network [3L]
Basic concept of Soft Computing; Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer, multilayer, competitive layer; Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Neuron.

Pattern Recognition [4L]
Pattern Classification, Pattern Association, Clustering, Simple Clustering algorithm, k-means & k-medoid based algorithm.

Models Of Neural Network [10L]
Architecture, Algorithm & Application of -- McCulloh-Pitts, Hebb Net, Perceptron (with limitations & Perceptron learning rule Convergence theorem), Backpropagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet , Kohonen Self Organizing Maps, ART1,ART2.

Fuzzy Sets & Logic [8L]
Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable, basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; Defuzzification methods; FAM;

Genetic Algorithm [10L]
Basic concept; role of GA in optimization, Fitness function, Selection of initial population, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation; Genetic Programming; Schema theorem; Multiobjective & Multimodal optimization in GA; Application—Travelling Salesman Problem, Graph Coloring problem;

Hybrid Systems [10L]
Hybrid systems, GA based BPNN (Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A;

Textbooks:

1. Neural Networks- A Comprehensive foundation, Simon Haykin, 2nd Ed; Pearson
2. Fuzzy Sets & Fuzzy Logic, Klir & Yuan, PHI
3. Genetic Algorithm – Melanie Mitchell, PHI

References:

4. Neural Networks, Fuzzy Logic & Genetic Algorithms – Synthesis & applications, T.S. Rajasekaran & G.A. Vijaylakshmi Pai, PHI
5. Genetic Algorithm & fuzzy Logic Systems - Sanchez, Takanori, Zadeh; World Scientific
6. Genetic Algorithm, Goldberg David E.; Pearson
7. Fuzzy Set Theory & Its Applications - Zimmermann H. J.; Allied Publishers Ltd.
8. Fundamentals of Neural Networks, architectures, algorithms & applications --- Laurence Fausett; Prentice Hall, Englewood Clifts.

Image Processing and Pattern Recognition

Code: MSE 303C
Weekly Contact Hour: 4L
Credit: 4

Introduction to Image Processing [3L]
Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation [5L]
A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries [4L]
Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Discrete Cosine & Sine Transform.

Image Enhancement [5L]
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

Image Restoration [5L]
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 [6L]
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Threshold - Foundation, Simple Global Threshold, Optimal Threshold; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Introduction to Pattern Recognition [4L]
The nature of statistical pattern recognition; three learning paradigms; the sub-problems of pattern recognition; the basic structure of a pattern recognition system; Comparing classifiers.

Bayes Decision Theory [3L]
General framework; optimal decisions; Classification; Simple performance bounds

Learning – Parametric Approaches [6L]
Basic statistical issues; Sources of classification error; Bias and variance; three approaches to classification: density estimation, regression and discriminant analysis; Empirical error criteria; Optimization methods; Failure of MLE, Linear and quadratic discriminants, Perceptrons.

Feature Extraction [4L]
Optimal features; Optimal linear transformations; Linear and nonlinear principal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering, Syntactic pattern recognition, Fuzzy set Theoretic approach to PR.

Textbooks:

1. Digital Image Processing, Tao Gonzalez, Woods, Pearson

References:

2. Digital Image Processing, Jahne, Springer India
3. Fundamentals of Digital Image Processing, Jain, PHI
4. Image Processing, Analysis & Machine Vision, Sonka, VIKAS

Mobile Communications
Code: MSE 303D
Weekly Contact Hour: 4L
Credit: 4

Introduction [6L]
A General Overview: History, Transmission Medium, Need, Advantages, Disadvantages and Different Standards. AMPS, GSM, GPRS, 3G.

Wireless LANs [8L]
Characteristics, IEEE 802.11: Architecture, Physical Layer, MAC Layer, MAC Management, 802.11a and 802.11b. HIPERLAN: History, WATM, BRAN and HiperLAN2. Blue tooth: Architecture, Radio Layer, Base band Layer, Link Management Protocol, L2CAP and Security.

Mobile Transport and Network Layer [15L]
Introduction, Traditional TCP: Congestion Control, Slow Start, Fast Retransmit and Implications of Mobility. Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP and Fast Retransmit. Mobile IP: Introduction, IP Packet Delivery, Agent Discovery, Registration, Tunneling and Encapsulation, Optimizations and Reverse Tunneling. Mobile Ad-hoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing and Alternative Metrics.

Cellular Networks [12L]
Cellular Concept, Frequency Reuse, Channel Allocation Management, Call Setup, Location Management, Cell Handoffs, and Interference: Co-channel and Adjacent Interference. System Capacity, Improving Cell Capacity and Coverage: Cell Splitting, Sectoring, Repeaters and Micro cell Zone Concept.

Wireless Application Protocol [4L]
Introduction (WAP), Protocol Stack, Connections.

Text Books:

1. J. Schiller, Mobile Communications, Addison –Wesley, 2003

Reference:

2. T. S. Rapport, Wireless Communications, Principle and Practices
3. Forouzan, Data Communications and Networking, TMH

Data Encryption and Compression
Code: MSE 303E
Weekly Contact Hour: 4L
Credit: 4

Introduction To Security [4L]
Need for security, Security approaches, Principles of security, Types of attacks.

Encryption Techniques [5L]
Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

Symmetric & Asymmetric Key Cryptography [8L]
Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm.

User Authentication Mechanism [3L]
Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall

Case Studies Of Cryptography [5L]
Denial of service attacks, IP spoofing attacks, Secure inter branch payment transactions.
Conventional Encryption and Message Confidentiality, Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution

Public Key Cryptography and Message Authentication [8L]
Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital Signatures, Key Management

Introduction [4L]: Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio, Reqirements of data compression, Classification.
Methods of Data Compression [8L]: Data compression-- Loss less & Lossy; Entropy encoding-- Repititive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmatic & Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization & with error term); Differential encoding—Predictive coding, Differential pulse code modulation, Delta modulation, Adaptive differential pulse code modulation; Transform based coding : Discrete cosine transform & JPEG standards; Fractal compression.

Textbooks:
1. Cryptography and Network Security – B. Forouzan, McGraw-Hill.

References
1. The Data Compression Book, Nelson, BPB.
2. Cryptography & Network Security: Atul Kahate, TMH.

Remote Sensing & GIS
Code: MSE 303F
Weekly Contact Hour: 4L
Credit: 4

Introduction and Overview of Geographic Information Systems [4L]
Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.

GIS and Maps, Map Projections and Coordinate Systems [4L]

Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.

Data Sources, Data Input, Data Quality and Database Concepts [7L]
Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS.

Spatial Analysis [3L]
Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.

Making Maps [6L]
Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD-ROM distribution; interactive maps and the Web.

Implementing a GIS [5L]
Planning a GIS; requirements; pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and low-cost packages.

Technology & Instruments involved in GIS & Remote Sensing [8L]
GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS career options and how to pursue them.

Remote Sensing [8L]
Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape

Textbooks:

1. "Principles of geographical information systems", P. A. Burrough and R. A. Mcdonnel, Oxford.
2. "Remote sensing of the environment", J. R. Jensen, Pearson

References:

1. "Exploring Geographic Information Systems", Nicholas Chrismas, John Wiley & Sons.
2. "Getting Started with Geographic Information Systems",Keith Clarke, PHI.
3. "An Introduction to Geographical Information Systems", Ian Heywood, Sarah Cornelius, and Steve Carver. Addison-Wesley Longman.

Design & Analysis of Algorithm
Code: MSE303G
Weekly Contact Hour: 4L
Credit: 4

Models of computation [4L]
RAM,TM etc. time and space complexity

Asymptotic Notation [3L]
Big-O, omega, theta etc.; finding time complexity of well known algorithms like- heapsort, search algorithm etc.

Algorithm Design techniques [2L]
Recursion- Definition, Use, Limitations, Examples: Hanoi problem. Tail Recursion

Divide and Conquer [3L]
Basic method, use, Examples: Merge sort, Quick Sort, Binary Search

Dynamic Programming [4L]
Basic method, use, Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Traveling Salesman problem

Branch and Bound [2L]
Basic method, use, Examples: The 15-puzzle problem

Backtracking [3L]
Basic method, use, Examples: Eight queens problem, Graph coloring problem, Hamiltonian problem

Greedy Method [4L]
Basic method, use, Examples: Knapsack problem, Job sequencing with deadlines, minimum spanning tree (Prim's and Kruskal's algorithms)

Lower Bound Theory [2L]
Bounds on sorting and sorting techniques using partial and total orders.

Disjoint Set Manipulation [2L]
Set manipulation algorithm like UNION-FIND, union by rank, Path compression.

Properties of graphs and graph traversal algorithms [3L]: BFS and DFS

Matrix manipulation algorithms [5L]
Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes

Notion of NP-completeness [5L]
P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.

Approximation algorithms [3L]
Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem

Text Books:

1. A.Aho, J.Hopcroft and J.Ullman “The Design and Analysis of algorithms”
2. D.E.Knuth “The Art of Computer Programming”, Vol. I & Vol.2
3. Horowitz Ellis, Sahani Sartaz, R. Sanguthevar " Fundamentals of Computer Algorithms".
4. Goodman: Introduction to Design and Analysis Of Algorithms TMH

Reference:

1. K.Mehlhorn , “Data Structures and algorithms- Vol. I & Vol. 2 “
2. S.Baase “Computer algorithms”
3. E.Horowitz and Shani “Fundamentals of Computer algorithms”
4. E.M.Reingold, J.Nievergelt and N.Deo- “Combinational algorithms- Theory and Practice”, Prentice Hall , 1997
5. A.Borodin and I.Munro, “The computational complexity of Algebraic and Numeric problems

Practical Papers

Data Structure Lab
Code: MSE 191
Weekly Contact Hour: 3P
Credit: 3

Experiments should include but not limited to:
Implementation of array operations
Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem: Evaluation of expressions operations on Multiple stacks & queues :
Implementation of linked lists: inserting, deleting, and inverting linked list. Implementation of stacks & queues using linked lists
Polynomial addition, Polynomial multiplication
Sparse Matrices: Multiplication, addition.
Recursive and Non-recursive traversal of Trees
Threaded binary tree traversal. AVL tree implementation.
Application of Trees, Application of sorting and searching algorithms
Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

DBMS Lab
Code: MSE 192
Weekly Contact Hour: 3P
Credit: 3

Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes
2. **Table and Record Handling**
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements
3. **Retrieving Data from a Database**
   - The SELECT statement
   - Using the WHERE clause
   - Using Logical Operators in the WHERE clause
   - Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

Clause

   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Sub queries
4. **Database Management**
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE

Object Oriented Programming Lab
Code: MSE 193
Weekly Contact Hour: 3P
Credit: 3

Experiments should include but not limited to:
A complete C++ program
Assignments corresponding to fundamental C++ features like objects, classes, flexible declaration, dynamic initialization, reference variable, inline, friend function, static member function
Program introducing array, pointer to member, pointer to function.
Program illustrating fundamental OOP concept: abstraction, encapsulation, inheritance –single, multiple, multilevel, hierarchical
Program on operator and function overloading, virtual function
Program on files and exception handling.
Note: Use C++ program

Object Technology Lab
Code: MSE 291
Weekly Contact Hour: 3P
Credit: 3

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, vectors, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming, handling errors and exceptions, applet programming and graphics programming

Note: Use Java for programming.

SPM Lab
Code: MSE 292
Weekly Contact Hour: 3P
Credit: 3

Programs, assignments covering the need of Software Project Management and TQM (MSE202)

Web Technology Lab
Code: MSE 391
Weekly Contact Hour: 3P
Credit: 3

1. Basic use of html tag, linking image table, frame, form design.
2. DHTML- inline styles, creating style sheets with the style element, linking external style sheet, positioning elements, user style sheet.
3. Creating event handler that respond to mouse and keyboard event: Onload, onmouseover, onmouseout, onfocus, onblur, onsubmit, onresult, onclick, onchange.
4. Structuring data with xml, xml parser, extensible style language (xsl); customising markup language.
5. Configuring apache-tomcat server.
6. Building simple jsp: Declaring variables and methods in jsp, inserting java expression in jsp, processing request from user, generating dynamic response for the user. Accessing database from jsp, inserting applet into jsp.