ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.Tech.
Computer Science

(Effective for the students admitted from the Academic Year 2005-06)

Jawaharlal Nehru Technological University
Hyderabad – 500 072

COURSE STRUCTURE AND SYLLABUS

I-Semester

Code	Title	L	P
	Design and Analysis of Algorithms	4	-
	Computer Organization	4	-
	Computer Communications	4	-
	Operating Systems	4	-
	Mathematical Foundations of Computer Science	4	-
	Database Management Systems	4	-
Practical	Design and Analysis of Algorithms Lab (Through C++)	-	4

II-Semester

Code	Title	L	P
	Compiler Design	4	-
	Data Warehousing and Mining	4	-
	Software Engineering	4	-
	Object Oriented Analysis and Design	4	-
	Elective -I	4	-
	Elective - II	4	-
Practical	UML Lab	-	4

III-Semester

	Internal	External	Total
Project Seminar Satisfactory/Not-Satisfactory	-	-	-

IV-Semester

	Internal	External	Total
Project Seminar	-	-	-
Dissertation/Thesis Excellent/good/Satisfactory/Not-Satisfactory			

Note: Eligibility for admission to this course is B.E./B.Tech. in any branch of Engineering.

Elective - I

1. Pattern Recognition and Image Processing
2. Web Technologies
3. Network Security and Cryptography

Elective – II

1. Middleware Technologies
2. Embedded Systems
3. Neural Networks

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I-Semester

DESIGN AND ANALYSIS OF ALGORITHMS

UNIT-I

Overview of OOP Principles: Encapsulation, Inheritance, and Polymorphism. **Review of** C++-Classes and Objects, Class members, Access control, class scope, constructors and destructors, dynamic memory allocation and de-allocation (new and delete), Polymorphism-Function overloading, operator overloading, generic programming-function and class templates, Inheritance, run time polymorphism using virtual functions, abstract classes, File I/O and Exception handling.

UNIT-II

Algorithm Analysis and Review of Data Structures: Algorithms, Psuedo code for expressing algorithms, **Performance Analysis**-time complexity and space complexity-notation, Omega notation and Theta notation, little o notation, Probabilistic analysis, Amortized analysis, **Review of Data Structures**-The List ADT, Stack ADT, Queue ADT, Implementations using template class, Hash Functions, Collision Resolution in hashing, **Priority queues**-Definition, Priority queues-ADT, **Heaps**-Definition, Insertion and Deletion, **Applications**-Heap sort, **Disjoint sets**-Disjoint set ADT, Union and Find algorithms.

UNIT-III

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication.

UNIT-IV

Greedy method: General method, applications-Job sequencing with dead lines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT-V

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

UNIT-VI

Searching and Traversal Techniques: Efficient non-recursive Tree Traversal algorithms, DFS, BFS of Graphs, AND/OR graphs, game trees, Bi-Connected components, **Search Trees**- Balanced search trees- AVL trees, representation, Operations-insertion, deletion and searching, B-Trees-B-Tree of order m, Operations- insertion, deletion and searching.

UNIT-VII

Backtracking and Branch and Bound: General method (Backtracking), **Applications**-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.
General method (Branch and Bound), **Applications** - Traveling sales person problem, 0/1 knapsack problem-LC Branch and Bound solution, FIFO Branch and Bound solution.

UNIT-VIII

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP- Complete classes, Cook's theorem.

Text Books:

1. Computer Algorithms/C++, E.Horowitz, S.Sahani and S.Rajasekharan, Galgotia Publishers pvt. Limited.
2. Data Structures and Algorithm Analysis in C++, 2nd Edition, Mark Allen Weiss, Pearson Education.
3. Introduction to Algorithms, 2nd Edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, PHI Pvt.Ltd./ Pearson Education.

Reference Books:

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson Education.
2. Introduction to the Design and Analysis of Algorithms, A.Levitin, Pearson Education.
3. Data structures, Algorithms and Applications in C++, S.Sahni, University press (India)
pvt ltd, 2nd edition, Orient Longman pvt.ltd.
4 Object Oriented Programming Using C++, 2nd Edition, I.Pohl, Pearson Education.
5 Fundamentals of Sequential and Parallel Algorithms, K.A.Berman, J. L.Paul, Thomson
6 Data Structures And Algorithms in C++, 3rd Edition, Adam Drozdek, Thomson.
7. Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich and R.Tomassia, John Wiley and sons.

I-Semester

COMPUTER ORGANIZATION

UNIT-I:

BASIC STRUCTURE OF COMPUTERS: Computer Types, Functional unit, Basic OPERATIONAL concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data Representation. Fixed Point Representation. Floating – Point Representation. Error Detection codes.

COMPUTER ARITHMETIC: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit Decimal Arithmetic operations

UNIT-II:

REGISTER TRANSFER LANGUAGE AND MICROOPERATIONS: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Mircrooperatiaons, logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers Computer instructions – Instruction cycle.

Memory – Reference Instructions. Input – Output and Interrupt. STACK organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer.

UNIT-III:

MICRO PROGRAMMED CONTROL: Control memory, Address sequencing, microprogram example, design of control unit Hard wired control. Microprogrammed control

UNIT-IV:

PROGRAM AND NETWORK PROPERTIES

Conditions of Parallelism. Program Paritioning and Scheduling, Program flow Mechanism, System Interconnect Archcitectures.

SCALABILITY AND PERFORMANCE

Poricipels of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications. Speedup Performance Laws. Scalability Analysis and Approaches.

UNIT-V:

THE MEMORY SYSTEM: Basic concepts semiconductor RAM memories. Read-only memories Cache memories performance considerations, Virtual memories secondary storage. Introduction to RAID.

UNIT-VI:

INPUT-OUTPUT ORGANIZATION: Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt Direct memory Access, Input –Output Processor (IOP) Serial communication; Introduction to peripheral component, Interconnect (PCI) bus. Introduction to standard serial communication protocols like RS232, USB, IEEE1394.

UNIT-VII:

PIPELINE AND VECTOR PROCESSING:

Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors.

UNIT-VIII:

MULTI PROCESSORS: Characteristics or Multiprocessors, Interconnection Structures, Interprocessor Arbitration. InterProcessor Communication and Synchronization Cache Coherance. Shared Memory Multiprocessors.

MULTIPROCESSING

Multiprocessor System Interconnects. Cache Coherence and Synchronization Mechanisms.
Vector Processing Principles. SIMD Computer Implementation Models.
Larency Hiding Techniques. Principles of Multi Threading.
Data Flow Architecture Evaluation.

TEXT BOOKS:

1. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI
2. Computer Organization – Car Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.

REFERENCE:

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.
4. Computer Organization, Anjaneyulu, Himalaya Pub house.

I-Semester

COMPUTER COMUNICATIONS

UNIT-I

Introduction: Uses of computer Networks, Network H/w, Network S/W, Reference Models, Example Networks , Network Standardization.

UNIT-II

Physical Layer: Guided transmission media – Magnetic media, Twisted Pair, coaxial cable, fiber optics .

Data Link Layer: Design Issues, Error detection and correction , Elementary Data Link Protocols, Sliding Window Protocols, Protocol Verification, Example Data Link protocols.

UNIT-III

The Medium Access Sub Layer : The channel allocation problem, Multiple access Protocols, Ethernet , Wireless LANs , Broadband Wireless, Bluetooth ,Data Link Layer Switching.

UNIT-IV

The Network Layer : Network Layer Design Issues, Routing Algorithms ,Congestion Control Algorithms ,Quality Of Service, Internet Working ,Network Layer in Internet.

UNIT-V

The Transport Protocol: The Transport Service, Elements of transport protocol , A simple Transport Protocol , Internet Transport Protocols UDP, Internet Transport Protocols TCP, Performance Issues.

UNIT-VI

The Application Layer: DNS-(Domain Name System), Electronic Mail, World Wide Web Multimedia,

UNIT-VII

Network Security: Cryptography , Symmetric _key Algorithms, Public–Key Algorithms, Digital Signatures, Management of public keys.

UNIT-VIII

Communication Security, Authentications Protocols, E-mail Security, Web security, Social Issues.

TEXT BOOKS:

1. Computer Networks -- Andrew S Tanenbaum,4th Edition. Pearson Education/PHI

REFERENCE BOOKS:

1. Computer Communications and Networking Technologies –Michael A.Gallo, William M .Hancock - Thomson Publication
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

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I-Semester

OPERATING SYSTEMS

UNIT I:

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

UNIT II:

Process and CPU Scheduling - Process concepts and scheduling, Operation on processes, Cooperating Processes, Threads, and Interposes Communication Scheduling Criteria, Scheduling Algorithm, Multiple -Processor Scheduling, Real-Time Scheduling.

UNIT III

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging. Demand Paging , Performance of Demanding Paging , Page Replacement ,Page Replacement Algorithm, Allocation of Frames, Thrashing.

UNIT IV:

File System Interface and Implementation -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management, Directory Management, Directory Implementation, Efficiency and Performance.

Deadlocks - System Model, Dead locks Characterization, Methods for Handling Dead locks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

UNIT V:

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors.

UNIT VI:

Introduction to Distributed systems : Goals of distributed system, hardware and software concepts, design issues.

Communication in Distributed systems : Layered protocols, ATM networks , the Client - Server model, remote procedure call and group communication.

UNIT VII:

Synchronization in Distributed systems : Clock synchronization, Mutual exclusion, E-tech algorithms, the Bully algorithm, a ring algorithm, atomic transactions

UNIT VIII:

Deadlocks: deadlock in distributed systems, Distributed deadlock prevention, and distributed dead lock detection.

TEXT BOOKS:

1 Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley

2 Distributed Operating System - Andrew. S. Tanenbaum, PHI

REFERENCE BOOKS:

1. Operating System A Design Approach-Crowley,TMH.
2. Operating Systems – Internals and Design Principles Stallings, Fifth Edition–2005,
3. Pearson Education/PHI
4. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI
5. Operating Systems, Dhamdhere, TMH

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I-Semester

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

UNIT-I:

Fundamentals : Strings, Alphabet, Language, Operations. Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non deterministic finite automaton, transition diagrams and Language recognizers

Finite Automata:

NFA with $\in$ transitions- Significance, acceptance of languages. Conversions and Equivalence: Equivalence between NFA with and without $\in$ transitions, NFA to DFA conversion, minimisation of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines.

UNIT-II:

Regular Languages

Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions.

UNIT-III:

Push Down Automata

Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence.

Turing Machine

Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines

UNIT-IV:

Computability Theory

Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, undecidability of posts Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems

UNIT-V:

Elementary Combinatorics: Basis of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, the principles of Inclusion – Exclusion.

UNIT-VI:

Recurrence Relation: Generating Functions, Function of Sequences Calculating Coefficient of generating function, Recurrence relations, Solving recurrence relation by substitution and Generating funds. Characteristics roots solution of In homogeneous Recurrence Relation.

UNIT-VII:

Graph Theory: Representation of Graph, DFS, BFS, Spanning Trees, planar Graphs

UNIT-VIII:

Graph Theory and Applications, Basic Concepts Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers

TEXT BOOKS:

1. Discrete and Combinational Mathematics- An Applied Introduction-5th Edition – Ralph. P.Grimaldi. Pearson Education
2.Discrete Mathematical Structures with applications to computer science Trembly J.P. & Manohar .P, TMH
3. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker Prentice Hall.

Reference Books:

1.Discrete Mathematical Structures, Bernand Kolman, Roberty C. Busby, Sharn Cutter Ross, Pearson Education/PHI.
2. Mathematical Foundations of computer science Dr D.S.Chandrasekharaiaha Prism books Pvt Ltd.
3. Discrete Mathematics, Lovasz, Springer.
4. Discrete Mathematics for Computer science, Garry Haggard and others, Thomson

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I-Semester

DATABASE MANAGEMENT SYSTEMS

UNIT – I:
Data base System Applications, data base System VS file System – View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor – History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.

UNIT – II:
Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.
Relational Algebra and Calculus: Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

UNIT – III:
Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOTR – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

UNIT – IV:
Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – forth Normal Form.

UNIT – V:
Overview of Transaction Management: ACID Properties – Transactions and Schedules – Concurrent Execution of transaction – Lock Based Concurrency Control – Performance Locking – Transaction Support in SQL – Introduction to Crash recovery.

UNIT – VI:
Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – Lock Conversions – Dealing with Dead Locks – Specialized Locking Techniques – Concurrency without Locking.
Crash recovery: Introduction to ARIES – the Log – Other Recovery related Structures – the Write-Ahead Log Protocol – Check pointing – re3covering from a System Crash – Media recovery – Other approaches and Interaction with Concurrency control.

UNIT – VII:

Overview of Storage and Indexing: Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning.

UNIT – VIII:

Storing data: Disks and Files: - The Memory Hierarchy – Redundant Arrays of Indepencent – Disks – Disk Space Management – Buffer Manager – Files of records – Page Formats – record formats.

Tree Structured Indexing: Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure.

Hash Based Indexing: Static Hashing – Extendable hashing – Linear Hashing – Exendble vs. Liner hashing.

TEXT BOOKS:

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, IV edition.
3. Database Management Systems P. Radha Krishna HI-TECH Publications 2005

REFERENCE BOOK:

1. Introduction to Database Systems, C.J.Date Pearson Education
2. Data base Systems design, Implementation, and Management, Rob & Coronel 5th Edition.Thomson
3. Data base Management System, Elmasri Navrate Pearson Education
4. Data base Management System Mathew Leon, Leon Vikas.
5. Data base Systems, Connoley Pearson education

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I-Semester

DESIGN AND ANALYSIS OF ALGORITHMS LAB (Through C++)

1. Write C++ programs to implement the following using an array.
   a) Stack ADT
   b) Queue ADT

2. Write C++ programs to implement the following using a singly linked list.
   a) Stack ADT
   b) Queue ADT

3. Write C++ program to implement the deque (double ended queue) ADT using a doubly linked list.

4. Write a C++ program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.

5. Write a C++ program to implement circular queue ADT using an array.

6. Write a C++ program to implement all the functions of a dictionary (ADT) using hashing.

7. Write a C++ program to perform the following operations on B-Trees and AVL-trees:
   a) Insertion.
   b) Deletion.

8. Write C++ programs for the implementation of bfs and dfs for a given graph.

9. Write C++ programs to implement the following to generate a minimum cost spanning tree:
   a) Prim's algorithm.
   b) Kruskal's algorithm.

10. Write a C++ program to solve the single source shortest path problem.
    (Note: Use Dijkstra's algorithm).

11. Write C++ program that uses non-recursive functions to traverse a binary tree in:
    a) Pre-order.
    b) In-order.
    c) Post-order.
    d)

12. Write C++ programs for sorting a given list of elements in ascending order using the following sorting methods:
    a) Quick sort.
    b) Merge sort.

13. Write a C++ program to find optimal ordering of matrix multiplication. (Note: Use Dynamic programming method).

14.Consider the problem of eight queens on an (8x8) chessboard. Two queens are said to attack each other if they are on the same row, column, or diagonal. Write a C++ program that implements backtracking algorithm to solve the problem i.e. place eight non-attacking queens on the board.

15.Write a C++ program to find the strongly connected components in a digraph.

16.Write a C++ program to implement file compression (and uncompression) using Huffman's algorithm.

17.Write a C++ program to implement dynamic programming algorithm to solve the all pairs shortest path problem.

18.Write a C++ program to solve 0/1 knapsack problem using the following:
a) Greedy algorithm.
b) Dynamic programming algorithm.
c) Backtracking algorithm.
d) Branch and bound algorithm.

19.Write a C++ program that uses dynamic programming algorithm to solve the optimal binary search tree problem.

20.Write a C++ program for solving traveling sales persons problem using the following:
a) Dynamic programming algorithm.
b) The back tracking algorithm.
c) Branch and Bound.

Suggested Books for lab:

1. **Data Structures, A Pseudocode Approach with C++,** Richard F.Gilberg, Behrouz A.Forouzan, Thomson.
2. **Data Structures Using C++,** D.S.Malik, Thomson.

II-Semester

COMPILER DESIGN

Unit – I:
Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

Unit – II:
Parsing: Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

Unit – III:
Bottom up parsing: - Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing , handling ambiguous grammar, YACC – automatic parser generator.

UNIT IV
Semantic analysis: Intermediate forms of source Programs – abstract syntax tree, Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Unit – IV:
Symbol Tables: Symbol table format, organization for block structures languages, hashing, tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

Unit – VI:
Code Generation- Processing the intermediate Code- Interpretation, Code generation, Simple code generation, code generation for basic blocks, BURS Code generation and dynamic programming, Register allocation by graph coloring, Evaluation of code generation techniques Preprocessing the intermediate code, post processing the target code, machine code generation.

Unit – VII:
Code optimization: Consideration for Optimization, Machine dependent and machine independent code optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Unit – VIII:
Data flow analysis: Dataflow Analysis, Intermediate representation for flow analysis , Various dataflow analyses , Transformations using dataflow analysis Speeding up dataflow analysis , Alias analysis.
Loop Optimizations –Dominators, Loop-invariant computations, Induction variables, Array bounds checks, Loop unrolling

Text Books:

1. Principles of compiler design -A.V. Aho . J.D.Ullman; Pearson Education
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.

References:

1. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.
3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson..

II-Semester

DATA WAREHOUSING AND MINING

UNIT-I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining, Data Warehouse and OLAP Technology for Data Mining Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining.

UNIT-II

Data Preprocessing: Needs Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Online Data Storage.

UNIT-III

Data Mining Primitives, Languages, and System Architectures: Data Mining Primitives, Data Mining Query Languages, Designing Graphical User Interfaces Based on a Data Mining Query Language Architectures of Data Mining Systems.

UNIT-IV

Concepts Description: Characterization and Comparison: Data Generalization and Summarization-Based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between Different Classes, Mining Descriptive Statistical Measures in Large Databases.

UNIT-V

Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT-VI

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

UNIT-VII

Cluster Analysis Introduction :Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

UNIT-VIII

Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data, Mining Text Databases, Mining the World Wide Web.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER Harcourt India.
2. Data Mining Techniques – ARUN K PUJARI, University Press
3. Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd..

REFERENCE BOOKS:

1. Data Warehousing in the Real World – SAM ANAHORY & DENNIS MURRAY. Pearson Edn Asia.
2. Data Warehousing Fundamentals – PAULRAJ PONNAIAH WILEY STUDENT EDITION
3. The Data Warehouse Life cycle Tool kit – RALPH KIMBALL WILEY STUDENT EDITION
4. Data Mining Introductory and advanced topics –MARGARET H DUNHAM, PEARSON EDUCATION

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II-Semester

SOFTWARE ENGINEERING

UNIT-I:

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths.

A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

UNIT-II:

Process models: The waterfall model, Incremental process models, Evolutionary process models, The Unified process.

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

UNIT-III:

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models: Context Models, Behavioral models, Data models, Object models, structured methods.

UNIT-IV:

Design Engineering: Design process and Design quality, Design concepts, the design model.

Creating an architectural design: software architecture, Data design, Architectural styles and patterns, Architectural Design.

UNIT-V:

Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution.

Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

UNIT-VI:

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.

Product metrics: Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

UNIT-VII:

Plans for testing: Snooping for information, Coping with complexity through teaming, Testing plan focus areas , Testing for recoverability , Planning for troubles.

UNIT-VIII:

Preparing for the tests: Software Reuse, Developing good test programs , Data corruption, Tools, Test Execution ,Testing with a virtual computer, Simulation and Prototypes, Managing the Test, Customer's role in testing

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGrawHill International Edition.
2. Software Engineering- Sommerville , 7th edition, Pearson education.
3.Software Testing Techniques – Loveland, Miller, Prewitt, Shannon, Shroff Publishers & Distribution Pvt Ltd..,

REFERENCE BOOKS:

1. Software Engineering- K.K. Agarwal & Yogesh Singh,New Age International Publishers
2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
3. Systems Analysis and Design- Shely Cashman Rosenblatt,Thomson Publications.
4. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

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II-Semester

OBJECT ORIENTED ANALYSIS AND DESIGN

UNIT-I:

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT-II:

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams.
Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

UNIT-III

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

UNIT- IV:

Basic Behavioral Modeling-I: Interactions, Interaction diagrams.

UNIT-V:

Basic Behavioral Modeling-II: Use cases, Use case Diagrams, Activity Diagrams.

UNIT-VI:

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

UNIT-VII:

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT-VIII:

Case Study: The Unified Library application

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.

REFERENCE BOOKS:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Mark Priestley: Practical Object-Oriented Design with UML,TATA McGrawHill
5. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

II-Semester

PATTERN RECOGNITION AND IMAGE PROCESSING
(Elective- I)

UNIT-I

Introduction: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation (Text book-1, p.nos: 1-17).

Bayesian Decision Theory : Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces (Text book-1, p.nos: 20-27, 29-31).

UNIT-II

Normal density: Univariate and multivariate density, discriminant functions for the normal density-different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context (Text book-1, p.nos: 31-45,51-54,62-63).

UNIT-III

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case (Text book-1, p.nos: 84-97).

UNIT-IV

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering (Text book-1, p.nos: 517 – 526, 537 – 546).

UNIT-V

Pattern recognition using discrete hidden Markov models:

Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs

UNIT-VI

Continuous hidden Markov models :

Continuous observation densities, multiple mixtures per state, speech recognition applications.

UNIT-VII

Digital image fundamentals :

Introduction, an image model, sampling and quantization, basic relationships between pixels, image geometry

Image enhancement:

Back ground, enhancement by point processing histogram processing, spatial filtering, introduction to image transforms, image enhancement in frequency domain.

UNIT VIII

Image Segmentation and Edge Detection: Region Operations, Crack Edge Detection, Edge Following, Gradient operators, Compass and laplace operators. Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation- edge image thresholding, edge relaxation, border tracing, border detection,

Text Books:

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley student edition, Second Edition.
2. Fundamentals of speech Recognition, Lawerence Rabiner, Biing – Hwang Juang Pearson education.
3. R.C Gonzalez and R.E. Woods, "Digital Image Processing", Addison Wesley, 1992.

Reference Books:

1. A.K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India.
2. Digital Image Processing – M. Anji Reddy, BS Publications.
3. Pattern Recognition and Image Analysis – Earl Gose, Richard John baugh, Steve Jost PHI 2004

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II-Semester

WEB TECHNOLOGIES
(Elective - I)

UNIT-I:

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;

UNIT-II:

Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script

UNIT-III:

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX

UNIT-IV:

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

UNIT-V:

Web Servers: Introduction to Servelets: Lifecycle of a Serverlet, JSDK, The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues,

UNIT-VI:

Introduction to JSP: The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat

UNIT-VII:

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations

UNIT VIII:

Database Access : Database Programming using JDBC, Studying Javax.sql.* package,Accessing a Database from a JSP Page, Application – Specific Database Actions,Deploying JAVA Beans in a JSP Page, Introduction to struts framework..

Text Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
2. The complete Reference Java 2 Fifth Edition by Patrick Naughton and Herbert Schildt. TMH
3. Java Server Pages –Hans Bergsten, SPD O'Reilly

Reference Books:

1.Internet and World Wide Web – How to program by Dietel and Nieto PHI/Pearson Education Asia.
2. Jakarta Struts Cookbook , Bill Siggelkow, S P D O'Reilly for chap 8.
3. Murach's beginning JAVA JDK 5, Murach, SPD
4. An Introduction to web Design and Programming –Wang-Thomson
5. Web Applications Technologies Concepts-Knuckles,John Wiley
6. Programming world wide web-Sebesta,Pearson
7. Building Web Applications-NIIT,PHI
8. Web Warrior Guide to Web Programmming-Bai/Ekedaw-Thomas
9. Beginning Web Programming-Jon Duckett WROX.
10. Java Server Pages, Pekowsky, Pearson.

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II-Semester

NETWORK SECURITY AND CRYPTOGRAPHY
(Elective-1)

UNIT-I

Introduction:

Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security.

Classical Techniques:

Conventional Encryption model, Steganography, Classical Encryption Techniques.

UNIT-II

Modern Techniques:

Symplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.

Algorithms:

Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers.

UNIT-III

Conventional Encryption:

Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

Public Key Cryptography:

Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptograpy.

UNIT-IV

Number theory:

Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

Message authentication and Hash functions:

Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT-V

Hash and Mac Algorithms:

MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC.

Digital signatures and Authentication protocols:

Digital signatures, Authentication Protocols, Digital signature standards.

UNIT-VI

Authentication Applications:

Kerberos, X.509 directory Authentication service.

Electronic Mail Security:

Pretty Good Privacy, S/MIME.

UNIT-VII

IP Security:

Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management.

Web Security:

Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

UNIT-VIII

Intruders, Viruses and Worms:

Intruders, Viruses and Related threats.

Fire Walls:

Fire wall Design Principles, Trusted systems.

Text Books:

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

Reference Books:

1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Principles of Information Security, Whitman, Thomson.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
5. Introduction to Cryptography, Buchmann, Springer.

II-Semester

MIDDLEWARE TECHNOLOGIES
(Elective – II)

UNIT-I:
Introduction to client server computing: Evolution of corporate computing models from centralized to distributed computing, client server models. Benefits of client server computing, pitfalls of client server programming.

UNIT-II:
CORBA with Java: Review of Java concept like RMI, RMI API, JDBC.
Client/Server CORBA-style, The object web: CORBA with Java.

UNIT III:
Introducing C# and the .NET Platform; Understanding .NET Assemblies; Object – Oriented Programming with C#; Callback Interfaces, Delegates, and Events.

UNIT IV:
Building c# applications: Type Reflection, Late Binding, and Attribute-Based Programming; Object Serialization and the .NET Remoting Layer; Data Access with ADO.NET; XML Web Services.

UNIT-V:
Core CORBA / Java: Two types of Client/ Server invocations-static, dynamic. The static CORBA, first CORBA program, ORBlets with Applets, Dynamic CORBA-The portable count, the dynamic count multi count.

UNIT-VI:
Existential CORBA: CORBA initialization protocol, CORBa activation services, CORBAIDL mapping CORBA java- to- IDL mapping, The introspective CORBA/Java object.

UNIT-VII:
Java Bean Component Model: Events, properties, persistency, Intrespection of beans, CORBA Beans

UNIT-VIII:
EJBs and CORBA: Object transaction monitors CORBA OTM's, EJB and CORBA OTM's, EJB container frame work, Session and Entity Beans, The EJB client/server development Process The EJB container protocol, support for transaction EJB packaging EJB design Guidelines.

Text Books:

1 Client/Server programming with Java and CORBA Robert Orfali and Dan Harkey, John Wiley & Sons ,SPD 2nd Edition
2 Java programming with CORBA 3rd Edition, G.Brose, A Vogel and K.Duddy, Wiley-dreamtech, India John wiley and sons
3 C# and the .NET Platform Andrew Troelsen, Apress Wiley-dreamtech, India Pvt Ltd

Reference: Books:

1. Distributed Computing, Principles and applications, M.L.Liu, Pearson Education
2. Client/Server Survival Guide 3rd edition Robert Orfali Dan Harkey and Jeri Edwards, John Wiley & Sons
3. Client/Server Computing D T Dewire, TMH.
4. IBM Webspere Starter Kit Ron Ben Natan Ori Sasson, TMh, New Delhi
5. Programming C#, Jesse Liberty, SPD-O'Reilly.
6. C# Preciesely Peter Sestoft and Henrik I. Hansen, Prentice Hall of India
7. Intoduction to C# Using .NET Pearson Education
8. C# How to program, Pearson Education

II-Semester

EMBEDDED SYSTEMS
(Elective – II)

Unit I

Embedded Computing: Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Formalisms for System Design, Design Examples.

Unit II

The 8051 Architecture : Introduction, 8051 Micro controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

Unit III

Basic Assembly Language Programming Concepts : The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051. Data Transfer and Logical Instructions.

Unit IV

Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Further Details on Interrupts.

Unit-V

Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

Unit VI

Introduction to Real – Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

Unit VII

Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source); Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

Unit VIII

Introduction to advanced architectures: ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I^2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

Text Books:

1. Computers and Components, Wayne Wolf, Elseveir.
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.
3. An Embedded Software Primer, David E. Simon, Pearson Education.

Reference Books:

1. Embedding system building blocks, Labrosse, via CMP publishers.
2. Embedded Systems, Raj Kamal, TMH.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
5. Microcontrollers, Raj kamal, Pearson Education.

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II-Semester

NEURAL NETWORKS
(Elective- II)

UNIT I

INTRODUCTION - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks (p. no's 1 –49)

UNIT II

LEARNING PROCESS – Error Correction learning, Memory based learning, Hebbian learing, Competitive, Boltzmann learning, Credit Asssignment Problem, Memory, Adaption, Statistical nature of the learning process, (p. no's 50 –116)

UNIT III

SINGLE LAYER PERCEPTRONS – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron –convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment (p. no's 117 –155)

UNIT IV

MULTILAYER PERCEPTRON – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Comuter experiment, feature detection, (p. no's 156 –201)

UNIT V

BACK PROPAGATION - back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning. (p. no's 202 –234)

UNIT VI

SELF ORGANIZATION MAPS – Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification (p. no's 443 –469, 9.1 –9.8)

UNIT VII

NEURO DYNAMICS – Dynamical systems, stavility of equilibrium states, attractors, neurodynamical models , manipulation of attarctors as a recurrent network paradigm (p. no's 664 –680, 14.1 –14.6)

UNIT VIII

HOPFIELD MODELS – Hopfield models, computer experiment I (p. no's 680- 701, 14.7 – 14.8)

TEXT BOOKS:

1. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004

REFERENCE BOOKS

1.
2. Artificial neural networks - B.Vegnanarayana Prentice Hall of India P Ltd 2005
3. Neural networks in Computer intelligence, Li Min Fu TMH 2003
4. Neural networks James A Freeman David M S kapura Pearson education 2004

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II-Semester

UML LAB

1. The student should take up the case study of Unified Library application which is mentioned in the theory, and Model it in different views i.e. Use case view, logical view, component view, Deployment view, Database design, forward and Reverse Engineering, and Generation of documentation of the project.

2. Student has to take up another case study of his/her own interest and do the same what ever mentioned in first problem. Some of the ideas regarding case studies are given in reference books, which were mentioned in theory syllabus, can be referred for some idea.

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