

Detailed Syllabi of Revised Master of Computer Applications Course Jadavpur University, 2011

CSE/MCA/T/111A

Introduction to Programming

- Introduction to computing:** [1L]
block architecture of a computer, bit, bytes, memory, representation of numbers in memory
- Introduction to problem solving:** [2L]
Basic concepts of an algorithm, program design methods, flowcharts.
- Introduction to C programming:** [2L]
A Brief History of C, C is middle-level Language, is a Structured Language, Compiler Vs Interpreters, The Form of a C Program, Library & Linking, Compilation & Execution process of C Program .
- Variables, Data Types, Operator & Expression:** [3L]
Character Set, Token, Identifier & Keyword, Constant, Integer, Floating Point, Character, String, Enumeration, Data Types in C, Data Declaration & Definition Operator & Expression, Arithmetic, Relational, Logical, Increment & Decrement, Bit wise, Assignment, Conditional, Precedence & Associability of Operators.
- Console I/O:** [2L]
Introduction, Character input & Output, String Input & Output, Formatted Input/Output (scanf/printf), sprintf & sscanf
- Control Statement:** [4L]
Introduction, Selection Statements, Nested if, if-else-if, The ? Alternative, The Conditional Expression, switch, Nested switch, Iteration Statements, for loop, while loop, do-while loop, Jump Statements, Goto & label, break & continue, exit() function
- Array & String:** [5L]
Single Dimension Arrays, Accessing array elements, Initializing an array, Multidimensional Arrays, Initializing the arrays, Memory Representation, Accessing array elements, String Manipulation Functions, searching, sorting an array.
- Function:** [3L]
Introduction, advantages of modular design, prototype declaration, Arguments & local variables, Returning Function Results by reference & Call by value, passing arrays to a function, Recursion
- Storage Class & Scope:** [2L]
Meaning of Terms, Scope - Block scope & file scope, Storage Classes Automatic Storage, Extern Storage, Static, Storage, Register Storage
- Pointers:** [6L]
Introduction, Memory Organization, The basics of Pointer, The Pointer operator Application of Pointer, Pointer Expression, Declaration of Pointer, Initializing Pointer, De-referencing Pointer,

Void Pointer, Pointer Arithmetic, Precedence of &, * operators Pointer to Pointer, Constant Pointer, Dynamic memory allocation, passing pointer to a function, array of pointers, accessing arrays using pointers, handling strings using pointers

Structure, Union, Enumeration & typedef: [3L]

Structures, Declaration and Initializing Structure, Accessing Structure members, Structure, Assignments, Arrays of Structure, Passing, Structure to function, Structure Pointer, Unions,

C Preprocessor: [2L]

Introduction, Preprocessor Directive, Macro Substitution, File Inclusion directive, Conditional Compilation

File handling: [5L]

Introduction, File Pointer, Defining & Opening a File, Closing a File, Input/Output Operations on Files, Operations on Text mode files and binary mode files, Error Handling During I/O Operation, Random Access To Files, Command Line Arguments

Suggested Readings:

1. C: The Complete Reference: Herbert Schildt
2. Programming with C: Byron S. Gottfried
3. Let us C: Y.P. Kanetkar
4. Spirit Of "C": Moolish Kooper.
5. Programming in C : S. Kochan.
6. C Programming Language: Kernighan & Ritchie.
7. Programming in C: R. Hutchison.
8. Graphics Under C: Y. Kanetkar

CSE/MCA/T/112A

Digital Systems

Difference between Analog and Digital Systems.

[1L]

Number Systems :

Binary number systems, Conversion of binary numbers to decimal numbers and vice-versa, Binary addition, Representation of negative numbers, Binary subtraction, Binary multiplication and division, Octal and hexadecimal numbers, conversion from binary to octal or hexadecimal and vice-versa.

[6L]

Binary codes :

Binary Coded Decimal (8421 BCD, Excess-3 BCD) , Addition of BCD numbers, Gray code, Error detecting code, Seven-segment display code, other Alphanumeric codes (ASCII, EBCDIC,

ISCII, UNICODE).

[6L]

Boolean algebra and Logic Gates:

Truth Table, AND, OR , NOT and Exclusive-OR operations, Venn Diagram, De Morgan's Theorem, Universal logic operations, Writing Boolean functions from truth table, AND, OR, NOT, NAND, NOR, Exclusive-OR, Exclusive-NOR.

[4L]

Logic Families: Bipolar Logic Families (RTL, DTL, HTL, TTL, ECL), MOS families (MOSFET, CMOS, BiCMOS).

[5L]

Minimization of Boolean functions:

Karnaugh-Veitch Map method, Quine-McClusky Method.

[4L]

Combinational digital circuits:

Encoder, Decoder, Multiplexer, Demultiplexer, Magnitude comparator, Parity generator, Parity checker, Half-adder, Full-adder, Sequential adder, Parallel adder, Carry-Look-Ahead adder

[6L]

Sequential digital circuits:

Flip-flops, Registers, Up-down counters, asynchronous and synchronous counters, design methodology of sequential circuits.

[8L]

Suggested Readings:

1. Digital Design: M. Morris Mano and Michael D. Ciletti, Pearson Education
2. Digital Circuits and Design : S. Salivahanan and S. Arivazhagan, Vikas Publication
3. Engineering Digital Design, R.F.Tinder, Academic Press, Harcourt India Pvt. Ltd.
4. Introduction to Logic design, A.B.Marcovitz, Tata –McGraw-Hill Edition.
5. Computer Systems and Data Analysis, Basu, Nasipuri and Kundu, Narosa, New Delhi.
6. B. Vranesic, “ Fundamentals of Digital Logic with VHDL Design”, Tata-Mc-Graw-Hill Edition.
7. A. P. Malvino “Digital Principles and Applications”, McGraw Hill International Editions(Fourth Edition).

CSE/MCA/T/113A

Management Information Systems

An overview of MIS – Structure of a MIS – Hardware, Software and Communication technology for information systems – concepts of information. [2L]

Storage and retrieval of data – transaction processing – office automation and information processing - control functions – Decision making process – phases in the decision making process – Intelligence and design phases – concepts of decision making – Behavioral models of the decision maker/decision making. [12L]

System concepts – system concepts applied to management information systems – concepts of planning and control – Organizational structure and management concepts [8L]

Decision support systems – support systems for planning, control and decision making – support systems for management of knowledge work – Information systems requirements – strategies for the determination of Information requirements. [10L]

Data base requirements – user interface requirements – developing and implementing application systems – Quality assurance and evaluation of Information systems – future developments and their organizational and social implications. [8L]

Suggested Readings:

1. Gordon B. Davis, Margrethe H. Olson , “Management Information Systems – Conceptual foundations, Structure and Development “, 2nd edition Mc-Graw Hill
2. James A. Senn , “Analysis & Design of Information System “, Second edition, McGraw Hill.

CSE/MCA/Math/T/114A

Mathematical Foundation I

• **Probability Theory** [12L]

Basic Probability Theory, Conditional Probability, Bayes’ Theorem, Expected Value and Variance, Distributions – Binomial, Poisson, Normal etc.

• **Statistical Applications** [12L]

Concepts of mean, median and mode, Objectives of a sample survey, Sample estimate of the attribute of a population, Selection of a sample without bias, Simple random sampling – with and without replacement, Sampling Distributions, Central Limit Theorems, Confidence interval, Hypothesis Testing, Chi-square tests and other testing methods.

• **Linear Algebra** [9L]

Matrices and Determinants, Characteristic polynomials, Eigen values, Vector spaces, Concept of Inner Product and Metric, Linear Transformations.

• **Logic and Proofs** [7L]

Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Inference Rules, Proof Methods and Strategy.

Suggested Readings:

1. Feller: An Introduction to Probability Theory and Its Applications.
2. N. G. Das: Statistical Methods.
3. S. K. Mapa: Higher Algebra – Abstract and Linear.

CSE/MCA/Math/T/115A

Mathematical Foundation II

• **Sets, Functions, Relations** [8L]

Sets and Set Operations, Cartesian Product, Functions – one-one, onto, one-to-one, Relations, Equivalence Relation and Partitions, Partial Order Relations, Lattices.

• **Abstract Algebra** [12L]

Binary Operations, Groupoid, Semi-group and Monoid, Group and Subgroup, Cosets, Lagrange's theorem, Cyclic group, Order of a group, Generators, Normal subgroup, Quotient group, Homomorphism, Isomorphism, Permutation group, Direct product, Rings and sub-rings, Ideals and quotient rings, Integral domains and Fields.

• **Introduction to Number Theory** [6L]

Divisibility, GCD, Prime Numbers, Infinitude of Primes, Fundamental Theorem of Arithmetic, Congruences, Fermat's Little Theorem, Euler's Formula, Chinese Remainder Theorem.

• **Induction and Recursion** [7L]

Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction

• **Basic Counting** [7L]

Sum Rule and Product Rule, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations.

Suggested Readings:

1. C. L. Liu: Elements of Discrete Mathematics.
2. S. K. Mapa: Higher Algebra – Abstract and Linear.
3. Kenneth Rosen: Discrete Mathematics and Its Applications.
4. Hardy et. al.: An Introduction to the Theory of Numbers.

Approximations and Errors associated with numerical methods. [1L]

Solution of non-linear equations:

Iterative method using repeated substitutions, Bisection method, method of false position, Newton-Raphson method, Secant method, Chebyshev method.

Analysis and comparison of these methods. [6L]

Finding complex roots of a polynomial equation: Lin's method, Bairstow's method.

[2L]

Solution of linear simultaneous equations:

Direct methods:

Gaussian elimination, Gauss-Jordan elimination, matrix inversion using Gauss-Jordan elimination. [3L]

Iterative methods:

Jacobi's method, Gauss-Seidel method and their analysis. [2L]

Solution of non-linear simultaneous equations:

Iterative method and Newton-Raphson method. [2L]

Finding the eigenvalues and corresponding eigenvectors of a square matrix:

Definitions of eigenvalues and eigenvectors, Power method for finding the eigenvalues and corresponding eigenvectors of a square matrix. [3L]

Transform methods : Jacobi's method, Hessenberg's method. [3L]

Methods for interpolation:

Newton's forward difference formula, Newton's backward difference formula, Gauss central difference formula. [3L]

Divided difference formula, Lagrange's formula, iterative interpolation method. [2L]

Curve fitting: method of least squared error, cubic splines. [2L]

Methods for differentiation:

Computation of derivatives using Newton's forward/backward difference formulae. [1L]

Methods for integration:

Trapezoidal method, Simpson's method, Boole's method, analysis and comparison of these methods, Romberg's method, Gauss quadrature formula. [4L]

Solution of differential equations:

Euler's method, modified Euler's method, Runge-Kutta 2nd order formula, Runge-Kutta 4th order formula, predictor-corrector methods. [4L]

Solution of partial differential equations [2L]

Suggested Readings:

1. Numerical Algorithms by Krishnamoorthy and Sen
2. Numerical Methods by J.H.Mathews, PHI
3. Numerical Analysis and Algorithms by P. Niyogi, TMH
4. Numerical Methods for scientific and engineering computations by Jain, Iyengar and Jain, New Age International publisher
5. Computer Systems and Data Analysis by D.K.Basu, M.Nasipuri and M.Kundu, Narosa
6. Introductory Methods of Numerical Analysis by S.S.Sastry , P.H.I

CSE/MCA/T/122A

Data and File Structures

Fundamentals of algorithm analysis, Time and space complexity of algorithms, Elementary data structures and their applications. [8L]

Arrays: ordered lists, representation of arrays, linked lists: singly and doubly linked lists, stacks, queues, dequeues, multiples stacks and queues, generalized lists, Applications: polynomial arithmetic, sparse matrices, equivalence relations, infix, postfix and prefix arithmetic expression conversion and evaluations. [8L]

Binary trees: Definition, traversals, threaded binary tree, set representation and operations, Binary Search Trees, AVL trees, B-Tree: B+ tree. [6L]

Graphs: Representation, traversal, connected components, topological sort. [4L]

Searching & Sorting: Linear Search, Binary search, Hashing Internal and External sort, Insertion sort, Bubble sort, Selection sort, Quicksort, Merge sort. Radix sort, Bucket sort, Counting sort [8L]

Files and their organizations; Tree, Sequential, random, Hashed, indexed, Inverted files. [6L]

Suggested Readings:

1. Tannenbaum, "Data Structures", PHI
2. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C" , PHI
3. Horowitz and Sahani, "Fundamentals of Data structures", Galgotia publications

CSE/MCA/T/123A

**Microprocessors and Assembly
Language**

Introduction to microprocessors	[2L]
Microprocessor architecture	[2L]
Organisation and programming of microprocessor Intel-8085	[8L]
Memory interfacing	[4L]
Interrupt and DMA	[4L]
Serial and parallel communication	[4L]
I/O interfacing	[2L]
Key board & display, Programmable parallel interface, Programmable timer	
ADC & DAC etc	[8L]
Single chip microcomputer	[2L]
16-bit & 32-bit microprocessors	[4L]

Suggested Readings:

1. R. Gaonkar, "Microprocessor Architecture, Programming and Applications," 5th Ed., Pearson International, 2001.
2. C. Gilmore, "Microprocessors Principles and Applications," 2nd Ed., McGraw-Hill International, 1995.
3. D. Hall, "Microprocessors and Interfacing," 2nd Ed., Tata-McGraw-Hill, 1999.
4. Liu and Gibson, "Microcomputer Systems: The 8086/8088 Family," 2nd Ed., Prentice-Hall India, 1986.
5. Treibel and Singh, "The 8088 and 8086 Microprocessors," 4th Ed., Prentice-Hall India, 1991.
6. K. Ayala, "The 8051 Microcontroller – Architecture, Programming and Applications," 2nd Ed., Pearson International, 1996.
7. Mazidi, "The 8051 Microcontrollers & Embedded Systems," Pearson Education Asia
8. M. Predco, "Programming and Customizing the 8051 Microcontroller," Tata McGraw-Hill, 1999.

1. Introduction to basic structures and operational concepts, Instruction formats, Instruction execution, sequencing, Addressing modes, Stacks, Queues, Subroutines [Example instruction set may be used: INTEL/ARM/MOTOROLA/others] **[7L]**
2. Control unit – Concepts, Fetching and storing word from/in main memory, Register transfers, Operations, execution of a complete instruction
Hardwired control, Microprogrammed control, Concept of horizontal and vertical microprogramming, Nanoprogramming, Concepts of pipelining **[8L]**
3. Fixed point Arithmetic - Arithmetic and logical operations of signed numbers and their implementation,
Concepts of floating point numbers and operations, Bit-slice processors and Emulation **[5L]**
4. Memory – Basic concepts, RAM, ROM – different types, Characteristics, Cache memories, Performance (memory interleaving, hit rate etc.), Memory hierarchy - virtual memory – address translation, Secondary memories **[8L]**
5. Input/output organization: memory mapped, standard (isolated) and linear selection techniques of I/O addressing. Data transfer through programmed I/O, interrupt and DMA I/O processors. Data transfer over synchronous and asynchronous buses; discussions on some standard interface buses. **[8L]**
6. Brief introduction to RISC processors and parallel processing techniques. **[4L]**

Suggested Readings:

1. Computer Organization – C. Hamacher, Z. Vranesik, S. Zaky, McGraw Hill
2. Computer Architecture and Organization – John P. Hayes, McGraw Hill

- 1. Introduction to Project management** **[3L]**
 - a. Project Management Basics
 - b. Role of a Project Manager
 - c. Project Resources
 - d. Phases of Software Project
- 2. Introduction to PERT/CPM** **[5L]**
 - a. Work Breakdown Structure
 - b. Network diagramming
 - c. Critical Path

- d. PERT Probability
 - e. Crashing
 - f. Resource Leveling
 - g. Exercises
- 3. Software Effort Estimation [4L]**
- a. Estimations Basics
 - b. LOC Method
 - c. Function Points
 - d. Activity Based Estimation
 - e. COCOMO
 - f. Uncertainty in estimation
- 4. Project Planning [5 L]**
- a. Management
 - b. Risk
 - c. Configuration
 - d. Quality Assurance
 - e. Induction
 - f. Schedule
- 5. Configuration Management [4L]**
- a. Configuration Management Basics
 - b. Environment for Configuration Control
 - c. Configuration Control vs. Version Control
 - d. Code Management
 - e. Change Management
 - f. Information Management
- 6. Quality Assurance in Projects [4L]**
- a. Quality Basics
 - b. Quality Assurance Activities in Projects
 - i. Standards
 - ii. Coding Standards
 - iii. Documentation Standards
 - iv. Design Standards
 - v. Templates
 - vi. Formats
 - vii. Processes
 - c. Quality Control Activities in Projects
 - i. Verification
 - ii. Validation
 - iii. Quality Metrics
 - d. Introduction to ISO 9000, SEI – CMM Maturity Levels, Six Sigma
- 7. Productivity Aspects [2L]**
- a. Productivity Basics
 - b. Productivity Measurement & Metrics
- 8. Human Factors and Leadership [4L]**
- a. Motivation
 - b. Communication

- c. Handling Difficult People
- d. Leadership
- e. Team Dynamics
- 9. Progress Tracking & Control [3L]**
 - a. Progress Assessment & Reporting
 - b. Scope Management
 - c. Risk Mitigation
- 10. Project Closeout [3L]**
 - a. Project post-mortem
 - b. Collection of re-usable Components
 - c. Draw lessons from the good & bad Practices of the project
 - d. Project-End Audit
- 11. Organizational Support for Effective Project Management [3L]**
 - a. Recognition as a Specialist Discipline
 - b. Organize Knowledge Repository
 - c. Processes, Standards & Guidelines
 - d. Training

Suggested Readings:

Gilb, T., “Principles of Software Engineering Management”, Addison Wesley. Reading. M.A 1988.

Putnam. L.H., Myers. W., “Industrial Sire: Software - Effective Management using Measurement”. IEEE C.S. Press. 1997.

CSE/MCA/T/211A

Operating Systems

- 1. Introduction to Operating Systems [1L]
- 2. Concept of batch-processing, multi-programming, time sharing, real time operations [2L]
- 3. Process Management: Concept of process, state diagram, process control block; scheduling of processes – criteria, types of scheduling, non-preemptive and preemptive scheduling algorithms like: FCFS, Shortest Job First/Next (SJF/N), Shortest Remaining Time Next (SRTN), Round Robin (RR), Highest Response ratio Next (HRN), Priority based scheduling, different Multilevel queue scheduling etc.; [5L]
- 4. Threads – concept, process vs thread, kernel and user threads, multithreading models [2L]

5. Inter-process Communication (IPC) – Shared memory, message, FIFO, concept of semaphore, critical region, monitor [2L]
6. Process Synchronization: concepts, race condition, critical section problem and its solutions; synchronization tools- semaphore, monitor etc., discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber etc.
Deadlock – conditions, resource allocation graph, prevention techniques, avoidance technique – Banker’s algorithm and related algorithms [6L]
7. Memory management: Address space and address translation; static partitioning, dynamic partitioning, different types of fragmentation, paging, segmentation, swapping, virtual memory, demand paging, page size, page table, page replacement algorithms – FIFO, LRU, Optimal page replacement, Variants of LRU, etc; thrashing, working set strategy [6L]
8. File Management: File and operations on it, file organization and access; file allocation; directory structures, file sharing, file protection [4L]
9. Device management: Magnetic disks, disk scheduling- criteria, algorithms – FCFS, SSTF, SCAN, C-SCAN, LOOK, etc, disk management – formatting, boot block, disk free space management techniques, concept of RAID etc [3L]
10. Protection and Security: Concepts of domain, Access matrix and its implementation, access control, Security of systems- concepts, threats- Trojan horse, virus, worms etc, introduction to cryptography as security tool, user authentication [5L]
11. Case Studies [4L]

Suggested Readings:

1. Operating Systems Concepts – A. Silberschatz, P. Galvin and G. Gagne. Wiley India
2. Operating Systems Concepts - Gary Nutt, N. Chaki and S. Neogy, Pearson Education
3. Operating Systems – W. Stallings, Pearson Education
4. Operating Systems: A Concept-based Approach – D. M. Dhamdhare, Tata McGraw-Hill

CSE/MCA/T/212A

Object Oriented Programming

Introduction to object oriented programming concept

[1L]

C++:

Overview of Procedural Feature: Concept of Reference variable, Default Parameters to Function, Function overloading [1L]

Fundamental Object Oriented Features:

Class and Object, Abstraction/ Encapsulation, Access Specifier [1L]

Static Members, Friend Function [2L]

Constructor and Destructor [2L]

Operator Overloading [2L]

Inheritance [2L]

Abstract Class, Run time polymorphism, Virtual Base Class [2L]

File Handling [3L]

Exception Handling [1L]

Class Template and Function Template [2L]

JAVA:

Introduction: Features of Java, JVM, Concepts of Java Application and Applet [1L]

Fundamental Object Oriented Features:

Class and Object, Access Specifier, Static Members, Constructor, Garbage Collector [2L]

Function overloading, Inheritance, Runtime Polymorphism, Abstract class [2L]

Package and Interface [2L]

Exception Handling [1L]

Wrapper Classes [1L]

I/O handling [3L]

Threads, Communication and Synchronization of threads [4L]

Event Driven Programming: AWT/Swing GUI Components, AWT/Swing Events [5L]

Suggested Readings:

1. The Complete reference C++ by H. Schildt, McGrawHill
2. Learning C++: A Hands on Approach by Nagler, Jayco Publishing House
3. The C++ Programming Language by Stroustrup, Addison Wesley
4. Object Oriented Programming in C++ by R. Lafore, SAMS
5. Java 2.0 Complete Reference by H. Schildt, McGrawHill
6. JAVA How to Program by Deitel and Deitel, Prentice Hall

CSE/MCA/T/213A

Optimization Techniques

• Introduction

[3L]

Historical development, Engineering application of optimization, Formulation of design problems as mathematical programming problems, classification of optimization problems.

• Linear Programming

[14L]

Graphical method, Simplex method, Revised simplex method, Duality in linear programming, Sensitivity analysis, other algorithms for solving LP problems, Transportation Problem, Assignment Problem and other applications, Integer Programming.

• Non Linear Programming

[10L]

Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and indirect methods; Optimization with calculus, Khun-Tucker conditions.

• Dynamic Programming

[7L]

Introduction, Sequential optimization, computational aspects, curse of dimensionality.

• Introduction to Advanced Techniques of Optimization

[6L]

Simulated Annealing, Genetic Algorithms, Other methods for optimization and search.

Suggested Readings:

1. H. A. Taha: Operations research
2. S. Fang et al: Linear optimizations and Extensions
3. G. Hadley: Linear programming, Narosa Publishing House, New Delhi, 1990.
4. K. Deb: Optimization for Engineering Design – Algorithms and Examples.

• Introduction to Graph Theory**[3L]**

Definitions and Examples, Subgraphs, Complements, Graph Isomorphism, Degree, Directed and undirected graphs, weighted and unweighted graphs.

• Cycles, Planarity and Coloring**[8L]**

Walk, Trail, Path, Cycle, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Vertex coloring, Edge coloring, Chromatic Polynomials.

• Trees**[4L]**

Definitions, Properties and Examples, Rooted Trees, Trees and Sorting, Binary Trees, Weighted Trees and Prefix Codes

• Optimization in Graphs**[7L]**

Shortest Path Algorithms, Minimal Spanning Trees – the algorithms of Kruskal and Prim, Transport Networks – Max-flow Min-cut Theorem, Matching Theory.

• Principle of Inclusion and Exclusion**[6L]**

The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

• Generating Functions**[6L]**

Definition and Examples – application of calculus, Partitions of Integers, The Exponential Generating Function, The Summation Operator.

• Recurrence Relations**[6L]**

First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, Solving Recurrences by Generating Functions, Fibonacci Numbers and Golden Ratio.

Suggested Readings:

1. F. Harary: Graph Theory
2. N. Deo: Graph Theory with Applications to Engineering and Computer Science
3. A. Tucker: Applied Combinatorics

Software as an engineering product, Software vs. Program, Software engineering vs. conventional engineering, Goals of software engineering, Issues and challenges

[2L]

Software development process models, Waterfall, Prototyping, Spiral, Incremental, RAD and Component based development model. Comparative analysis of models

[2L]

Requirement Engineering, Tools for requirement elicitation and analysis, Analysis issues, System Requirement Specification, Formal techniques– Z, Spec, Analysis Models for Structured

approach & Object Oriented approach, Requirement Traceability.

[2L]

Software Design & Modeling - Problem partitioning, , Structured charts, coupling, cohesion, Modular Design and Structured Programming. Data design, User Interface design.

[2L]

Overview of models in software development – UML, DFD, ERD, Modeling concurrent & distributed systems - PetriNets, High Level Petri Nets

[4L]

Introduction to Design Patterns, Role of Design Patterns in Object Oriented design, Goals of Design Patterns, Selection of Design Patterns in Object Oriented systems, Using a Design Pattern, Describing Design Patterns, Design Patterns classification. Case study.

[2L]

Introduction to Aspect Oriented Paradigm. Case Study.

[2L]

Introduction to Software Architecture, Architecture models - 4+1 views, Architecture Definition Language, Evolution – Model Driven Architecture, Component Based architecture, Service Oriented Architecture, Event Driven Architecture, Architecture models

[2L]

Coding Standards and Guidelines, Code reviews & Walkthroughs, Coding Principles, Code reuse

[2L]

Program analysis – slicing and merging, Correctness proof, Symbolic execution, Formal Verification

Software testing objectives and principles, Verification vs. Validation, Types of testing, Cyclomatic complexity, Test Case Generation, Test tools & Models, Object-oriented Testing, Model Based testing, Test automation.

[6L]

Software Quality Assurance and Quality control, Software Process Control, Quality factors, Quality standards – TQM, ISO, SEI CMM, PCMM, Six sigma, Reliability, Hazard, Availability, Steady State Availability, Estimation of Residual Errors, Reliability Models

[4L]

Software Project Management concepts, Software Project Management Plan, Tools for project plan – WBS, PERT, GANTT, Project Scheduling & Monitoring, Risk Management, Software Project Complexity, Estimation Metrics –Size Oriented and Function Point Oriented; Cost Estimation - Algorithmic Cost Modeling, COCOMO Model (including COCOMO II and advanced COCOMO), Personnel Productivity & team structure

[6L]

Software Metrics, Significance, Project, process and product metrics, Halstead's metrics, OO metrics –Performance Metrics, Defect Metrics

[2L]

Software maintenance and types, Software reengineering process model; Computer Aided Software Engineering,, building blocks for CASE, Taxonomy of CASE tools

[2L]

Suggested Readings:

1. Fundamentals of Software Engineering – C. Ghezzi, M. Jazayeri, D. Mandrioli
2. Software Engineering – Sommerville, Pearson
3. Software Engineering – Martin L. Shooman, TMH
4. Software Engineering , A practitioner’s approach – Roger Pressman
5. Software Engineering – Rajib Mall

CSE/MCA/T/221A

Database Management System

Introduction: Advantages of DBMS, Various levels of Data Definition and abstraction, Data Independence [2 L]

Concepts of Different Database Models, Functional Components of DBMS and Overall Structure of DBMS [2 L]

Relational Model: Relation, Attribute, Key, Foreign Key and other Relational Constraints [2 L]

Database Design: ER Diagram, Mapping and Participation Constraints, Weak Entity Set, Aggregation, Extended ER diagram, Design of Database Tables from ER/EER Diagram [4 L]

Languages: Relation Algebra, Relational Calculus [3 L]

Structured Query Language [3 L]

Functional Dependency: Concepts of Functional Dependency, Normalization, Multivalued Dependency [5 L]

Database Storage: Fixed/Variable Length Record, Ordered/Unordered file and Operations on them [1 L]

Indexing: Primary/Clustering/Secondary/Multilevel Index, B/B+ Tree based Indexing, Hashing [3 L]

Query Optimization: Search Strategies, Expression level Optimization, Join strategies [2 L]

Database Security [1 L]

Case Study: Introduction to Oracle Architecture, PL/SQL, Trigger [3 L]

Transaction and Recovery: Concept of Transaction and its States, Log based Recovery, Checkpoint [3 L]

Concurrency Control: Lock based Protocol, Time Stamp based Protocol, Recoverable Schedule etc. [3 L]

Advanced Concepts: Object-oriented database concepts and other query languages [3L]

Suggested Readings:

1. Fundamentals of Database Systems by E. Navathe
2. Database System Concepts by Korth and Silberschatz
3. Commercial Application Development Using Oracle Developer - 2000 by I. Bayross

CSE/MCA/T/222A

Computer Graphics

Introduction to computer graphics and graphical input-output devices [2L]

Rasterization Algorithms: [8L]

Scan conversion of Straight lines: DDA algorithm, Bresenham's algorithm, Midpoint algorithm

Scan conversion of Circles: Bresenham's algorithm, Midpoint algorithm

Scan conversion of Ellipses: Midpoint algorithm

Generations of solid areas: [3L]

Scan line algorithms, Seed-fill algorithms.

2-D Transformations: [5L]

Scaling, Rotation, Translation, Reflection, Shear, Homogenous co-ordinate system, Rotation about an arbitrary point, reflection in an arbitrary straight line.

Display files and Segments. [2L]

2-D viewing and Clipping: [6L]

Cohen- Sutherland Algorithm, Mid-point subdivision algorithm, Sutherland-Hodgman Polygon Clipping.

Curves and Surfaces: [4L]

Bezier curves and surfaces, B-Spline curves and surfaces.

3-D Transformations: [4L]

Scaling, Rotation, Translation, Reflection, Rotation about an arbitrary straight line, reflection in an arbitrary plane, Parallel projections, Perspective projections.

Hidden surface removal. [2L]

Illumination model, colour, texture patterns. [4L]

Suggested Readings:

1. Procedural Elements of Computer Graphics: D.E.Rogers, McGraw Hill.
2. Computer Graphics: Hearn and Baker, Prentice Hall India.
3. Computer Graphics, principles & practices by J.D. Foley, A. van Dam, S.K. Feiner and J.F. Huges, Addison Wesley.
4. Computer Graphics, a programming approach, by S. Harrington, TMH publication.
5. A.N.sinha, A.D.Udai, "Computer Graphics", TMH, New Delhi,2008.
6. M.K.Pakhira, "Computer Graphics, Multimedia and Animation" PHI Pvt. Ltd., 2008.
7. Foley, van Dam, Feiner, Hughes, " Computer Graphics : Principles and Practice", Addison Wesley.

CSE/MCA/T/223A

Data Communication and Computer Networks

Introduction: Uses of Computer Networks, Types of Computer Networks, OSI Reference Model, Example Networks [4L]

Physical Layer: Data and signal fundamentals, Transmission impairments, Attenuation, Distortion, Noise, Data rate limits for noisy and noiseless channels, Performance [2L]

Digital Transmission – Problems with digital transmission, Different line coding schemes, Block coding schemes, Scrambling techniques, Analog to digital encoding. Analog Transmission. [4L]

Transmission Media - Guided (wired) media – Twisted pair cable, Coaxial cable and Fibre optic cable, Unguided (wireless) media – Different propagation modes, Radio waves, Terrestrial microwaves, Satellite communication. [2L]

Concept of multiplexing, Frequency division multiplexing, Time division multiplexing – Synchronous and Statistical time division multiplexing, Handling variable length data, Pulse stuffing. Concept of spreading spectrum, Frequency hopping spread spectrum and Direct sequence spread spectrum. [4L]

Data Link Layer: Link Layer Services, Error detection and Correction Techniques, Multi Access Protocols, Link Layer Addressing, Ethernet, Hubs, Switches and Switches, Point to Point Protocol, Asynchronous Transfer Mode, Multiprotocol Label Switching [6L]

Network Layer: Introduction, Virtual Circuit and Datagram Networks, IP Addressing, Subnetting, Routing Algorithms (Link State, Distance Vector, Hierarchical), Routing in the Internet (RIP, OSPF, BGP), Broadcast and Multicast Routing Algorithms, Routers, ICMP, IPv6 [8L]

Transport Layer: Introduction to Transport Layer Services, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control, Sockets, Quality of services (QOS) [6L]

Application Layer: Web and HTTP, Domain Name Space (DNS), Electronic Mail (SMTP, MIME, IMAP, POP3), File Transfer Protocol, Cryptography [4L]

Suggested Readings:

1. **Computer Networking: A Top-Down Approach Featuring the Internet**, by James F. Kurose and Keith W. Ross, 5th Edition, Pearson Education, 2010
2. **Data communication and Networking**, by Behrouz A. Forouzan, 4th Edition, Tata McGraw-Hill, 2007
3. **Computer Networks**, by Andrew S. Tanenbaum, 4th Edition, Prentice Hall India, 2003
4. **Computer Networks: A Systems Approach**, by Larry L. Peterson and Peter S. Davie, 4th Edition, Morgan Kauffman Publishers, 2007
5. **Data and Computer Communication**, by William Stallings, 9th Edition, Pearson Education, 2011
6. **Unix Network Programming: Networking APIs: Sockets and XTI, (Volume 1)** by W. Richard Stevens, 2nd Edition, Prentice Hall India, 1999

• **Finite Automata and Regular Languages :** [14L]

DFA, NFA, Recognition of a language by an automaton, Equivalence of DFA and NFA, Minimization of FA, Equivalence of FAs, Pumping Lemma for Regular Languages, Closure Properties of Regular Sets.

• **Context-free Languages and Push-Down Automata:** [12L]

Non-regular languages, CFLs, Closure properties of CFLs. Grammars, Ambiguity, Push-Down Automata, Pumping Lemma for CFL.

• **Turing Machines:** [8L]

Introduction to Context Sensitive Languages and Grammars, Turing Machines and its variants, Universal TMs, Halting Problem, Recursive Functions and Sets, Recursively Enumerable Sets, Arithmetization of TMs.

• **Basics of Complexity Theory :** [6L]

Space and Time Complexity, Ram programs and TMs, PTIME, NP, PSPACE etc., Polynomial reducibility.

Suggested Readings:

1. J. E. Hopcroft and J. D. Ullman: Introduction to Automata Theory, Languages and Computation.
2. H. R. Lewis and C. H. Papadimitriou: Elements of the Theory of Computation.

• **Complexity Analysis :** [3L]

Complexity measures, Worst, Best and Average Case, Upper and Lower bounds, Order Notations.

• **Divide and Conquer Technique:** [7L]

Binary Search, Merge Sort, Quick Sort, Multiplication of Large Integers.

• **Sorting :** [7L]

Comparison Tree, Lower bound on comparison-based sorting, Sorting in Linear Time, Counting Sort, Radix Sort.

• **Greedy Algorithms** [7L]

Minimum spanning tree, Union find, Set cover, Huffman coding, Fractional Knapsack Problem.

• **Dynamic Programming** [7L]

Matrix Chain Multiplication, Longest Common Subsequence, 0-1 Knapsack Problem, Traveling Salesman.

• **Introduction to Branch and Bound and backtracking techniques.** [3L]

• **Introduction to NP-completeness** [6L]

Classes of Problems, Easy and Hard Problems, Concept of Reduction, The classes P, NP, NP-hard and NP-complete, Proving NP-completeness, Examples of NP-complete problems such as 3SAT, CLIQUE, VERTEX COVER etc.

Suggested Readings:

1. Cormen et. al.: Introduction to Algorithms.
2. Sahni and Horowitz: Fundamentals of Computer Algorithms

CSE/MCA/T/311A

System Software and Compiler

Introduction to system softwares [1L]

Assembler: functions, features, design of one pass and two pass assemblers [5L]

Macroprocessors: functions, features and design [2L]

Introduction to Compiler, Different phases and passes of compiler [1L]

Lexical Analysis: Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Finite state machines and regular expressions and their applications to lexical analysis, Implementation of lexical analyzers [4L]

Syntax Analysis: Role of the parser, Formal grammars and their application to syntax analysis, Context free grammars, Derivation and parse trees, Top Down parsing, LL(1) grammars, Predictive Parsing, Bottom-up-parsing, Shift Reduce Parsing, LR(0) grammars, LR parsing algorithms [10L]

Syntax Directed Translation: Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions [2L]

Runtime Environments: Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter passing mechanism [2L]

Intermediate Code Generation: Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples) [2L]

Code Optimization and generation: Introduction, Basic blocks and flow graphs, Transformation of basic blocks, DAG representation of basic blocks, Principle sources of optimization, Loops in flow graph, Peephole optimization.

Issues in the design of code generator, Register allocation and assignment [3L]

Loader and Linkers: Basic Concepts of Linkers and Loader Functions, Boot Loaders, Linking Loaders, Linkage Editors, Dynamic Linking [5L]

Concept of Editor and text editor, Interpreters, Simulator,
Text editors - Overview of the Editing Process - User Interface – Editor Structure. - Interactive debugging systems - Debugging functions and capabilities – Relationship with other parts of the system – User-Interface Criteria. [3L]

Suggested Readings:

1. Alfred Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles, Techniques and Tools”, Pearson Education Asia (2nd Ed. - 2009).
7. **Leland L. Beck**, “System Software: An Introduction to Systems Programming”, 3/E, Addison-Wesley, 1997.
3. Allen I. Holub “Compiler Design in C”, Prentice Hall of India, 2003.
4. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Pearson Education.
5. J.P. Bennet, “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill, 2003.
6. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
7. Kenneth C. Loudon, “Compiler Construction: Principles and Practice”, Thomson Learning.
8. Systems Programming and Operating Systems – D. M. Dhamdhare, TMH
9. John J. Donovan, “ Systems Programming”, 3rd edition, 1997, Addison Wesley.

CSE/MCA/T/312A

Artificial Intelligence and Applications

Introduction

[2L]

Intelligent Agents

[2L]

Solving problems by Searching – Uninformed (BFS, DFS, DLS, ID, IB, Bi-directional Search, Island-Driven Search), Informed/Heuristic (Greedy, A*, IDA*)

[5L]

Advanced intelligent search techniques – Uniform Cost Search, Hill Climbing, Simulated Annealing, Genetic Algorithm, Tabu Search

[8L]

Adversarial search - Game Playing	[2L]
Knowledge and Reasoning - Predicate calculus in Artificial intelligence, Resolution Refutation Systems, Structured Knowledge Representation Techniques	[6L]
Reasoning under Uncertainty – Non Monotonic Reasoning Systems, Assumption based Truth Maintenance System, Probabilistic Reasoning, Fuzzy Reasoning	[4L]
Machine Learning - Decision Trees, Artificial Neural Networks	[5L]
Planning – Classical, Algorithm for Planning as State-space Search, Planning Graph	[2L]
Some Applications of Artificial Intelligence	[4L]

Suggested Readings:

1. N. J. Nilsson. Artificial Intelligence : A New Synthesis, Elsevier India, 2010
2. N. J. Nilsson. Principles of Artificial Intelligence, Narosa Publishing House, 2002
3. N. J. Nilsson. Problem-Solving Methods in Artificial Intelligence, New York: McGraw-Hill, 1971.
4. S. Russel, P. Norvig. Artificial Intelligence and Modern Approach, Pearson Education, 2003
5. G. F. Lugar, Artificial Intelligence, Pearson Education, 2001
6. M. Ginsberg, Essentials of Artificial Intelligence, Morgan Kaufman Publishers, 1993
7. Elaine Rich, Kevin Knight. Artificial Intelligence

CSE/MCA/T/313A

Web Technology

Introduction to web technology	[1L]
Mark-up languages for presentation: SGML and HTML, DOM, XML	[2L]
Scripting language (JavaScript/ VBScript etc.) and DHTML.	[4L]
XML Processing Technologies for Data Representation; DOM, SAX for XML.	[4L]
Server side programming (Servlet, ASP, JSP etc.)	[8L]
Web Clients: Browsers, cookies, spiders, search engines and agents	[2L]

Web Proxies	[1L]
Web services: Design and modeling of web services, Technologies for implementing web services	[8L]
Web Servers Web Caching and Content Distribution	[2L]
Load Balancing	[2L]
Web Security and Firewalls	[3L]
Web Protocols: TCP, IP and HTTP, SMTP, POP3, FTP	[3L]

Suggested Readings:

1. Head First Servlets and JSP by Bryan Basham, Kathy Sierra, Bert Bates
2. *Internet and World Wide Web: How to Program - 4th Edition* by P. J. Deitel and H. M. Deitel
3. Java Web Services by David A Chappell, Tyler Jewell

CSE/MCA/T/314A

Image Processing

Fundamentals of Digital Image Processing, Image representation, Basic Image transforms, image file format	[4L]
Image Enhancement: Contrast stretching, Histogram Equalization, Binarization	[4L]
Filtering in Spatial domain: Mean filter, Order Statistics filters.	[2L]
Filtering in Frequency domain : Butterworth filter, Gaussian filter.	[2L]
Image Restoration : Image degradation models, Weiner filter.	[2L]
Image textures: Run Length Coding, Gray-level co-occurrence matrix	[2L]
Image Segmentation:	
Edge detection: Gradient operators, Compass operator, Laplacian operators. LoG operator.	[4L]
Region Segmentation : Region growing, region splitting and merging.	[2L]
Shape detection: Least Mean Square error line fitting, Eigenvector line fitting, Straight line Hough Transform, Generalized Hough Transform.	[4L]

Morphological Operators:

Dilation, Erosion, Opening , Closing, Hit-and-Miss transforms, Applications. [4L]

Image Compression. [4L]

Image Understanding:

Feature extraction techniques, Statistical Decision making techniques, Nearest Neighbour Clustering,

Maxi-min Clustering, Discriminant functions, Artificial Neural Networks. [6L]

Suggested Readings:

1. Digital Image Processing: R.C. Gonzalez and R. E. Woods, Pearson Education.
2. Pattern Recognition and Image Analysis: E. Gose, R. Johnsonbaugh, Steve Jost, Prentice Hall India.
3. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis", PHI.
4. Anil K. Jain, "Fundamentals of Digital Image Processing", PHI.
5. M. Sonka, V. Hlavac, R. Boyle, "Image Processing, Analysis and Machine Vision", Thomson Learning, 1999.
6. Malay K. Pakhira, Digital Image Processing and pattern recognition, PHI, 2011

CSE/MCA/T/314B

Distributed Computing

Introduction to distributed environment: [4L]

Goals, hardware & software concepts, P2P, Cluster, Grid, Cloud, the client-server model, Strengths and weakness of distributed computing, forms of computing

Communication: [4L]

Layered protocols, RPC, remote object invocation, message-oriented communication

Distributed computing paradigms: [5L]

Message passing, client server, P2P, remote procedure call model, distributed objects, object space, collaborative application (groupware)

Socket: [2L]

Socket metaphor, datagram socket API, stream mode socket API, sockets with non blocking I/O, secure socket API

Java RMI: [6L]

Client side, Server Side, object registry, Remote Interface, Server side software, client side software, RMI vs Socket

Advanced RMI: [3L]

Client callback, stub downloading, RMI security manager

Group Communication: [2L]
Unicasting, multicasting, connection oriented & connectionless, reliable and unreliable multicast, Java basic multicast API

Internet Applications: [5L]
HTML, XML, HTTP, Applets, Servlets, Web services, SOAP

Mobile Agents: [2L]
Basic architecture, advantages, mobile agent framework systems, design, implementation using Java RMI

Distributed coordination-based systems JINI: [5L]
Runtime environment, architecture, discovery protocol, join protocol, lookup service, distributed event, distributed leasing, transactions, surrogate architecture

New paradigms of distributed computing environment [2L]

Suggested Readings:

1. Distributed Computing: Principles and Applications, M. L. Liu, Pearson/Addison-Wesley.
2. A Programmer's Guide to Jini Technology, Jan Newmarch, Apress.
3. A. Taunenbaum, Distributed Systems: Principles and Paradigms, PHI
4. G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts and Design, Pearson Education
5. Core Jini, W. Kieth Edwards, Apress.

CSE/MCA/T/314C

IT Security

Introduction to IT Security [8L]

Introduction and Terminologies, Security Infrastructure, Key Management and Protocols

Information Security Management System (ISMS) [8L]

Establishing and managing the ISMS, Documentation requirements, Management responsibility,

Internal ISMS audits, Management review of the ISMS, ISMS improvement

IT Risk Management [8L]

Risk Management Fundamentals, Risk Management Techniques

Cryptography [8L]

Cryptographic Techniques

IT Security Standards and Best Practices

[8L]

ISO/IEC 27002:2005, NIST SP 800-53, COBIT, SSE-CMM, ITBPM

Suggested Readings:

1. Ross Anderson, "Security Engineering: A Guide to Building Dependable Systems", John Wiley & Sons, Inc. 2001.
2. V. Hassler, "Security Fundamentals for E-Commerce", Artech House Inc., 2001.
3. T.R. Peltier, "Information Security Policies and Procedures", Second Edition, Auerbach Publications, USA, 2004.
2. T.R. Peltier, "Information Security Risk Analysis", Third Edition, Auerbach Publications, USA, 2010.

CSE/MCA/T/314D

Industrial Quality Assurance

Basic concepts of Quality Assurance System: SQC

[8L]

Control Charts for process control

[8L]

Acceptance Sampling, Concepts & Plans, Sampling Tables;

[8L]

Product & System Reliability Measurement, Prediction, Evaluation & Optimisation;

[8L]

Fault-tree Analysis, Maintainability; Total Quality Control, Case Exercises.

[8L]

Suggested Readings:

1. Grant, E.L. & Leavenworth, R.S.: Statistical Quality Control, 5th Edn., McGraw-Hill, 1980.
2. Juran, J.M. & Gryna, F.M. : Quality Planning & Analysis form Product Development through Usage, 2nd Edn., McGraw-Hill.

CSE/MCA/T/314E

Enterprise Resource Planning

Introduction

[8L]

ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM

ERP Implementation [8L]

ERP Implementation Lifecycle, Implementation Methodology, Hidden Costs, Organizing the Implementation, Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring

The Business Modules [8L]

Business modules in an ERP Package, Finance, Manufacturing, Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution

The ERP Market [8L]

ERP Market Place, SAP AG, Peoplesoft, Baan, JD Edwards, Oracle, QAD, SSA

ERP – Present and Future [8L]

Turbo Charge the ERP System, EIA, ERP and e-Commerce, ERP and Internet, Future Directions

Suggested Readings:

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, New Delhi, 2000
2. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology, USA, 2001.
3. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – Concepts and Practice”, PHI, New Delhi, 2003

CSE/MCA/T/314F

Coding Theory

Introduction to Communication System and Coding Theory.

[1L]

Block Code:

A) Introduction to Block Code [1L]

B) Single-Parity-Check Code [1L]

- C) Product Code and Repetition Codes [1L]
- D) Probability correct/incorrect decoding and failure [1L]
- E) Hamming Code [3L]

Linear Code:

- A) Definition, Generator and Parity Check Matrices [2L]
- B) Hamming Code as Linear Code [1L]
- C) Error Detection and Correction [3L]

Cyclic Code:

- A) Definition and Introduction to Polynomials [2L]
- B) Generator Polynomial and Encoding [2L]
- C) Decoding Cyclic Code [2L]
- D) Concept of LFSR in Encoding and Decoding Cyclic Code [2L]

Introduction to Linear Algebra [3L]

Introduction to Galois Field [4L]

Elementary concept of BCH Codes, Encoding and Decoding [5L]

Elementary concept of Reed-Solomon Code [3L]

Elementary Concept of Convolutional Code [3L]

Suggested Readings:

1. Error Control Coding: Fundamentals and Applications – Shu Lin, Danilel J. Costello, Jr.
2. Introduction to Error Control Codes – S. Gravano
3. Information Theory, Coding and Cryptography – Ranjan Basu
4. Principles of Digital Communication – Das, Mukherjee, Chatterjee

5. The Theory of Error-Correcting Codes, Vol 1 & 2, by F.J. MacWilliams and N.J.A. Sloane
6. Coding and Information Theory by Richard W. Hamming
7. Handbook of Coding Theory, Vol 1 & 2, by V. S. Pless and W. C. Huffman
8. Algebraic Codes for Data Transmission by Richard E. Blahut
9. Introduction to Coding Theory by Jacobus Hendricus van Lint
10. Coding and Information Theory by Steven Roman
11. Error Control Coding by Shu Lin and Daniel J. Costello
12. Error Correction Coding: Mathematical Methods and Algorithms by Todd K. Moon

CSE/MCA/T/314G

Combinatorial Algorithms

- **Generating Combinatorial Objects** [8L]
Subset generation, Lexicographic ordering, Generation of Permutations and Combinations.
- **Partitions and Tree enumeration** [8L]
Set partitions - Bell and Stirling Numbers of First and Second Kind, Labeled Trees – Catalan numbers.
- **Backtracking** [8L]
Generating all Cliques, Traveling Salesman Problem, Knapsack Problem, Branch and bound strategy.
- **Permutation Groups and Orbits** [8L]
Schreier-Sims Algorithm, Burnside's Lemma, Coset Representatives, Orbits of ktuples.
- **Basis Reduction** [8L]
Theoretical background, Solving systems of integer equations, Factorizing Polynomials, LLL algorithms.

Suggested Readings:

1. L. Kreher and D.R. Stinson, Combinatorial Algorithms: Generation, Enumeration and Search.
2. E. M. Reingold, J. Nievergelt and N. Deo: Combinatorial Algorithms: Theory and Practice.

CSE/MCA/T/314H

Cryptography

- **Introduction to Cryptography** [6L]
Cryptosystem, Encryption and Decryption, Cryptographic Attacks, Notions of Security, Perfect Secrecy, Symmetric and Asymmetric Key Cryptosystems.
- **Block Ciphers** [8L]
Block and Stream Ciphers, Data Encryption Standard, Advanced Encryption Standard, Differential Cryptanalysis, Linear Cryptanalysis.
- **Stream Ciphers** [8L]
LFSR-based stream ciphers, Software stream ciphers, Correlation Attacks, Algebraic Attacks.
- **Public Key Cryptosystems and Related Topics** [10L]
RSA, ElGamal, Elliptic Curve Cryptography, Digital Signatures, Digital Certificates, Public Key Infrastructures, Key Distribution and Key Agreement schemes.
- **Advanced Topics** [8L]
Pseudorandom Number Generation, Hash Functions, Identification and Authentication, Secret Sharing, Multiparty Computation, Zero-knowledge Protocols.

Suggested Readings:

1. Stinson: Cryptography: Theory and Practice.
2. Schneier: Applied Cryptography: Protocols, Algorithms, and Source Code in C, by Bruce, Wiley, 1996.

CSE/MCA/T/314J

Machine Learning

- Introduction:** [3L]
Machine learning applications, concepts learning
- Introduction to Bayesian learning theory:** [5L]
regression, feature selection, supervised learning, class conditional probability distributions, Examples of classifiers Bayes optimal classifier and error, learning classification approaches, handling continuous attributes.
- Decision tree learning algorithms:** [6L]
Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples, entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm, handling continuous and missing attributes, confidence, overfitting, pruning, learning with incomplete data
- Artificial Neural Network:** [4L]
Single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, multi-Layer perceptron: two-layers universal approximators, backpropagation

learning, important parameters, Margin of a classifier, dual perceptron algorithm, learning non-linear hypotheses with perceptron.

Instance-based Learning: [2L]

Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability,

Machine learning concepts and limitations: [10L]

Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

Support Vector Machine (SVM): [3L]

Kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

Machine learning assessment and Improvement: [3L]

Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

Unsupervised learning: [2L]

introduction, K- means clustering, Hierarchical clustering

Semi-supervised learning: [2L]

introduction, self-training, co-training

Suggested Readings:

1. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997.
2. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. R. O. Duda, P. E. Hart, and D.G. Stork, Pattern Classification, John Wiley and Sons, 2001.
5. Vladimir N. Vapnik, Statistical Learning Theory, John Wiley and Sons, 1998.
6. Shawe-Taylor J. and Cristianini N., Cambridge, Introduction to Support Vector Machines, University Press, 2000.

CSE/MCA/T/314K

Soft Computing

1. Introduction to Soft Computing, Components of Soft Computing, Importance of Soft Computing, Applications. [2L]
2. Fuzzy Set Theory - Definition, Different types of fuzzy set membership functions. Fuzzy set theoretic operations, Fuzzy rules and fuzzy reasoning, Fuzzy inference systems. [8L]

3. Rough set theory. [2L]
4. Probabilistic Reasoning. [4L]
5. Genetic Algorithms, Simulated Annealing, applications. [6L]
6. Neural Networks- Artificial neural networks models, Supervised Learning, Unsupervised Learning, Applications. [10L]
7. Hybrid Systems and applications [8L]

Suggested Readings:

1. Neuro Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence - Jang, Sun and Mizutani, Printice Hall.
2. Soft Computing : Integrating Evolutionary, Neural, and Fuzzy Systems, by Tettamanzi, Andrea, Tomassini, and Marco. (2001), Springer.

CSE/MCA/T/314L

Biometric Systems

1. Introduction to Biometric Systems: History, Definition, Characteristics, Systems model, Identification, Verification/Authentication, Applications. [2L]
2. Image processing and Pattern recognition Fundamentals: Introduction to biometric samples, Representation, Biometrics as pattern recognition systems, Preprocessing, Segmentation, Noise removal techniques, etc. [4L]
3. Biometric Traits: Fundamentals of acquisition sensors and techniques, Characteristics of Biometric traits: Face, Gait, Iris, Fingerprint, Signature, etc. [2L]
4. Biometric Systems Performance Terminology: Performance assessment terminology – Estimation of errors, FAR, FRR, ROC, Ranking; Testing methods used in biometrics, Graphical analysis of system performance. [2L]
5. Biometric Feature Extraction: Subspace-based approaches: Principal Component Analysis (PCA), Fisher’s Linear Discriminant Analysis (FLDA), Independent Component Analysis (ICA), Variants of PCA, FLDA and ICA, Kernel version of subspace-based approaches; Geometric-feature-based approaches; Hybrid approaches. Invariant features, etc. [10L]
6. Biometric Classification & Recognition: Design of classifiers: Neural networks-based classifiers, Probabilistic classifiers, Neuro-Fuzzy classifiers; Template matching, etc. [5L]

7. Multi-biometric Systems: Introduction to multi-biometric systems, Types of multi-biometric systems, levels of fusion in multi-biometric systems: Image fusion, Feature level fusion, Dimension reduction, Decision level fusion, Demster Shafer (DS) Theory, Multi-level fusion. [5L]
8. Video-based Person Identification: Acquisition, Generic systems model, Face detection and recognition from video, Tracking. [4L]
9. 3D face recognition systems: 3D face model – Reconstruction, feature extraction and recognition; Expression and Action recognition; Multi-view 3D reconstruction. [4L]
10. Biometric Standards & Privacy: Introduction to biometric standards, importance of biometric standards, privacy, Biometric attacks, interoperability of data, systems and applications. [2L]

Suggested Readings:

1. Introduction to Biometrics, A. K. Jain and A. Ross, Springer
2. Biometrics: Theory, Methods & Applications, N. V. Boulgouris, K. N. Plataniotis, E. Micheli-Tzanakou, IEEE Press, 2009.
3. A. Ross, K. Nandakumar and A. K. Jain, "Handbook of Multibiometrics", Springer Publishers.
4. Guide to Biometrics, Ruud Bolle, J. Connell, S Pankanti, N Ratha, A Senior, Springer.
5. Biometric Technologies and Verification Systems, J R Vacca, Elsevier.
6. Biometric Systems: Technology, Design & Performance Evaluation, J. Wayman, A. K. Jain, D. Maltoni, D. Maio, Springer Verlag, 2004.
7. Handbook of Biometrics, Springer Verlag, 2008, A. K. Jain, P. Flynn and A. A. Ross.

CSE/MCA/T/315A

Programming Language Paradigms

Overview: Overview of programming languages, programming language design issues, programming paradigms and models. [2L]

Imperative paradigm: [6L]

Principles, data, flow of control, program, composition, Memory allocation, binding names to memory locations, program execution environment, parameter passing methods, I/O, examples of imperative languages, C/Pascal/Fortran/Cobol

The Object-Oriented Paradigm [6L]

The Limits of Abstract Data Types , software reuse and independence, Fundamental Concepts, Objects , Classes ,methods, Encapsulation, Subtypes , Inheritance, Dynamic binding, design issues in object-oriented languages,implementation issues in object-oriented languages.

Example languages: C++/ Java/ Smalltalk

The Functional Paradigm [10L]

Programs as functions , Expressions and Functions, Computation as Reduction , Fundamental Ingredients ,Evaluation, Values, Capture-Free Substitution, Evaluation Strategies , Comparison

of the Strategies, functional Programming in an imperative Language, Local Environment , Types, The λ -calculus, delayed evaluation, higher order functions, functional programming using Scheme/Python .

The Logic Programming Paradigm

[10 L]

Logic and logic programs, Deduction as Computation , Syntax, The Language of First-Order Logic, Theory of Unification , Substitution, Most General Unifier, An Unification Algorithm, The Computational Model, The Herbrand Universe, Declarative and Procedural Interpretation, Procedure Calls, Control: Non-determinism, Horn clauses, The language prolog, Logic Programming and Databases , problems with logic programming, constraint logic programming language

Parallel Programming

[6L]

Principles of Parallelism, co-routines, communication and synchronization, parallel procedural and logic programming concepts and their implementation

Suggested Readings:

1. Concepts of Programming Languages, 8th Edition. Robert W. Sebesta. Copyright © 2008 Pearson Education, Inc. (ISBN: 9780321493620).
2. Programming Languages- principles and practice - Kenneth C. Louden
3. Programming Language Pragmatics, 3rd ed., Michael Scott, Morgan Kaufmann Publishers, 2009.
4. Programming Languages Design and Implementation, Forth Edition, Terrence W. Pratt and Marvin V. Zelkowitz, Prentice Hall (ISBN: 978-81-203-2035-2).
5. Programming Languages – Concepts & Constructs, Ravi Sethi, Pearson Education _ Programming languages - Glezzi, 3/E, John Wiley
6. Programming Languages Design and Implementation, Pratt and Zelkowitz, 4th edition, PHI/Person Education.
7. Structure and Interpretation of Computer Programs, Harold Abelson and Gerald Jay Sussman with Julie Sussman, Available at <http://www.mitpress.mit.edu/sicp/fulltext/book/book.html>
8. Prolog Programming: A first course by Paul Brna. Available at <http://computing.unn.ac.uk/staff/cgpb4/prologbook/>

CSE/MCA/T/315B

Information Retrieval and Web Mining

Information Retrieval Concepts and Models: Vector space retrieval model , Statistical language models for IR, Introduction to World Wide Web, Hypertext Data. [5L]

Search Engines, Crawling the Web, Basic architecture of a crawler. [4L]

Indexing and Search: Boolean Queries and Inverted Index, Relevance ranking, relevance feedback, Similarity search, Web directories, Combining Searching with Browsing, Metasearchers, Web Query Languages, Dynamic Search and Software Agents. [6L]

Clustering and Classification, Introduction to text categorization: Naïve Bayes, SVM	[5L]
Social network analysis	[4L]
Measuring and Modeling the Web	[4L]
Question answering System	[5L]
Semantic Web.	[3L]
Ontology, ontology driven search	[4L]

Suggested Readings:

1. Baeza-Yates, R. and Ribeiro-Neto, B., Modern Information Retrieval. Pearson Education 1999.
2. Chakrabarti, S., Mining the Web, Morgan Kaufmann (An Imprint of Elsevier) 2005.
3. Grossman, D. A. and Frieder, O., Information Retrieval: Algorithms and Heuristics. Kluwer 1998.

CSE/MCA/T/315C

MANAGEMENT ECONOMICS

The theory of Consumer Behaviour: The concept of utility, Indifference Curve analysis, Demand Analysis, The concept of 'Elasticity'. [2L]

Supply Analysis: The law of supply, Derivation of Supply curve, The concept of 'Reservation Price'. [3L]

The Theory of Production: The production function (Cobb-Douglas), Law of Production (law of Returns of Scale, The law of Variable Proportions, Equilibrium of the Firm, Choice of Optimal Combination of Factors, Choice of Optimal Expansion path). [8L]

The Theory of Costs: Analysis of the concepts of costs, The traditional theory of cost (Short-Run costs, Long-Run costs: The 'Envelope curve'), Modern Theory of costs (Short-Run and long-Run costs, The 'L' shaped scale curve), The Analysis of Economies of Scale (Real economies of scale, pecuniary economies soft scale). [8L]

Theory of the Firm, Market Analysis: Perfect competition (Assumptions, Short - Run and Long - Run Equilibrium, Dynamic changes and Industry Equilibrium), Monopoly (Definition, Demand

and Revenue, Costs, Equilibrium of the Monopolist, Predictions in Dynamic Changes, The multiplant Firm), Price Discrimination (Assumptions, Types of price discrimination, Price discrimination and Elasticity of Demand), Monopolistic Competition (Assumptions, Product differentiation and the Demand Curve, Equilibrium of the firm), Classical Oligopoly (Assumptions, The 'Kinked Demand model, Price leadership (Collusive Oligopoly)).

[10L]

Theories of Pricing: Full-cost pricing principle, Average cost pricing principle.

[2L]

Theory of Distribution: The marginal Productivity theory Rent - Modern theory of rent, Wages - Meaning, determination of Wages in a competitive Market, Monopsony in Labour market, Unions and Wages, Interest - Time preference, the classical theory, the loanable funds theory, Keynes Liquidity preference theory, Profits - Meaning, Different Theories of Profit.

[7L]

Suggested Readings:

1. Dwivedi, D.N.: Managerial Economics, Vikas Publ. House Pvt. Ltd., New Delhi, 1986.
2. Varshney, R.L. & Maheshwari, K.L. : Managerial Economics, 9th Edn. Sultan Chand and Sons, New Delhi, 1988.

CSE/MCA/T/315D

Mobile Computing

1. Introduction to wireless networks and mobile computing – Characteristics, Issues and challenges [4L]
2. Fundamentals of wireless transmission - Medium Access Control Protocols, Different types of multiple access techniques and their characteristics [8L]
3. Cellular concept, Overview of different Generations (upto 3G) [4L]
4. Mobile IP, Mobile transport layer - Mechanisms for improving TCP performances on wireless links [4L]
5. Overview of Wireless LAN IEEE 802.11 series [4L]
6. Overview of Bluetooth [2L]
7. Wireless application Environments : WAP, WML, Push Architecture, Push/Pull Services [6L]
8. Mobile Adhoc Networks – Characteristics, Routing protocols [4L]
9. Overview of Wireless Sensor Networks [2L]
10. Overview of Security in mobile environments [2L]

Suggested Readings:

1. Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy & B. S. Manoj, Pearson Education
2. Mobile Communications, Jochen Schiller, Pearson Education
3. Wireless Communications and Networks – William Stallings, Pearson

4. Mobile Computing, Raj Kamal, Oxford

CSE/MCA/T/315E

Parallel Computing

- Introduction to High Performance Computing: Milestones and applications. [4L]
High-Performance Computing architectures: Overview of the major classes of HPC architectures and their evolution. [6L]
Parallel programming models and performance analysis: Parameterisation, modeling, performance analysis, Amdahl's law, efficiency, and benchmarking of systems. [4L]
Programming parallel computers: Overview of parallel programming, parallel languages, parallelizing compilers, message passing and data parallel programming models, introduction to MPI and OpenMP. [10L]
Multi-Thread Models with primary sources of overhead, memory architecture and memory access times and associated sources of overhead; Multi-Process Execution Model. Restructuring for Parallel Performance - Loop Transformations; Data Transformations; Dependence Analysis; Compiler Strategies. [8L]
Parallel Algorithms - Cyclic Reduction; Iterative Algorithms (Jacobi, Gauss-Seidel and Red-Black Orderings); Divide-and-Conquer Algorithms, Adaptive Quadrature. [8L]

Suggested Readings:

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series,
3. Parallel Programming in C with MPI and OpenMP by M.J. Quinn, McGraw-Hill

CSE/MCA/T/315F

Pattern Recognition

- Basic concepts of Pattern Recognition [2L]
Pattern Preprocessing and Feature Selection [3L]
Decision Functions [2L]

Bayesian decision theory	[2L]
Parametric Estimation: Maximum likelihood estimation and Bayesian estimation	[5L]
Non- parametric Estimation: Parzen windows, Nearest Neighbor estimation	[4L]
Pattern Classification:	
Linear classifier: Perceptron, SVM	[3L]
Non-linear classifiers: MLP, Non-linear SVM	[5L]
Unsupervised learning and Clustering: Partitioning method, Density-based method, MST- based method, Self organizing map, Hierarchical Clustering, Cluster validity	[10L]
Syntactic Pattern Recognition (Basic concepts)	[2L]
Some real-life applications	[2L]

Suggested Readings:

1. Pattern Recognition Principles, Tou and Gonzalez, Addison-Wesley
2. Pattern Classification, Duda, Hart and Stork, Second Edition, Wiley
3. Pattern Recognition and Machine Learning, Christopher Bishop, Springer
4. Introduction to Statistical Pattern Recognition, Fukunaga, Second Edition, Academic Press

CSE/MCA/T/315G

Multimedia Technology

Introduction

Multimedia and its Application, Different Media, Hypertext and Hypermedia, Issues in Multimedia System, Component of a Multimedia System [2L]

Overview of Text and Graphics:

Types of Text Data (Plain/Formatted/Hypertext), Unicode Scheme, Concept of Font, File Formats (txt, doc, rtf, ps, pdf etc.), Vector and Raster Graphics [2L]

Image:

Image Digitization, Digital Image, Binary/GrayScale/ Colour Image, Colour Models, File Formats, Overview of Contrast Intensification, noise removal, edge detection and segmentation [5 L]

Image Descriptors (Shape, Texture and Colour Features) [3L]

Loss-less and Lossy Image Compression including JPEG [3L]

An overview of Content Based Image Retrieval System [3L]

Audio:

Audio Digitization (Sampling and Quantization, Representation based on PCM/DPCM/DM/ADM), File Formats [2L]

Time Domain Descriptors (ZCR, STE etc.), Frequency Domain Descriptors (Spectral Centroid, Spectral Flux, Spectral Roll Off etc.), and Perception based Descriptors (Mel Scale, MFCC) [3 L]

Psycho Acoustics and Audio Compression [2L]

An Overview of Audio Classification/Retrieval System [2L]

Video:

Structure of Video Data, File Formats [1L]

Video Compression [2L]

Motion Estimation [1L]

Structural Segmentation of Video Data [3L]

Overview of Video Summarization, Browsing and Retrieval System [2L]

Animation:

Keyframes & tweening, cel & path animation, principles and techniques of animation, Web animation, 3D animation principles, camera, special effects, transformations and editing, rendering algorithms, features of animation software, file formats. [4L]

Suggested Readings:

1. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods
2. Digital Image Processing and Analysis by B. Chanda and D. Dutta Majumder
3. Principles of Multimedia by Ranjan Parekh
4. Multimedia –A Practical Approach by Sanhker, Jaico.
5. Multimedia Systems by Buford J. K., Pearson Education.
6. Multimedia and Imaging Databases by S. Khoshafian, A. Brad Baker, Morgan Kaufmann.
7. Multimedia Systems Design, Prabhat k. Andleigh & Kiran Thakkar, Prentice Hall PTR.
8. Digital Multimedia by Nigel Chapman & Jenny Chapman, John-Wiley.

9. Fundamentals of Computer Graphics and Multimedia by D.P. Mukherjee, PHI

CSE/MCA/T/315H

Computational Geometry

Geometric Objects – Points, Lines, Planes, Polygons, 3D Objects – Geometric Algorithms – Degeneracies and Robustness – Application Domains 3L

Convex Hull in 2D – Incremental Algorithm [2L]

Line Segment Intersection Algorithms – Doubly Connected Edge List – Map Overlays – Boolean operations [6L]

Polygon Triangulation – Partitioning Polygons into Monotone Pieces – Triangulation of Monotone Polygons – Art Gallery Problem [6L]

Half Plane Intersections – Use of Linear Programming Techniques – Manufacturing with Moulds [6L]

Orthogonal Range Searching – Kd Trees – Range Trees – Higher Dimensional Range Trees – Database Searching – Point Location [6L]

Voronoi Diagrams – VD of Line Segments – Farthest Point VDs – Post Office Problem 6L

Convex Hulls in 3-space [3L]

Robot Motion Planning – Work Space and Configuration Space – Translational Motion Planning [2L]

Suggested Readings:

1. Computational Geometry – Algorithms and Applications by Berg, Cheong, Kreveld and Overmars 3e, Springer
2. Computational Geometry – An Introduction by Preparata and Shamos, Springer
3. Computational Geometry in C – Joseph O'Rourke, 2e, Cambridge Univ Press

CSE/MCA/T/314L

Bioinformatics

Introduction to molecular biology, The Central Dogma of Molecular Biology, Physical mapping

[4L]

Protein sequence data bank. NBRF-PIR, SWISSPROT, GenBank, EMBL nucleotide sequence data bank, Protein Data Bank (PDB) etc. [3L]

Motif finding in DNA and proteins [4L]

Sequence alignment for DNA and protein sequences, Concepts: homology, sequence similarity and sequence alignment; dynamic programming algorithms, Pairwise alignment, Global and local alignment using dynamic programming, Heuristic alignment methods: BLAST/FASTA and the statistics of local alignments, Multiple sequence alignment: Definition, scoring, techniques, Aligners for proteins sequences, Spliced alignment [5L]

Gene ontology, Annotation and Metadata [5L]

Secondary and Tertiary Structure predictions; Chao-Fasman algorithms; The basic HMM algorithms: forward, backward, Viterbi, Baum-Welch; Neural Networking [5L]

Phylogenetic analysis, Neighbor joining, parsimony, and maximum likelihood methods, Gene expression analysis and clustering methods [5L]

Comparative genomics: gene regulation, gene finding, genome rearrangements [4L]

Protein folding, protein-protein interactions, Molecular Modeling & Dynamics, Drug Designing. [5L]

Suggested Readings:

- [1] M. Lesk, "Introduction to Bio Informatics," Oxford University Press
- [2] Hooman Rashidi, Lukas K. Buehler, "Bioinformatics Basics: Applications in Biological Science and Medicine," CRC Press/Taylor & Francis Group, 2nd edition, May 2005
- [3] Jeffrey Augen, "Bioinformatics in the Post-Genomic Era: Genome, Transcriptome, Proteome, and Information-Based Medicine," Addison-Wesley
- [4] Stephen A. Krawetz, David D. Womble, "Introduction to Bioinformatics: A Theoretical and Practical Approach," Humana Press
- [5] Bryan Bergeron, "Bioinformatics Computing," Prentice Hall PTR
- [6] Malcolm Campbell, Laurie J. Heyer, "Discovering Genomics, Proteomics, and Bioinformatics," Benjamin/Cummings
- [7] Teresa K. Attwood, David Parry-Smith, "Introduction to Bioinformatics," Pearson Education
- [8] Gusfield, Dan, "Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology," Cambridge, UK: Cambridge University Press, 1997.
- [9] Waterman, Michael, "Introduction to Computational Biology: Maps, Sequences, and Genomes," Boca Raton, FL: CRC Press, 1995.
- [10] Durbin, Richard, Graeme Mitchison, S. Eddy, A. Krogh, and G. Mitchison, "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids," Cambridge, UK: Cambridge University Press, 1997.
- [11] Jones, Neil, and Pavel Pevzner, "An Introduction to Bioinformatics Algorithms," Cambridge, MA: MIT Press, 2004.

CSE/MCA/T/315K

Data Warehousing and Data Mining

Introduction: concepts of data mining,	[2L]
Differences of conventional Database with data warehouse	[2L]
Concepts of Data Cubes and OLAP Data Processing	[3L]
Types of Data Warehouses and Schemas	[2L]
Development Methodologies	[4L]
Management of Data Warehouses	[2L]
Data Mining Algorithms in general with scalability issues	[2L]
Evaluation of data mining results	[1L]
Data Preprocessing Techniques	[5L]
Application of Association Rule Mining in data mining	[5L]
Application of Clustering Algorithms in data mining	[4L]
Application of Classification Algorithms in data mining	[4L]
Text mining, Web mining and other Applications	[3L]
Recent Trends	[1L]

Suggested Readings:

1. J. Han & M. Kamber, Data Mining: Concepts and Techniques, Elsevier, 2nd Ed.
2. Data warehousing: OLAP & data mining, S. Nagabhushan, New age publications.
3. Introduction to data mining by Tan, Steinbach, Kumar, Pearson Education
4. Data mining: A tutorial based primer by Roiger, Geatz,, Pearson Education

Network Security

Introduction: Security Goals, Threat, Vulnerabilities and Attacks, Types of Attacks, Security Services and Mechanisms [1L]

Cryptographic Tools: Symmetric Key Cryptography, Asymmetric Key Cryptography, Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signatures [4L]

User Authentication: Password Based Authentication, Token Based Authentication, Biometric Authentication, Remote User Authentication [3L]

Internet Security Protocols and Standards: IPSec, SSL and TLS, PGP and S/MIME [8L]

Internet Authentication Applications: Kerberos, X.509, Public Key Infrastructure [4L]

Security Appliances: Intrusion Detection Systems (IDS), Classes of IDS, ID Techniques, Firewalls, NAT, Intrusion Prevention Systems [5L]

Malicious Software: Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Bots, Rootkits [3L]

Software Security: Buffer Overflow Attacks, Defence against Buffer Overflows, Handling Program Inputs, Writing Safe Program Codes, Interaction with Operating System and Other Software [4L]

Operating System Security: Linux Security, Windows Security [4L]

Wireless Network Security: Authentication and Authorization in Wireless LANs, Data Protection in Wireless LANs [4L]

Suggested Readings:

1. Computer Security: Principles and Practices, by William Stallings and Larry Brown, First Edition, 2008, Pearson Education
2. Network Security: Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Second Edition, 2003, Prentice Hall India
3. Cryptography and Network Security, by William Stallings, Fifth Edition, , Prentice Hall, 2010
4. Network Security Essentials: Applications and Standards, by William Stallings, Edition, , Pearson Education
5. Cryptography and Network Security by Behrouz A. Forouzan and Debdeep Mukhopadhyay, Second Edition, 2010, Tata McGraw Hill

6. Security in Computing, by Charles P. Pfleeger, Shari Lawrence Pfleeger, 4th Edition, 2007, Prentice Hall