

AT01 MATHEMATICS—I

1 Multivariate Calculus 18 hours

- 1.1 Limit and continuity of functions of several variables, Partial derivatives of one and higher order.
- 1.2 Total differential and its application to approximations and errors, Implicit and homogeneous functions, Euler 's theorem.
- 1.3 Taylor's theorem and series of function of several variables, Maxima and Minima of functions of two variables, Method of Lagrange multipliers.
- 1.4 Double and triple integrals, Change of order of integration, Application to computation of volume and surface areas of simple solids.

II [2]

2 Ordinary Differential Equations 16 hours

- 2.1 Separable, homogeneous, exact and linear first order differential equation, Bernoulli 's equation.
- 2.2 Homogeneous and non-homogeneous linear differential equation of second order, method of variation of parameters and method of undetermined coefficients, Euler - Cauchy equation, Higher order linear homogeneous differential equation with constant coefficients.

I [1, 2]; II [4, 5]

3. Matrices 16 hours

- 3.1 Addition, scalar multiplication and product of matrices, Elementary row operations.
- 3.2 Rank and inverse of a matrix, Consistency and solution of a system of linear equations.
- 3.3 Eigenvalues and eigenvectors, Hermitian, skew-Hermitian and unitary matrices, Diagonalization of matrices.

I [6, 7]; II [3]

4 Special Functions 10 hours

- 4.1 Power series solution of O.D.E., Series solution of Legendre and Bessel Equations.
- 4.2 Legendre polynomials and their properties, Bessel function of first kind and their properties, Recurrence relations for Bessel functions.

I [4]; II [6, 7]

Text Books

- I. Erwin Kreyszig, “Advanced Engineering Mathematics” 8th edition, John Wiley and Sons (Asia) --- 2000
- II. R. K. Jain and S. R. K. Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing House --- 2002

Reference Books

1. Peter V. O’neil, “Advanced Engineering Mathematics” 4th edition Brooks / Cole Publishing Company ---1995
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AT02 COMMUNICATION AND TECHNICAL WRITING

- | | |
|---|-----------------|
| 1. Basics of Communication | 8 hours |
| 1.1 Communication Process.
1.2 Speech Act Theory.
1.3 Principles of Communication.
1.4 Communication Barriers
1.5 Listening and Hearing,
1.6 Language as Tool of Communication.
1.7 Oral and Written Communication,
1.8 Body language and Para-language. | |
| II [1, 2, 3, 6] | |
| 2. Remedial English | 10 |
| hours | |
| 2.1 Errors of Syntax and Accidence.
2.2 Errors of Punctuation.
2.3 Errors of Vocabulary and Usage. | |
| I [1,2, 3]; III [24]; IV [1, 2] | |
| 3. Technical English | 10 hours |
| 3.1 Nature of Technical English; Impersonal Style
3.2 Technical Vocabulary.
3.3 Definition, Descriptions, Explanation.
3.4 Argumentative Writing. | |

IV [1(1.1), 3, 4, 5, 6, 7]

4. Technical Writing **22 hours**

- 4.1 Writer, Audience and Documentation.
- 4.2 Preparatory Organization.
- 4.3 Writing Specific Documents (Resumes, Letters, Memos, Specifications, Procedures, Proposals, Product Descriptions).
- 4.4 Report and Paper Writing (The Beginning, Body and Ending of the Report, The Cover Materials, Graphics).
- 4.5 Types of Reports
- 4.6 Writing and Designing for Web.

III [1-21]

5. Technical Presentations **10 hours**

- 5.1 Essentials of Professional Presentation.
- 5.2 Types of Presentation
- 5.3 Preparing a Presentation.
- 5.4 Standards of Delivery.
- 5.5 Extra Verbal Clues (Body and Paralanguage).
- 5.6 Handouts.
- 5.7 Visuals.
- 5.8 Demonstration Models.

II [4]; III [26, 27, 28]

Text Books:

- I. Maison, Margaret M, *Examine Your English*, New Delhi: Orient Longman, 1980.
- II. Kaul Asha. *Business Communication*. New Delhi Prentice: Hall of India, 1999.
- III. Sides, Charles H. *How to Write & Present Technical Information*. Cambridge: Cambridge University Press 1999 (Third Edition)
- IV. Sharma, R.S. *Technical Writing*. New Delhi: Radha Publication, 1999.

Reference Books:

- 1. Borowick, Jerome N. *Technical Communication and its Application*. New Jersey: Prentice Hall, 2000.
- 2. Eisenberg, Anne. *Writing Well For the Technical Professions*. New York Harper & Row, Publishers, 1989

3. Forsyth, Sandy & Lesley Hutchison. *Practical Composition*. Edinburgh: Oliver & Boyd, 1981
 4. Guffy, Mary Allen. *Business Communication: Process and Product*. Cincinnati: South-Western College Publishing, 2000 (Third Edition)
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T05 PROGRAMMING & PROBLEM SOLVING THROUGH "C"

1. Problem Solving and Algorithm Design 6 hours

- 1.1 Introduction to Computer based Problem Solving.
- 1.2 Program Design concepts : {Top-down design and stepwise refinement, loops basic programming constructs}.
- 1.3 Programming Environment: {Assemblers, compilers, interpreters, linkers, loaders}.

I [1-3]

2. Algorithm Design 9 hours

- 2.1 Algorithm design Issues.
- 2.2 Complexities of Algorithms.
- 2.3 Development of Algorithms for various Examples : {Summation of set of numbers and series, sine function computation, Fibonacci sequence, Reversing digits of an integer, Square root of a number, Smallest divisor, Raising a number to a large power, generation of prime numbers}.

I [4, 5]

3. Overview of C Programming 9 hours

- 3.1 Data types.
- 3.2 Constants and Variables.
- 3.3 Expressions and Operators.
- 3.4 Basic I/O.
- 3.5 Control Constructs.
- 3.6 Arrays.
- 3.7 Examples of arrays: {Array order reversal, Removal of duplicates from an ordered array, Binary search, Matrix manipulations, finding kth minimum element in an array}
- 3.8 Simple sorting techniques : {insertion sort, bubble sort, sorting using partitioning}.

I [4, 5]; II [1-7]

4. Advanced Programming Techniques 12 hours

- 4.1 Handling Strings.
- 4.2 Scope Rules.
- 4.3 Functions (Parameter passing: call by value, call by reference, calling functions with arrays, nesting of functions).
- 4.4 Recursive functions.
- 4.5 Structures and union : {Arrays of structures, Arrays within structures, Structures within structures, Structures and functions}.

II [8-10]

5. Dynamic Data Structures in C 18 hours

- 5.1 Dynamic Memory Allocation.
- 5.2 Pointers (Pointer arithmetic, pointer vs arrays, pointers to functions, functions with variable number of arguments).
- 5.3 Linked list concepts
- 5.4 Various linked list operations : {Insertion and deletion in a singly linked list, Traversal, counting number of nodes, reversal of linked list }
- 5.5 Applications of linked lists
- 5.6 File Management in C
 - 5.6.1 Input / Output operations
 - 5.6.2 Error handling during Input / Output operations
 - 5.6.3 Random access files

II [11-13]

6. The Preprocessors 3 hours

- 6.1 Macro Substitutions
- 6.2 File inclusions
- 6.3 Compiler Control Directives

II [14]

5 7 Program testing & Documentation 3 hours

- 7.1 Coding style- variable names, declarations, statement construction
- 7.2 Test case design - Basic path testing, Black box testing
- 7.3 Principles of Documentation

II [15]

Text Books

- I. R.G. Dromey, "How to Solve it by Computer", Prentice Hall of India, 1992.
- II. E Balagurusamy, Programming in ANSI C, edition 2.1, Tata McGraw-Hill, reprint 2002.

Reference Books

1. B.W. Kernighan & D.M. Ritchie, "The C Programming Language", Prentice Hall of India, 1989.
 2. Cooper, Mullish, "The Spirit of C", Jaico Publishing House, New Delhi, 1987.
 3. Richard Johnson-Baugh & Martin Kalin, "Application Programming in C", Macmillan International editions, 1990.
 4. Kenneth A., C, "Problem Solving and Programming", Prentice Hall International.
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AT06 DATA STRUCTURES AND ALGORITHM DESIGN

- 1. Analysis 7 hours**
 - 1.1 Abstract data Types.
 - 1.2 Ordered lists and arrays.
 - 1.3 Polynomial representation using arrays.
 - 1.4 Algorithm analysis using frequency count.
 - 1.5 Measuring time complexity using big O notation.
 - 1.6 Recursive calls.

I [1 (1.1, 1.3, 1.4), 2(2.1, 2.2)]; II [1 (1.1), 2, 5 (5.1-5.3)]
- 2. Linked Lists 10 hours**
 - 2.1 Manipulations on singly linked list.
 - 2.1.1 Insertion.
 - 2.1.2 Deletion.
 - 2.1.3 Copy.
 - 2.1.4 Append.
 - 2.2 Circular list.
 - 2.3 Double linked list.
 - 2.4 Polynomial addition using linked lists.
 - 2.5 Sparse matrices.
 - 2.6 Linked list representation of stacks and queues.
 - 2.7 Evaluation of arithmetic _expression.
 - 2.8 Simulation using queues.

I [2 (2.3), 3 (3.3), 4 (4.1, 4.2, 4.4, 4.7)]; II [3 (3.1-3.3), 4 (4.8)]
- 3. Trees 14 hours**
 - 3.1 Binary trees.
 - 3.1.1 Height.
 - 3.1.2 Representation using pointers.
 - 3.2 Traversal-Inorder, Preorder and Postorder.
 - 3.2.1 Recursive.

- 3.2.2 Non-Recursive.
- 3.2.3 Tree reconstruction using inorder and preorder traversal.
- 3.2.4 Relationship between internal and external nodes.
- 3.2.5 Threaded Binary trees.

I [5 (5.1- 5.6)]; II [6 (6.1-6.4)]

4. Search Trees

8 hours

- 4.1 Binary search tree-time complexity of insertion and retrieval.
- 4.2 Heaps and priority queues.
- 4.3 AVL trees.
- 4.4 B-trees.
- 4.5 Time complexity of all the tree algorithms.

I [9 (9.2)]; II [6 (6.7-6.9), 7(7.1.1)]

5. Searching And Sorting

14 hours

- 5.1 Sequential and Binary search.
 - 5.1.1 Time complexity.
- 5.2 Insertion sort.
- 5.3 Selection and bubble sort.
- 5.4 Quick sort.
- 5.5 Merge sort.
- 5.6 Heap sort.
- 5.7 Hashing schemes.
 - 5.7.1 Collision handling using linear and quadratic probe.

I [1 (1.1, 1.4), 7 (7.1-7.3, 7.5, 7.6), 9 (9.3)]; II [9 (9.1, 9.3), 10 (10.1,10.2)]

6. Graphs

7 hours

- 6.1 Graph operations.
 - 6.1.1 Representation.
 - 6.1.2 Traversal.
 - 6.1.3 Spanning trees.
 - 6.1.4 Kruskal's algorithm for minimum-cost spanning trees.
 - 6.1.5 Dijkstra's algorithm for shortest path.

I [6 (6.1, 6.2)]; II [8 (8.1, 8.2, 8.5)]

Text Books

- I.** E. Horowitz and S. Sahni, "Fundamentals of Data Structures," Galgotia Publications, 2003.
 - II.** A. Drozdek, "Data Structure and Algorithms in C++", Vikas Publishing House/ homson Leaqrning, 2001.
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- 5.1 Machine and Assembly language
- 5.2 Pseudo-operations
- 5.3 Subroutine in assembly language
- 5.4 Interrupt and I/O Programming
- 5.5 Examples

I [6 (6.1-6.3, 6.7, 6.8)]

6. Micro programmed Control Unit 4 hours

- 6.1 Basic organization of micro programmed controller
- 6.2 Horizontal and vertical formats
- 6.3 Address sequencer

I, II

7. Arithmetic Algorithms 5 hours

- 7.1 Addition and subtraction for sign magnitude and 2's compliment numbers
- 7.2 Integer multiplication using shift and add
- 7.3 Booth's algorithm
- 7.4 Integer division
- 7.5 Floating point representations and arithmetic algorithms

I [10 (10.2-10.5)]

8. I/O organization 4 hours

- 8.1 Strobe based and handshake based communication
- 8.2 Vector and priority interrupts
- 8.3 DMA based data transfer

I [11 (11.2-11.6)]

9. Memory Organization 10 hours

- 9.1 Basic cell of static & dynamic RAM
- 9.2 Building large memories using chips
- 9.3 Associative memory
- 9.4 Cache memory organization
- 9.5 Virtual memory organization

I [12 (12.1, 12.2, 12.4-12.6)]

Text books

- I. M. Morris Mano, “ Computer System Architecture”, Prentice Hall, International 3rd edition,1993
- II. J.P. Hayes, “ Computer Organization and Design”, McGraw- Hill, New York, 1988.

Reference books

1. Gaonkar, “ Microprocessor Architecture, Programming and Architecture”, Wiley Eastern Limited
 2. P.Pal Choudhary, “ Computer Organization and Design”, Prentice Hall of India Ltd.,1994
-

AT08 SYSTEM SOFTWARE

1. Introduction 5 hours

- 1.1 System software and Machine Architecture.
- 1.2 The simplified Instructional Computer (SIC): SIC Machine architecture, SIC/ XE Machine architecture, SIC Programming Examples.

I [1]; II [2]

2. Assemblers 12 hours

- 2.1 Basic Assembler Functions : A simple SIC Assembler, Assembler Algorithm and Data Structures.
- 2.2 Machine – Dependent Assembler Features: Instruction Formats and Addressing Modes, Program Relocation.
- 2.3 Machine – Independent Assembler Features: Literals, symbol – Defining statements, Expressions, Program Blocks, Control sections and Program Linking.
- 2.4 Assembler Design options : One – Pass Assemblers, Multipass Assemblers.

II [2]; II [4]

3. Loaders and Linkers 8 hours

- 3.1 Basic Loader Functions:- Design of an absolute loader, A simple Boot strap loader.
- 3.2 Machine – Dependent Loader Features: Relocation, Program Linking, Algorithm and Data structures for a linking loader.
- 3.3 Machine – Independent Loader Features: Automatic Library Search, Loader Options.
- 3.4 Loader Design Options: Linkage editors, dynamic linking, Boot-strap Loaders.

I [3]; II [7]

4. Macro Processors 5 hours

- 4.1 Basic Macro Processor Functions: Macro definition and Expansion, Macro Processor Algorithm and Data Structures.
- 4.2 Machine – Independent Macro Processor Features: Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro parameters.
- 4.3 Macro Processor Design Options: Recursive Macro Expansion, General Purpose Macro Processors, Macro Processing within Language Translators.

I [4]; II [5]

5. Compilers 12 hours

- 5.1 Basic Compiler Functions: Grammars, Lexical Analysis, Syntactic Analysis, Code Generation.
- 5.2 Machine – Dependent Compiler Features: Intermediate Form of the program, Machine – Dependent Code Optimisation.
- 5.3 Machine – Independent Compiler Features: Structured variables, Machine – Independent code optimisation, storage Allocation, Block – Structured Languages.
- 5.4 Compiler – Design Options: Division into Passes, interpreters, P-code Compilers, Compiler – Compilers.

I [5]; II [6]

6. Operating Systems 10 hours

- 6.1 Basic operating system Functions: Types, user interface, Run – Time Environment.
- 6.2 Machine – Dependent OS Features: interrupt Processing, Process Scheduling, I/O supervision, Management of Real Memory.
- 6.3 Machine – Independent OS Features: File Processing, Job Scheduling, Resource Allocation, Protection.
- 6.4 OS Design Options: Hierarchical Structure, Virtual Machines, Multiprocessor OS, Distributed OS, Object Oriented OS.

I [6]

7. Other System Software 8 hours

- 7.1 Database Management Systems: Basic Concepts, Levels of Data Description, Use of a DBMS.
- 7.2 Text Editors: Overview of the Editing Process, User interface, Editor Structure.
- 7.3 Interactive Debugging Systems: Debugging Functions and Capabilities, Relationship with other parts of the system, user – interface criteria.
- 7.4 Object – Oriented System Design: [7, 8 (1)]

Principles of Object-Oriented Programming, Object – Oriented Design of an Assembler.

I [7]; II [8]

Text Books

- I. Leland L Beck (1985), "System Software-An Introduction to System Programming" 3rd edition Addison Wesley – 1997.
- II. D M Dhamdhere, "Systems Programming and Operating Systems" (2nd revised edition) Tata McGraw-Hill Publishing Co. Ltd., New Delhi 2003.

Reference Books

1. Calingaert P, "Assemblers, Compilers and Program Translation" Computer Science Press Meryland (1979)
-

AT09 NUMERICAL COMPUTING

1. Errors in Numerical Computation 3 hours

- 1.1 Sources of errors in numerical computation.
- 1.2 Round off error.
- 1.3 Truncation error.
- 1.4 Inherent error.
- 1.5 Stability of numerical algorithms.

I [1 (1.1, 1.3)]

2. Transcendental and Polynomial Equations 9 hours

- 2.1 Bisection method.
- 2.2 Secant method.
- 2.3 Regula-Falsi method.
- 2.4 Newton-Raphson method.
- 2.5 Rate of convergence of iterative methods.
- 2.6 System of nonlinear equations.

I [2 (2.2, 2.3, 2.5, 2.7)]

3. Systems of Linear Equations and Inverse of a Matrix 9 hours

- 3.1 Direct methods (Gauss-elimination method, Gauss-Jordan method, LU decomposition method, Cholesky method for symmetric definite systems).
- 3.2 Iterative methods (Gauss-Jacobi method, Gauss-Seidel method).
- 3.3 Rate of convergence of iterative methods.

I [3 (3.1, 3.2, 3.4)]

4. Eigenvalue Problems 9 hours

- 4.1 Power method.
- 4.2 Inverse power method.
- 4.3 Jacobi method for symmetric matrices.
- 4.4 Given's method for symmetric matrices.

I [3 (3.5, 3.6)]

5. Interpolation and Approximation 9 hours

- 5.1 Lagrange interpolation.
- 5.2 Errors of interpolation.
- 5.3 Divided differences.
- 5.4 Newton's divided difference interpolation.
- 5.5 Finite differences.
- 5.6 Newton's forward difference interpolation.
- 5.7 Newton's backward difference interpolation.
- 5.8 Least squares approximation.

I [4 (4.2-4.4, 4.9)]

6. Numerical Differentiation 6 hours

- 6.1 Methods based on interpolation.
- 6.2 Methods based on finite differences.
- 6.3 Methods based on undetermined coefficients.
- 6.4 Choice of optimal step size.
- 6.5 Richardson extrapolation methods.

I [5 (5.2-5.4)]

7. Numerical Integration 9 hours

- 7.1 Newton Cotes methods (Trapezoidal rule, Simpson's rule).
- 7.2 Composite integration methods.
- 7.3 Derivation of methods using the method of undetermined parameters.

- 7.4 Romberg integration.
- 7.5 Gaussian methods (Gauss-Legendre methods, Gauss-Chebyshev methods, Gauss-Laguerre methods, Gauss-Hermite methods).

I [5 (5.7 - 5.10)]

8. Numerical Solution of First Order Ordinary Differential Equations 6 hours

- 8.1 Single step methods (Taylor series method, Euler method, Runge-Kutta methods (Second and Fourth order methods)).
- 8.2 Multistep methods (Advance).

I [6 (6.4)]

Text Books

- I. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation”, Fourth Edition, New Age International Publishers, 2003.

Reference Books

- 1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods : Problems and Solutions”, New Age International Publishers, 1994.
- 2. A. Ralston and P. Rabinowitz “A First Course in Numerical Analysis”, McGraw-Hill, 2nd edition, 1978.

AT10 DATA COMMUNICATION AND NETWORKS

1 Introduction 4 hours

- 1.1 Evolution of Network Architecture and Services
- 1.2 Future Network Architectures and Their Services
- 1.3 Examples of Protocols, Services, and Layering
- 1.4 The OSI Reference Model
- 1.5 Overview of TCP/IP Architecture
- 1.6 Application Layer protocols and TCP/IP Utilities

I [1 (1.1, 1.2), 2]

2 Data Communication Techniques 8 hours

- 2.1 Digital Representation of Analog Signals
- 2.2 Characterization of Communication Channels
- 2.3 Fundamental Limits in Digital Transmission
- 2.4 Line Coding, Modems and Digital Modulation
- 2.5 Properties of Media and Digital Transmission Systems
- 2.6 Error Detection and Correction

I [3]

3 Circuit Switching Networks 6 hours

- 3.1 Circuit-Switching Networks
- 3.2 Multiplexing (FDM, TDM-T1/E1Stds, Statistical Muxing, CDM, WDM)
- 3.3 SONET
- 3.4 Circuit Switches
- 3.5 The Telephone Network (Signaling, Traffic and Overload Controls in Telephone Networks)
- 3.6 Cellular Telephone Networks

I [3]

4 Peer to Peer Protocols and Data Link Layer 8 hours

- 4.1 Peer-to-Peer Protocols and Service Models
- 4.2 ARQ Protocols and Reliable Data Transfer Service
- 4.3 Other Peer-to-Peer Protocols
- 4.4 Data Link Controls (Framing, Point-to-Point Protocol, HDLC Data Link Control)

I [4 (4.1-4.3)]

5 LANs and MAC protocols 6 hours

- 5.1 Multiple Access Communications
- 5.2 Local Area Networks
- 5.3 Random Access
- 5.4 Scheduling Approaches to Medium Access Control
- 5.5 LAN Protocols (Ethernet and IEEE 802.3 LAN Standard, Token-Ring and IEEE 802.4 LAN Standard)
- 5.6 FDDI
- 5.7 Wireless LANs (IEEE 802.11 Standard)
- 5.8 LAN Bridges

I [6 (6.1-6.3, 6.6, 6.7)]

6 Packet Switching Networks 8 hours

- 6.1 Network Services and Internal Network Operation

- 6.2 M/M/1 Queues (Littles Formula)
- 6.3 Packet Network Topology
- 6.4 Data grams and Virtual Circuits,
- 6.5 Routing in Packet Networks
- 6.6 Shortest-Path Routing Algorithms

I [7 (7.1 – 7.4) & Appendix A]

7 TCP/IP Networks 8 hours

- 7.1 The TCP/IP Architecture
- 7.2 The Internet Protocol
- 7.3 IPv6
- 7.4 User Data gram Protocol
- 7.5 Transmission Control Protocol
- 7.6 Internet Routing Protocols
- 7.7 Multicast Routing
- 7.8 DHCP and Mobile IP
- 7.9 Internet Routing protocols
- 7.10 Multicast Routing

I [8]

8 ATM Networks 6 hours

- 8.1 Broadband ISDN(BISDN Reference Model)
- 8.2 ATM(ATM Layer, ATM adaptation Layer)
- 8.3 ATM Signaling
- 8.4 PNNI Routing

I [9]

9 Advanced Network Architectures/Protocols 6 hours

- 9.1 IP forwarding Architectures
- 9.2 Overlay Model
- 9.3 MPLS
- 9.4 Integrated services in the Internet
- 9.5 RSVP,
- 9.6 Differentiated Services
- 9.7 Real-Time Transport Protocol,
- 9.8 Session Control Protocols,
- 9.9 Network Management

I [10,12(12.3,12.4) & Appendix B]

Text Book

I. Leon Garcia and Widjaja., Communication Networks,2/e, Tata McGraw-Hill,2003

Reference Books

1. W.L.Scheweber "Data Communications" McGraw-Hill International Student Edition, 1999
 2. Behrouz ., Forouzan., Data Communication and Networking TMH 1999
 3. Stallings W. Data and Computer Communications. PHI Ltd Seventh Edition, 2003
-

AT11 DATA BASE MANAGEMENT SYSTEMS

1. Introduction 3 hours

- 1.1 Database System : Purpose, View of Data, Data Models
- 1.2 Database Languages
- 1.3 Management Issues : Transaction, Storage, Database Administrator, Database Users
- 1.4 Overall System Structure

I [1]

2. Entity-Relationship Model 6 hours

- 2.1 Basic Concepts : Design Issues, Mapping Constraints, Keys
- 2.2 Entity-Relationship Diagram : Entity Sets , Relationship Sets, Weak Entity Sets, Extended E-R Features
- 2.3 Design and Mapping : Design of an E-R Database Schema, Reduction of an E-R Schema to Tables

I [2]

3. Relational Model 9 hours

- 3.1 Structure of Relational Databases
- 3.2 Manipulation : The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus, Outer Join

I [3]

4. SQL 9 hours

- 4.1 SQL Basics : Basic Structure, Set Operations, Aggregate Functions, Null Values,
- 4.2 Other SQL Features : Nested Subqueries, Derived Relations, Views, Modification of the Database, Joined Relations
- 4.3 SQL DDL : Data-Definition Language
- 4.4 Embedded SQL

I [4]

5. Relational Database Design 9 hours

- 5.1 Integrity Constraints : Domain Constraints, Referential Integrity, Assertions, Triggers
- 5.2 Functional Dependencies
- 5.3 Normalization : Decomposition, Normalization Using Functional Dependencies, Normalization Using Multivalued Dependencies, Normalization Using Join Dependencies, Domain Key Normal Form
- 5.4 Alternative Approaches to Database Design

I [6, 7]

6. Storage and File Structure 6 hours

- 6.1 Physical storage : RAID, File Organization, Data-Dictionary Storage
- 6.2 Indexing : Ordered Indices, B⁺ Tree Index Files, B-Tree Index Files
- 6.3 Hashing : Static Hashing, Dynamic Hashing
- 6.4 Comparison of Ordered Indexing and Hashing
- 6.5 Index Definition in SQL, Multiple-Key Access

I [10 (10.1-10.8), 11]

7. Query Processing 6 hours

- 7.1 Computing Query Cost : Selection Operations, Sorting, Join Operation, Evaluation of Expressions
- 7.2 Transformation of Relational Expressions

I [12]

8. Transactions 3 hours

- 8.1 Concepts : Definition, State, ACID properties, Serializability, Recoverability
- 8.2 Transaction definition in SQL
- 8.3 Testing for Serializability

I [13]

9. Concurrency Control and Recovery 9 hours

- 9.1 Protocols : Lock-Based, Time-Stamp Based, Validation-Based
- 9.2 Multiple Granularity, Multiversion Schemes
- 9.3 Deadlock : Handling

- 9.4 Recovery : Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent Transactions
- 9.5 Failure with Loss of Nonvolatile Storage

I [14, 15]

Text Book

- I. 'Database System Concepts' by A. Silberchatz, H.F. Korth and S. Sudershan, Third Edition, McGraw Hill 1997
-

AT13 SOFTWARE ENGINEERING

1. Introduction 5 hours

- 1.1 Software Crisis: No Silver Bullet, Software Myths
- 1.2 What is Software Engineering: Definition, Program Versus software, Software Process
- 1.3 Software Life Cycle Models: Build and Fix Model, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Evolutionary Development Model, Spiral Model
- 1.4 Capability Maturity Model: Maturity Levels, Key Process Areas, Common Features
- 1.5 ISO 9000: Mapping ISO 9001 to the CMM, Contrasting ISO 9001 and the CMM, Conclusion

I [1]

2. Software Requirements Analysis and Specification 8 hours

- 2.1 Software Requirements: Crucial Process Step, State of Practice, Need for SRS, Requirement process
- 2.2 Problem Analysis: Analysis Issues, Informal Approach, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Structured Analysis, Object-Oriented Modeling, Other modelling approaches, Prototyping
- 2.3 Requirements Specification: Characteristics of an SRS, Components of an SRS, Specification Languages, Structure of a requirements document
- 2.4 Validation: Requirement Reviews, other methods

I [4]; II [3]

3. Software Metrics 7 hours

- 3.1 Software Metrics: What & Why: Definition, Areas of application, Problems during implementation

- 3.2 Size Metrics: Lines of Code (LOC), token Count, Function Count, Equivalent Size Measures
- 3.3 Data Structure Metrics: The amount of Data, The Usage of Data within a Module, Program Weakness, The Sharing of Data Among Modules
- 3.4 Information Flow Metrics: The basic information flow model, A more sophisticated information flow model

I [2]

4. Software Project Planning 6 hours

- 4.1 Cost Estimation
- 4.2 Models: Static, Single Variable Models, Static, Multivariable Models
- 4.3 The Constructive Cost Model: Basic Model, International Model, Detailed COCOMO Model
- 4.4 The Putnam Resource Allocation Model: Te Norden/Rayleigh Curve, Difficulty Metric, Productivity versus Difficulty, The trade-off-of-time versus cost, Development sub-cycle
- 4.5 Software Risk Management: What is Risk? Typical Software risks, Risk Management activities

I [3]; II [4]

5. Software Design 13 hours

- 5.1 What is Design: Conceptual and Technical Designs, Objectives of Design
- 5.2 Modularity: Module Coupling, Module Cohesion
- 5.3 Strategy of Design: Bottom-Up Design, Top-down Design, Hybrid Design
- 5.4 OO Analysis and OO Design
- 5.5 Concepts: classes and Objects, Relationships among Objects, Inheritance and Polymorphism, Design Concepts
- 5.6 Design Notation and Specification
- 5.7 Design Methodology: Dynamic Modeling, Functional Modeling, Defining Internal Classes and Operations, Optimize and Package
- 5.8 Module Specifications: Specifying Functional Modules, Specifying classes
- 5.9 Detailed Design: PDL, Logic/algorithm Design, State Modeling of Classes
- 5.10 Verification: Design Walkthroughs, Critical Design Review, Consistency Checkers

I [5]; II [5, 6, 7]

6. Software Reliability 6 hours

- 6.1 Importance
- 6.2 Software Reliability and Hardware Reliability
- 6.3 Failures and Faults: Environment
- 6.4 Reliability Concept: Uses of Reliability Studies
- 6.5 Reliability Models: Macro-Models, Basic Model, Logarithmic Poisson Model, Calendar Time Component

I [6]

7. Software Testing 10 hours

- 7.1 Testing Process: Why should we test? Who should do the Testing? What should we test?
- 7.2 Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table based Testing, Cause Effect Graphing Technique
- 7.3 Structural Testing: Path Testing, Data Flow Testing, Mutation Testing
- 7.4 Test Activities: Unit Testing, Integration Testing, System Testing
- 7.5 Debugging: Debugging Techniques, Debugging Approaches, Debugging Tools
- 7.6 Testing Tools: Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools

I [7]

8. Software Maintenance 5 hours

- 8.1 What is Software Maintenance: Categories of Maintenance, Problems during Maintenance, Potential solutions of maintenance Problems
- 8.2 The Maintenance Process: Program Understanding, Generating Particular Maintenance Proposal, Ripple Effect, Modified Program Testing, Maintainability
- 8.3 Maintenance Models: Quick-fix Model, Iterative Enhancement Model, Reuse Oriented Model, Boehm's Model
- 8.4 Reverse Engineering: Scope & Tasks, Levels of Reverse Engineering, Reverse Engineering Tools
- 8.5 Software Re-engineering: Source Code Translation, Program Restructuring
- 8.6 Estimation of Maintenance Costs: Belady & Lehman Model, Boehm Model
- 8.7 Configuration Management: Configuration Management Activities, Software Versions, Change Control Process
- 8.8 Documentation: User Documentation, System Documentation, Other classification schemes

I [8]

Text Books

- I.** K K Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2001
- II.** P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991

Reference Books

1. Stephen R Schach, "Classical & Object Oriented Software Engineering", IRWIN, 1996
 2. James Peter, W Pedrycz, "Software Engineering", John Wiley & Sons
 3. Sommerville, "Software Engineering", Addison Wesley, 1999
 4. Shari Lawrence Pfleeger, "Software Engineering: Theory and Practice", PHI
 5. Roger S Pressman, "Software Engineering: A Practitioner's Approach", 5th Ed., Tata, McGrawHill
-

AT14 IMAGE PROCESSING AND COMPUTER GRAPHICS

1. Overview of Graphics Systems 2 hours

- 1.1 Refreshing cathode ray tubes, Raster scan display devices
- 1.2 Beam penetration and shadow mask methods
- 1.3 Flat panel displays
- 1.4 Mouse, Data gloves, Digitizers, Scanners, Touch Panels, Light pens

II [1 (2-5), 8-9]

2. Screen Primitives 7 hours

- 2.1 Basics of line drawing algorithms
- 2.2 Digital differential analyzer line drawing algorithm
- 2.3 Bresenham line generation algorithm
- 2.4 Mid-point circle generation algorithm
- 2.5 2D translation, rotation, scaling and mirroring transformations
- 2.6 Homogeneous coordinates
- 2.7 Composite transformations

I [3 (2, 5), 5 (1-4)]

3. Clipping 3 hours

- 3.1 Cohen Sutherland line clipping algorithm

I [6 (7)]

4. 3D Graphics 12 hours

- 4.1 Translation, rotation and scaling transformations
- 4.2 Homogeneous coordinates
- 4.3 Composite transformations
- 4.4 Establishing viewing coordinate system
- 4.5 Transformation from world to viewing coordinates
- 4.6 Orthographic/ Oblique parallel projections
- 4.7 Perspective projections and vanishing points
- 4.8 One point perspective projection and its matrix representation
- 4.9 Numeric examples

I [11 (1-5), 12 (2-3)]

5. Visible Surface Detection 6 hours

- 5.1 Back face detection
- 5.2 Z-buffer algorithm

I [13 (2-3)]; II [4 (9)]

6. Elements of Image Processing 2 hours

- 6.1 Image processing applications
- 6.2 Image acquisition
- 6.3 Sampling and quantization

III [2 (3, 4.1-4.3)]

7. Image Enhancement 14 hours

- 7.1 Introduction to histogram
- 7.2 Histogram equalization
- 7.3 Histogram matching
- 7.4 Histogram statistics for image enhancement
- 7.5 Spatial filters for smoothing and sharpening
- 7.6 Discrete Fourier transform and its properties, FFT
- 7.7 Smoothing and sharpening using frequency domain filters
- 7.8 Colour models

III [3 (3, 5-7), 4, 6 (2)]

8. Image Compression 6 hours

- 8.1 Error free compression
- 8.2 Hoffman coding
- 8.3 LZW coding
- 8.4 Bit plane coding
- 8.5 Lossy compression
- 8.6 Transform coding with DCT, JPEG

III [8 (4.1-4.2, 5.2, 6.2)]

9. Image Segmentation 8 hours

- 9.1 Line and edge detection in an image
- 9.2 Edge linking and boundary detection using local and global processing
- 9.3 Thresholding techniques and their merits and limitations
- 9.4 Region oriented segmentation
- 9.5 Region splitting and merging

III [10 (1.2-1.3, 2.1-2.2, 3.1-3.5, 4)]

Text Books

- I.** Hearn D. and Baker P.M., Computer Graphics, 2nd Edition, Prentice Hall of India, 1997
- II.** Rogers D.F., Procedural Elements of Computer Graphics, 2nd Edition, TMH Publishing, 2001
- III.** Gonzalez R.C. and Woods R.E., Digital Image Processing, 2nd Edition, Pearson Education Inc., 2003

Reference Books

- 1. Foley J.D., van Dam A., Feiner S.K. and Hughes J.F., Computer Graphics. Principles and Practice, 2nd Edition, Addison Wesley Publishing
- 2. Rogers D.F. and Adams J.A., Mathematical Elements of Computer Graphics, 2nd Edition, McGraw-Hill
- 3. Jain A.K., Fundamentals of Digital Image Processing, Pearson Education Inc.

AT15 INTERNET AND WEB TECHNOLOGY

1. Review of Network Concepts

12 hours

- 1.1 Introduction to Internet – Motivation and Tools
- 1.2 Packets, Frames and Error detection
- 1.3 Network Topology, Repeaters, Bridges, Switches
- 1.4 Hardware addressing and frame types
- 1.5 WAN Technologies and Routing
- 1.6 OSI Stack

I [2, 7 - 13, 16]

2. Internetworking Technology

16 hours

- 2.1 Internetworking – concepts, architecture, and protocol (TCP/IP)
- 2.2 IP Addresses
- 2.3 Binding Protocols
- 2.4 IP datagram and Datagram Forwarding
- 2.5 IP Encapsulation, Fragmentation and Reassembly
- 2.6 Internet Routing
- 2.7 Network Address Translation
- 2.8 Error Reporting Mechanism (ICMP)
- 2.9 Datagram transport Service (UDP)
- 2.10 Reliable Transport Service (TCP)
- 2.11 Future IP (Ipv6)

I [2, 17- 27]

3. Internet Applications

10 hours

- 3.1 Client-Server Interaction
- 3.2 The Socket Interface
- 3.3 Domain Name System
- 3.4 Electronic Mail Representation and Transfer
- 3.5 IP Telephony
- 3.6 File Transfer and Remote File Access
- 3.7 Trivial File Transfer Protocol
- 3.8 HTTP

I [28 –34]; II [6]

4. Internet Management and Security

5 hours

- 4.1 Network (Internet) Management (SNMP)
- 4.2 Network Security
- 4.3 Initialization (configuration)

I [39-41]; II [13]

5. Web Technologies 14 hours

- 5.1 Introduction to Web technology
- 5.2 Web pages and Browsing
- 5.3 Dynamic Web Pages
- 5.4 Dynamic web document technologies - CGI, JSP, ASP, Coldfusion
- 5.5 Active web pages and Active Web technologies
- 5.6 RPC and Middleware
- 5.7 Extensible Markup Language
- 5.8 Middleware and component-based Architecture
- 5.9 Introduction to E-Commerce
- 5.10 Electronics Data Interchange (EDI)

I [35 - 38]; II [7-10, 15 – 17]

6. Wireless Application Protocol 3 hours

- 6.1 Limitation of mobile devices
- 6.2 Emergence of WAP
- 6.3 WAP Architecture
- 6.4 WAP Stack
- 6.5 Concern about WAP and its future
- 6.6 Alternative to WAP

II [18]

Text Books

- I.** Douglas E. Comer, “Computer Networks and Internets”, 4th Edition, Pearson Education Asia, 2004.
- II.** Achyut S Godbole and Atul Kahate, “Web Technologies, Tat McGraw-Hill, 2003

Reference Books

- 1. H M Dietel and A B Goldberg, ‘ Internet and World Wide Web: How to Program’, Pearson Education, 2004.
- 2. Douglas E. Comer, “The Internet”, 3rd Edition, Pearson Education Asia, 2001.

- 4.2 Application Services and transaction models: C2B Transactions, B2B Transactions, Intra-organizational Transactions.
- 4.3 WWW architecture: Client server structure of the web, e-commerce architecture.
- 4.4 Technology behind the web

I [6]

5. Consumer-Oriented E-Commerce 5 hours

- 5.1 Consumer Oriented Application: Finance and Home Banking, Home shopping, Home Entertainment
- 5.2 Mercantile Process Models, Consumers perspective, Merchants perspective.

II[7]

6. Electronic Payment Systems (EPS) 10 hours

- 6.1 Types of Electronic Payment Systems
- 6.2 Token-based, Electronic Payment Systems, E-cash, E-cheque.
- 6.3 Smart cards, Credit Cards, Charge Cards, third party processing.
- 6.4 Risks and Design Issues

I [8]; II [7]

7. Electronics Data Interchange (EDI) 5 hours

- 7.1 EDI concepts
- 7.2 Applications in business – components of international trade, Customs, Financial EDI, Electronic fund transfer.
- 7.3 Manufacturing using EDI, Digital Signatures and EDI

I [9]; II [9]

8. Intra Organizational E-Commerce 8 hours

- 8.1 Work flow Management
- 8.2 Customization
- 8.3 Supply chain management – logistics Marketing, Distribution
- 8.4 Electronic brokerages

I [11]; II [9]

Text Books

- I** R Kolkota and A B Whinston, “Frontiers in Electronic Commerce”, Addison-Wesley (Indian reprint)
- II** G.P. Schneider and James T. Perry, “Electronic Commerce” Thomson Learning, Course Technology, India.

Reference Books

1. K.K. Bajaj and D Nag, “E-Commerce – The Cutting Edge of Business”, Tata-McGraw Hill.
-

AT17 TELECOMMUNICATION SYSTEMS

1. Introduction 1 hour

- 1.1 Evolution of Telecommunication.

I [1 (1.1)]

2. Telecommunication Switching 10 hours

- 2.1 Switching Functions.
2.2 Space Division Switching.
2.3 Time Division Switching.
2.4 Two – Dimensional Switching: TS, ST, TST, STS Switches.

I [4 (4.7-4.9), 6 (6.1-6.6)]; II [5 (5.1,5.4,5.4.1,5.4.2)]

3. Subscriber Loop 6 hours

- 3.1 Transmission Systems: Two-wire and Four-wire transmission, Pair gain systems.
3.2 Transmission Impairments: Attenuation, interference, noise, cross-talk, distortion, Echoes.
3.3 Analog Subscriber Loop Interface, BORSCHT.

II [1 (1.2.4,1.2.5,1.2.8), 5 (5.6.2)]

4. Telecommunication Traffic 8 hours

- 4.1 Traffic Characterization.
- 4.2 Loss Systems.
- 4.3 Delay Systems.

I [8 (8.1, 8.2, 8.5, 8.6)]; II [12 (12.1, 12.2, 12.4,12.4.1-12.4.3)]

5. Mobile Communication 7 hours

- 5.1 Cell Concept.
- 5.2 Global System for Mobile Communication (GSM).
- 5.3 Code Division Multiple Access(CDMA) Cellular Systems : Channel establishment, Multipath, Power control, Handoff.

I [9 (9.10)]; II [1 (1.2.14), 9 (9.2, 9.3)]

6. Fiber Optic Systems 10 hours

- 6.1 Transmission: Multimode and Single Mode fibers, Attenuation, Chromatic dispersion, Channel bandwidth
- 6.2 Line codes for fiber optic transmission
- 6.3 Wavelength division multiplexing (WDM)
- 6.4 Fiber System Design
- 6.5 Introduction to SONET / SDH

II [8 (8.1-8.5,8.5.1,8.5.2)]

7. Digital Subscriber Access 8 hours

- 7.1 Integrated Services Digital Network (ISDN) : Basic and primary rates, access architecture; S,T and U interfaces, D- channel
- 7.2 ISDN Services
- 7.3 Digital Subscriber Loop (DSL)

I [11 (11.3-11.6, 11.8)]; II [11 (11.1, 11.2.1)]

8. Data Networks 10 hours

- 8.1 WAN, MAN, LAN
- 8.2 PSTN
- 8.3 Circuit Switching, Packet Switching
- 8.4 Data Communication Architecture
- 8.5 Asynchronous Transfer Mode (ATM) networks : ATM cells, service categories, ATM connections-virtual channel and virtual path

Text Books

- I. T. Vishwanathan, “Telecommunication Switching Systems and Networks”, Prentice-Hall of India, 1992
 - II. J. C. Bellamy, “Digital Telephony”, John Wiley (International Student Edition), Third Edition, 2002
-

AT18

PROJECT

The Project will consist of hardware/software, design/development, experimental/theoretical work or a critical in-depth literature survey of a contemporary topic or a combination of these. A student is expected to put in about six hours/week spread over a period of three to four months. There will be no joint project work.

The students may work for their project in any industry, in an educational institution, in R&D Laboratory or in a library depending upon the nature of the project. The student will be required to have a supervisor from one of these places who can supervise and guide the project work. In case of difficulties, the students may contact the local centre.

The project work can be taken only after clearing 14 compulsory papers of Section A& B. Such eligible students are required to submit their project applications to their Local centre with brief write up of the intended project, bio-data of their guide, guide’s willingness letter to supervise the project along with a draft of Rs 1000/- as project fee. The Project applications should be submitted so as to reach their Local centre by 20 Oct/20 April. On approval of their application, Local centres will issue the approval letters to the individual students.

On completion of the project, the student will submit two bound copies of the Project Report to IETE Local Centre as per the dates intimated by the Centre. The project work will be assessed by an Assessment Board. The students will be intimated by the local centres of the venue, date & time for presentation of their project report & appearing before the Assessment Board. The result of the project will be finalized at IETE HQ and declared along with the main IETE examination result. Pass marks for the project will be 50%. Students not getting 50% marks will be required to re-register for the project following the usual procedure. The students will have the option of taking up a new project or continue with the earlier project.

AT19

DATA WAREHOUSING AND DATA MINING

- 1. Evolution of Decision Support Systems and the Data Warehouse Environment** **5 hours**
 - 1.1 The Evolution.
 - 1.2 4 GL Technology.
 - 1.3 The Architected Environment.**I [1]**

- 2. Data Warehouse & OLAP Technology for Data Mining** **15 hours**
 1. What is Data Mining.
 2. A Multidimensional Data Model.
 3. Data Warehouse Architecture.
 4. Data Warehouse Implementation.
 5. Data Cube Technology.**II [2]**

- 3. Executive Information Systems and Data Warehouse** **8 hours**
 - 3.1 Drill-Down Analysis.
 - 3.2 The Data Warehouse as a Basis for EIS.
 - 3.3 Event Mapping.
 - 3.4 Detailed data and EIS.**I [7]**

- 4. External/Unstructured Data and the Data Warehouse** **8 hours**
 - 1.1 External/Unstructured Data and the Data Warehouse.
 - 1.2 Metadata and External Data.
 - 1.3 Modeling and External/Unstructured Data.
 - 1.4 Archiving External Data.**I [8]**

- 5. Data Preprocessing** **8 hours**
 - 5.1 Data Cleaning.
 - 5.2 Data Integration & Transformation.
 - 5.3 Data Reduction.
 - 5.4 Discretization of Concept Hierarchy.

II [3]

6. Migration to the Architected Environment 8 hours

- 6.1 A Migration Plan.
- 6.2 The feedback loop.
- 6.3 Methodology and Migration.

I [9]

7. Data Mining and Machine Learning 8 hours

- 7.1 Introduction.
- 7.2 Machine Learning.
- 7.3 Machine Learning and Statistics.
- 7.4 Association Rules.
- 7.5 Classification.

II [6 (6.1, 6.2,), 7 (7.1-7.3)]

Text Books

- I. W.H. Inmon, "Building the Data Warehouse", Second Edition, John Wiley and Sons, Inc. Latest Edition.
- II. Jiawei Han & Micheline Kamber, "Data Mining-Concepts & Techniques", Morgan Kaufman Publishers.

Reference Books

- 1. H. Witten and E. Frank, "Data Mining-Practical Machine Learning Tools and Techniques with JAVA Implementation", Morgan Kaufman Publishers Inc. Latest Edition
-

AT20 INDUSTRIAL MANAGEMENT

1. Management Concept and Functions 5 hours

- 1.1 Management Concept
 - 1.1.1 Evolution and Development of Management Thought
 - 1.1.2 Principles of Management
 - 1.1.3 Levels of Management
 - 1.1.4 Industrial Management
- 1.2 Functions of Management

- 1.2.1 Planning – types of plans, objectives of planning
- 1.2.2 Organizing
- 1.2.3 Staffing – role and definition
- 1.2.4 Directing – Concept, salient features, principles of directing
- 1.2.5 Control – Managerial control, techniques of Managerial Control

I [15]; II [3]

2. Organisation 6 hours

- 2.1 Importance of Organisation
- 2.2 Characteristics of Organisation
- 2.3 Process of Organisation
- 2.4 Principles of Organisation
 - 2.4.1 Span of Control
 - 2.4.2 Delegation of Authority – Principles and Problems
 - 2.4.3 Authority and Responsibility
- 2.5 Organisation – Structure and Need
- 2.6 Types of Organisation
 - 2.6.1 Line Organisation
 - 2.6.2 Functional Organisation
 - 2.6.3 Line & Staff Organisation
 - 2.6.4 Project Organisation
 - 2.6.5 Matrix Organisation

I [3]; II [9, 10]

3. Organisational Behaviour 9 hours

- 3.1 Group Dynamics – Concepts, Characteristics of Group, types of Groups, advantages and disadvantages of groups
- 3.2 Organisational Change – Causes, response and resistance to change
- 3.3 Organisational Development - Concept, objectives and characteristics
- 3.4 Organisational Conflict – Stages of conflict, causes of conflict, sources of conflict and conflict resolution
- 3.5 Managerial Leadership – Concept, styles of managerial leadership
- 3.6 Motivation – Definition, Need, factors affecting motivation, motivational techniques
- 3.7 Morale – Concept, high & low morale, factors affecting morale
- 3.8 Communication – formal & informal communication, communication channel & structure, communication process & systems, barriers to successful communication

I [3,19, 20]; II [11]

4. Personnel Management 7 hours

- 4.1 Principles of a good personnel policy
- 4.2 Recruitment and Selection
- 4.3 Education and Training
- 4.4 Labour Turnover
- 4.5 Wages and Salary Administration
- 4.6 Discipline – Causes, disciplinary action & punishment, disciplinary procedure
- 4.7 Grievances Handling

I [20]; II [54, 62, 63]

5. Industrial Relations and Labour Laws 8 hours

- 5.1 Industrial Relations
 - 5.1.1 Trade Unions
 - 5.1.2 Industrial Dispute
 - 5.1.3 Strikes, lockout, Picketing & Gherao
 - 5.1.4 Collective Bargaining
 - 5.1.5 Workers Participation in Management
 - 5.1.6 Union – Management Relations
- 5.2 Labour Laws – Essential Provisions
 - 5.2.1 Factories Act 1948
 - 5.2.2 Payment Of Wages Act 1943
 - 5.2.3 Workmen Compensation Act 1943
 - 5.2.4 Industrial Disputes Act 1947
 - 5.2.5 Minimum Wages Act 1948

I [21, 22]; II [61, 64 – 66, 68]

6. Productivity and Quality 8 hours

- 6.1 Productivity - Factors affecting productivity, Increasing productivity, Productivity measures, Productivity & Quality
- 6.2 Production, Planning & Control – Forecasting, scheduling, control of production and process control
- 6.3 Quality Control – Definition, Concepts & basic fundamentals of SQC, Objectives, elements tools & implementation of TQM
- 6.4 Work Study – objectives, procedures, time study and work measurement
- 6.5 Inventory Control – Objectives, material requirement planning, ABC Analysis, EOQ and simple inventory models

I [2, 7, 8, 9, 24]; II [79, 25, 27, 34]

7. Decision Making 7 hours

- 7.1 Definitions and Importance of Decision Making
- 7.2 Types of Decisions
- 7.3 Decision Making Process
- 7.4 Guidelines for effective decision-making
- 7.5 Quantitative Techniques in Decision Making
 - 7.5.1 OR
 - 7.5.2 Cost-Benefit Analysis
 - 7.5.3 Linear Programming
 - 7.5.4 Network Analysis – CPM/PERT
- 7.6 Decision Making under Certainty, Uncertainty and Risk

I [18]; II [81]

8. Finance and Accounting Fundamentals

7 hours

- 8.1 Finance Management
 - 8.1.1 Finance Management Concepts
 - 8.1.2 Working Capital
 - 8.1.3 Factors affecting working capital
 - 8.1.4 Financial Statement and Financial Ratios
- 8.2 Cost Accounting
 - 8.2.1 Elements of Cost
 - 8.2.2 Types of Cost
 - 8.2.3 Cost Control and Accounting
 - 8.2.4 Break-even Analysis
- 8.3 Budget
 - 8.3.1 Budget and Budgetary Control
 - 8.3.2 Types of Budget
 - 8.3.3 Preparation of Budget
 - 8.3.4 Budget as a process of planning, coordination and control

I [26, 27, 28]

9. Marketing Fundamentals

3 hours

- 9.1 Marketing – definition, principles and functions
- 9.2 Market Management and functions
- 9.3 Market Research
- 9.4 Product Packaging
- 9.5 Product Mix

I [31]; II [82]

Text Books

- I. O.P.Khanna , ‘ Industrial Engineering and Management,’ Dhanpat Rai and Sons, Delhi (2003).
- II. K.K. Ahuja, ‘ Industrial Management,’ Khanna Publishers, Delhi (2003).

Reference Books

1. Ravi Shankar, “Industrial Engineering and Management’, Galgotia Publications Pvt Ltd, New Delhi (2003).
 2. “Management Guide Series” (14 Booklets), National Productivity Council, New Delhi (1990).
 3. R.S. Davar, “ Personnel Management”, Vikas Publishing House, Delhi (1997).
-

AT21 ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS

- | | |
|--|----------------|
| 1. Scope of AI | 1 hour |
| 1.1 General Issues and overview of AI | |
| 1.2 The AI problems | |
| 1.3 Characteristics of AI applications | |
| I [1] | |
| 2. Problem Solving, Search and Control Strategies | 6 hours |
| 2.1 General Problem solving | |
| 2.2 Control strategies | |
| 2.2.1 Forward and backward chaining | |
| 2.3 Exhaustive Searches | |
| 2.3.1 Depth first and Breadth first search. | |
| 2.4 Heuristic Search Techniques | |
| 2.4.1 Hill climbing | |
| 2.4.2 Branch and Bound technique | |
| 2.4.3 Best first search & A* algorithm | |
| 2.5 Constraint Satisfaction problems. | |
| I [2, 3] | |
| 3. Game playing | 5 hours |

- 3.1 AND/OR graphs
- 3.2 Problem reduction & AO* algorithm
- 3.3 Minimax search procedure
- 3.4 Alpha-Beta cutoffs
- 3.5 Additional Refinements

I [12]

4. Knowledge Representations 9 hours

- 4.1 First order predicate calculus
 - 4.1.1 Skolemization
 - 4.1.2 Resolution Principle & Unification
 - 4.1.3 Inference Mechanisms
 - 4.1.4 Horn's clauses
- 4.2 Semantic Networks
- 4.3 Frame Systems and Value Inheritance
- 4.4 Scripts
- 4.5 Conceptual Dependency

I [9, 10]; II [5, 6, 10]

5. AI Programming Languages (PROLOG) 12 hours

- 5.1 Introduction to PROLOG
 - 5.1.1 General Syntax and Prolog Control Strategy
 - 5.1.2 Recursive Programming
 - 5.1.3 Lists
 - 5.1.4 Iterative Programming
- 5.2 Advanced Prolog Concepts
 - 5.2.1 Cut, Fail predicates
 - 5.2.2 Binary Trees and Objects
 - 5.2.3 Meta Level Programming and Meta interpreters

II [7-10]

6. Learning 9 hours

- 6.1 Concept of Learning
- 6.2 Learning by Induction, Analogy
- 6.3 Example Based Learning
- 6.4 Neural Networks
 - 6.4.1 Perceptrons
 - 6.4.2 Multilayer Feedforward Networks
 - 6.4.3 Back Propagation Algorithm
 - 6.4.4 Hopfield Network
 - 6.4.5 Neural Network Applications

I [17, 18]

7. Planning 4 hours

- 7.1 Overview - An Example Domain: The Blocks World
- 7.2 Component of Planning Systems;
- 7.3 Goal Stack Planning (linear planning)
- 7.4 Non-linear Planning using goal sets

I [13]

8. Handling Uncertainty 5 hours

- 8.1 Probabilistic Reasoning and Uncertainty
 - 8.1.1 Probability theory
 - 8.1.2 Bayes theorem and Bayesian networks
- 8.2 Fuzzy Logic

I [8]

9. Expert Systems 6 hours

- 9.1 Need and justification for Expert systems
- 9.2 Application of Expert systems
- 9.3 Expert System Architecture
 - 9.3.1 Rule Based Expert System (Production Systems)
 - 9.3.2 Non Production Systems
- 9.4 Various Expert System Shells
- 9.5 Knowledge Acquisition
- 9.6 Case studies: MYCIN and R1

I [20]

10. Natural Language Processing 3 hours

- 10.1 Parsing techniques
- 10.2 Context-free grammar
- 10.3 Recursive Transitions Nets (RTN)
- 10.4 Augmented Transition Nets (ATN)
- 10.5 Definite Clause Grammar (Logic grammar)

I [15]; II [11]

Text Books

- I. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw-Hills, 1991.
- II. Logic and Prolog Programming - Saroj Kaushik, New Age International Ltd, publisher, 2002.

Reference Books

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice all of India, 1992.
 2. S Russell & P Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, reprint 2003.
 3. N J. Nilsson, “Artificial Intelligence: A New Approach”, Morgan Kaufmann, reprint 2000.
 4. L. Sterling & E. Shapiro, “Art of Prolog, Advanced Programming Techniques, Prentice Hall of India, reprint 1996.
-

AT22 OBJECT ORIENTED PROGRAMMING

1. Principles of Object-Oriented Programming 3 hours

- 1.1 Software Evolution : The Traditional Approach, Structured Methodology Overview, Shortcoming of procedure Oriented Languages
- 1.2 Object Oriented Paradigm : Basic Concepts of Object oriented Programming, Benefits of OOP, Object Oriented Languages

II [1]

2. Programming Basics 3 hours

- 2.1 Basic Program Construction : Input/output using cin/cout, Processor Directives
- 2.2 Basic and user-defined data types- Literal Constant, Variables, Pointer types, String Types, const Qualifier, Reference Types, The bool type, Enumeration Types, Array Types
- 2.3 Operators : Arithmetic, Equality, Relational, Logical, Assignment, Increment, Decrement, Conditional, sizeof, new, delete, Comma
- 2.4 Type Conversions.
- 2.5 Loops : for, while and do
- 2.6 Decision : if, if .. else, switch
- 2.7 Control Statements : break, continue and goto
- 2.8 Simple Functions
- 2.9 Function prototyping
- 2.10 Inline Functions
- 2.11 Pointer to Functions

I [1, 3 (3.1–3.9), 4, 5, 7]

3. Classes 15 hours

- 3.1 Class : Definition, Class Objects, Class Member Functions, The Implicit this Pointer, Static Class Members, Pointer to Class Member
- 3.2 Union: A Space-Saving Member
- 3.3 Other Features: Class Scope, Nested Classes, Local Classes, Objects Arrays and Composite class
- 3.4 Object Construction : Constructor, Destructor, The Member Initialization List, Copy Constructor
- 3.5 Special Features : Friends, *this* pointer

I [13, 14]; II [2, 5, 6, 7]

4. Operator Overloading 9 hours

- 4.1 Overloading unary and binary operators : Arithmetic, Comparison, Assignment
- 4.2 Special Operators : Operator [], Operator (), Operator ->, Operator ++ and --, Operator << and >>
- 4.3 User-Defined Conversions : conversion between basic types, between objects of different classes, Selecting a Conversion
- 4.4 Other Features : Overload Resolution and Member Functions, Overload Resolution and Operators

I [15]; II [9]

5. Inheritance and Polymorphism 13 hours

- 5.1 Class hierarchy : Definition, Identifying the members of the hierarchy, Base class member access
- 5.2 Constructors: Base and derived class construction, Memberwise initialization and assignment
- 5.3 Virtual functions
- 5.4 Multiple inheritance
- 5.5 Access Specifiers: Public, private, and protected inheritance, Class scope under inheritance
- 5.6 Virtual classes

I [17, 18]; II [3, 8]

6. Templates 5 hours

- 6.1 Class template : Definition, Instantiation, Member functions of class templates, Specializations
- 6.2 Function template : Definition, Instantiation, Template argument deduction, Explicit template arguments

I [16]; II [10]

7. Files and Streams 9 hours

- 7.1 Stream classes
- 7.2 Character I/O
- 7.3 File input and output
- 7.4 States : Condition states, Format state
- 7.5 String streams

I [20]

8. Exception Handling 3 hours

- 8.1 Exception :Throwing, The try...catch block
- 8.2 Exception specifications

I [11]

Text Books

- I.** Stanley B. Lippman and Josee Lajoie, 'C++ Primer', Addison Wesley, Third Edition (1998)
- II.** Parimala N., 'Object Orientation through C++', Macmillan, 1999

AT35 MATHEMATICS—II

1. Complex Analysis 22 hours

- 1.1 Analytic function, Cauchy- Riemann equations, Elementary functions of complex variable, Harmonic functions.
- 1.2 Conformal mapping, Linear fractional transformations.
- 1.3 Complex line integral, Cauchy integral theorem, Cauchy integral formula, Cauchy inequality, Liouville and Morera theorems.
- 1.4 Taylor and Laurent series, Singularities and zeros, Poles, Residues and Residue theorem.
- 1.5 Evaluation of real integrals by contour integration.

I [12, 13, 14, 15]; II [10, 11, 12, 13, 14]

2. Vector Analysis 20 hours

- 2.1 Vector and scalar function and fields, Differentiation of vector function, Tangent vector to a curve in space.
- 2.2 Gradient, Divergence, Curl.
- 2.3 Line integral of vector functions, Independence of path, Green's theorem.
- 2.4 Surface integrals, Divergence theorem, Stoke's theorem.

I [8, 9]; II [15]

3. Partial Differential Equations 8 hours

- 3.1 Solution of Partial Differential Equations by method of separation of variables.
- 3.2 One dimensional wave and heat conduction equation, Laplace equation in two variables.

I [11]; II [9]

4. Probability Concepts 10 hours

- 4.1 Random variable, Probability mass function and density function.
- 4.2 Expectation, Mean and variance of a random variable.
- 4.3 Binomial, Poisson and Normal distributions.

I [22]

Text Books

- I.** Erwin Kreyszig, "Advanced Engineering Mathematics" 8th edition, John Wiley and Sons (Asia) --- 2000
- II.** R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House --- 2002

Reference Books

- 1. Peter V. O'neil, "Advanced Engineering Mathematics" 4th edition Brooks / Cole Publishing Company ---1995
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