

Page No. _____

1994

“अंतरा पेदु दानज्येह”

**NORTH MAHARASHTRA UNIVERSITY,
JALGAON - 425 001**

**Syllabus
FOR M.Sc.(Computer Science)
with effect from July 1994**

DEPARTMENT OF COMPUTER SCIENCE

M.Sc. COMPUTER SCIENCE

STRUCTURE

SEMESTER - I

CS-101	Computer Programming and problem solving (Using PASCAL)
CS-102	Computer Organization And Assembly programming.
CS-103	Mathematical Foundations of Computer Science.
CS-104	Computer based Numerical Techniques.
CS-105	Combinatorics and Graph Theory.
CS-106	Applied Probability Models.

SEMESTER - II

CS-201	Data & File structures (Pascal,C).
CS-202	Computer Architecture.
CS-203	Theoretical Computer Science.
CS-204	Computer based Optimization Techniques.
CS-205	Business Data Processing.
CS-206	System Software.

SEMESTER -III

CS-301	Stochastic Models.
CS-302	Data Base Management Systems.
CS-303	Operating Systems.
CS-304	Design And Analysis of Algorithms.
CS-305	Computer Networks.
CS-306	Programming Languages.

SEMESTER-IV

CS-401	Computer Graphics.
CS-402	Parallel Computing.
CS-403	Artificial Intelligence.
CS-404	Software Engineering.
CS-405 } CS-406 }	Project.

DETAILED SYLLABUS

CS-101 COMPUTER PROGRAMMING & PROBLEM SOLVING.
(L : 4, P : 4)

Problem Analysis , Flow charts, decision tables, Pseudo codes and algorithms, High Language and programmer & Model computer system.

Algorithmic Programming Languages:

Representation of integers, reals, characters, constants and variables, arithmetic expressions and their evaluation using rules of hierarchy, Assignment statements, logical constants variables and expression. Control structures - sequencing , alternation, iteration. Arrays, Manipulating vectors and matrices.

Subroutines and linkage, Data Management, Sample I/O statements, Documentation , Debugging, storage and execution time estimation.

Examples illustrating structured program development methodology and use of a block structured algorithm language to solve specific problems.

Reference books:

1. Dromey, G. : How to solve it by computer, Prentice Hall, 1985.
2. Wirth, N. : Systematic Programming and Introduction, Prentice -Hall, 1978.
3. Jackson N.A.:Principles of Programme Design, Academic Press, 1978.
4. Gries D. :Programming Methodology, Springer-verlag, 1987.
5. Conway R. :Gries D. and Zimmerman, E.C. :A primer on Pascal, Winthrop Publ. Co. Cambridge, 1978.
6. Rajaraman V.:Computer Programming in Pascal,Prentice -Hall India , 1983.
7. Jensen K. & Wirth N. : PASCAL User Manual and Report, Narosa Publ. House, 1985.
8. Schneider G.M. & Bruell S.C. :Advanced Programming and Problem Solving with PASCAL, Wiley - Inter Science, 1981.
9. Grover P.S. :PASCAL Programming Fundamentals (Allied Publishers, 1989)

CS-102 COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING

(L : 4, P : 4)

Representation of information : Number systems, integer and floating point representation , character codes (ASCII, EBCDIC), Error detection and correction codes.

Basic Building blocks: Boolean Algebra, Combination logic design, flip-flops, registers, counters, ALU; Arithmetic and Logic Operations, Organization of Control Units, Memory; types and organization, Peripheral Devices, I/O Devices (Video terminals and printers) and controllers, Storage devices (Tape and Disks), Programmed and Interrupt Control mechanisms, I/O Controllers, Bus bandwidths, Assembly Language Programming; Programmers Model of a machine, Example of a typical 16 to 32 bit Processor, Registers, Addressing Models, Instruction set, Use of Assembly Language for specific programs for typical problems like: Table Search, Subroutines; Symbolic and Numeric manipulations and I/O.

Reference Books:

1. Gear, C.W. : Computer Organization and Programming, McGraw-Hill, 1975.
2. Tannenbaum, A.S. : Structured Computer Organization, Prentice-Hall of India.
3. Mano, M.M. : Computer System Architecture, Prentice-Hall of India, 1983
4. Langholz, G., Grancioni, J. and Kandel, A. : Elements of Computer Organization, Prentice-Hall International, 1988.
5. Assembler Manual for the chosen Machine.
6. Hayes, : Computer Architecture and Organization, McGraw-Hill International Edition.
7. Sloan, M.E. : Computer Hardware and Organization, 2nd Edn. Galgotia Publ., Pvt. Ltd.

CS-103 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE.
(L : 4; P : 0)

Sets, Relations and Functions:

Defination of Sets and Subsets; Intersection, Union and Complements; DeMorgan's law; Cardinality; Relations - Equivalence relations etc.; Mappings - One-one, Onto etc.

Logic:

Logic operators like AND, OR etc.; Truth tables; Theory of inference and Deduction; Mathematical Induction; Predicate Calculus; Predicates and Quantifiers.

Linear equations and matrices:

Row/Column operations; Gaussian Elimination; Decomposition; Inverse.

Determinants:

Properties of determinants; Cramer's Rule; Determinants of transpose and inverse.

Vector spaces:

Linear independence; Bases, subspace and dimensionality.

Inner Products and Norms.
 Length, angle, direction cosines, Orthogonalizations.
 Reference Books:
 1. Heritage, R.H. Discrete Computational Structures, Academic Press, 1974.
 2. Preparata, F.P., Yeh, K.F. Introduction to Discrete Structures, Addison-Wesley, 1973.
 3. Assembly, J.R. and Manphar, R.P. Discrete Mathematical Structures, McGraw-Hills, 1975.
 4. Law, Computer Science: A Mathematical Introduction, Prentice-Hall International, Paperback Edition.

CS-104 COMPUTER BASED NUMERICAL TECHNIQUES

3. Numerical methods: In the following topics on Numerical Methods, Students are expected to be able to write programs or subprograms or program segments as well as perform Numerical calculations using Electronics Calculators and mathematical tables.
- I. Iterative methods for solution of Algebraic Equations.
 - Newton Raphson method, Iteration method, method of False Position, Rate of Convergence, Comparison of these methods, choice of an iterative method and implementation.
 - II. Solution of Simultaneous Equations:
 - Direct methods- Cramer rule, Gauss Elimination method, Pivotal condensation, Iterative methods- Gauss-Seidel method, Jacobi method.
 - III. Interpolation
 - Lagrange and Newton Interpolation method, Finite Difference operators, Interpolating Polynomials using finite differences, Difference tables- Central, Forward, Backward.
 - IV. Numerical Integration
 - Method based on interpolation, method based on undetermined coefficient, composite integration methods- Trapezoidal and Simpson's Rules, Double Integration (Derivation, Applications and Errors in the Formulae, comparison of two Formulae).
 - V. Numerical Differentiation
 - Methods based on Interpolation, Finite Differences and Undetermined Coefficient.
 - VI. Solution of Differential Equations
 - Numerical Methods- Euler's method, Backward Euler method, Single step method- Taylor series method, Runge-Kutta methods, Multistep methods, Stability Analysis.

Reference Books:

1. Programming with FORTRAN 77 ,
Ram Kumar, Tata McGraw-Hill Company.
2. Introductory methods of Numerical Analysis,
S.S. Sastry, Prentice-Hall of India.
3. Numerical Mathematical Analysis.
J.B. Scarborough, Oxford, 1964.
4. Computer Programming in FORTRAN IV,
V. Rajaraman, Prentice-Hall of India, 1974.
5. Computer Oriented Numerical methods,
V. Rajaraman, Prentice-Hall of India.

CS-105 COMBINATORICS AND GRAPH THEORY

(L : 4, P : 0)

Combinatorics :

Counting, rule of sum and Product, Permutations, combinations, Placing balls in boxes. distinct balls distinct Boxes; Distinct balls, identical boxes and Sterling Numbers of Second kind; Nondistinct balls distinct boxes. Non distinct boxes and partition of Integers.

Generation of Permutation and Combinations:

Recursive relations : homogeneous and Particulars Solutions, Generating functions.

Graph Theory : Basic notations, directed multigraph, Directed Graph, degree, Regular graph, Antisymmetric graph, Clique, bipartite graph, chain, Path, connected graph.

Matrix representation of graphs: Incidence: Adjacency matrices and their properties.

Shortest path in weighted Graphs- Dijkstra's Algorithm, Tree, Strongly connected graph, Quasi-strongly connected graph, Rooted tree, binary tree, recursive definition of (rooted) tree, Sequential (array) representation of binary tree, full binary Tree, complete binary tree.

Prefix codes- Optimal Binary Prefix codes- Huffman Procedure for their Construction.

Network flow Problem- Ford and Fulkerson's Algorithm, Maxflow Min-cut theorem, Exponential behaviour of Ford and Fulkerson's Algorithms.

Planner Graph: combinatorial and Geometric duals; Kuratowski's graph: Detection of Planarity.

Text:

Liu, C.L.: Elements of Discrete Mathematics, McGraw-Hill N.Y. (Second Edition) (International Edition, McGraw-Hill, Singapore 1986.)

References:

1. Berge, C. : "Graphs", North Holland, Amsterdam (Second revised edition 1985)
2. Berlekamp, E.R. : "Algebraic Coding Theory", McGraw Hill N.Y. 1969.
3. Bose, R.C. and S. Mancel : "Introduction to Combinatorial Theory", John Wiley and Sons, Y. N. (1984)
4. Foulds, L.R. : "Graph Theory Applications", Springer Verlag, N.Y. (1983). (Faros Publishing House, New Delhi Reprint, 1983)
5. Joshi, K.D. : "Foundations of Discrete Mathematics", Wiley Eastern Ltd., New Delhi (1989).
6. Papadimitriou, C.H. and K. Steiglitz : "Combinatorial Optimization Algorithms and Complexity", Prentice-Hall, Englewood Cliffs., N.J. (1982).
7. Stoll, R.R. : "Set Theory and Logic", W.H. Freeman and Co. San Francisco 1968.
8. Vilenkin, N. : "Combinatorial Mathematics for Recreation", Mir Publishers, Moscow 1969.
9. Wilf, H.S. : "Algorithm and Complexity", Prentice-Hall, Inc., Englewood Cliffs, N.J. (1985).

CS-103 APPLIED PROBABILITY MODELS

(L : 4, P : 0)

Conditional Probability and Expectations. Problems based on conditional Probability, Markov chains with stationary transition probabilities, properties of transition functions, classification of states, stationary distribution of Markov chains, existence and uniqueness, convergence to the stationary distribution.

Markov pure jump processes, Poisson process, Birth and Death process. Application to Queuing, Inventory, Machine-Repairmen problems. Elements of time series analysis.

Reference Books:

1. Medhi, J. : "Stochastic Processes", Wiley Eastern, New Delhi.
2. Feller, W. : "An Introduction to Probability Theory and its Applications, Vol. I (Third Edition)", Wiley Eastern, New Delhi.
3. Karlin, & Taylor : "A First course in Stochastic Processes (2nd Edi.), Academic Press, London.
4. Hoel, Port, & Stone, C. Jr. : "Introduction to Stochastic Processes", Universal Press, New Delhi.
5. Ross, S. : "Introduction to Probability Model", Academic Press, London.

CS-201 DATA AND FILE STRUCTURES (PASCAL, C)

(L : 4, P : 4)

Fundamental Notations : Primitive and composite data types, Times and space complexity of Algorithms.

Data structures : Concepts of fields, records and files, Sequential file organisation, variable length records and text files, Indexing structures like B-trees, ISAM, Hashing techniques for direct files, Inverted lists, Multilists.

Sorting : Internal and External sorts, Searching techniques, Merging algorithms.

Reference Books.

1. Wirth, Nicolaus : Algorithms + Data structures = Programs, Prentice Hall International, 1976.
2. Horwits, E. and Sahani, S. : Fundamentals of Data Structures, Computer Science Press, 1978.
3. Knuth, D. : The art of Computer Programming, Vols 1-2, Addison-Wesley, 1970-80.
4. Aho, A. V., Hopcroft, and Ullman, J. E. : Data structures and Algorithms, Addison Wesley, 1982.
5. Tanenbaum, A.M., and augenstein, M.J. : data Structures with Pascal, Prentice Hall International, 1985.
6. Trembley and Serenson : Data structures using Pascal, McGraw Hill ,1985.
7. Stubas, D. : Data Structures with Abstract Data Types and Modula 2, Brooks & Cole Publ. Comp., 1987.

CS-202 COMPUTER ARCHITECTURE.

CL : 4, P : 0

Introduction of Parallel Processing : Parallel processing mechanism; Parallelism in uniprocessor system.

Parallel Computer Structures : Architecture classification scheme.

Pipelining and Vector Processing : Instruction and arithmetic Pipelines; vector processing requirements; Pipeline computers and Vectorization methods; Various vector processors - STAR 100, CRAY- ,CYBER-205, Fujitsu 200 and their special features.

SIMD Array Processors : Parallel algorithms for array processors; SIMD computers and performance enhancement.

Multiprocessor Architecture and Programming : Functional structures, Interconnection networks, Parallel memory organizations; Multiprocessor Scheduling strategies, Parallel Algorithms for Multiprocessor - synchronous and asynchronous.

Data Flow computers : Data-driven computing and Languages; Advantages and Potential difficulties, etc.

Reference Books:

1. Hawang, K., Briggs, f.A. :computer Architecture and Parallel Processing, McGraw Hill, 1985.
2. Koggi, H. : The Architecture of Pipelined Computers McGraw Hill, 1981.
3. Beer, J.L. :Computer system Architecture, computer Sci. Press,1980.

4. Evans, D.J.: Parallel Processing system, Cambridge Univ., 1982.
5. Hockney, R.W., Jesshope, C.R.: Parallel Computers : Architecture, Programming and algorithm, Adam hilger, 1981.
6. Willis, N. & Kerridge, J. : Introduction to computer Architecture, A.h. wheeler 7 comp, 1983.
7. Stone, H.S. & others Introduction to Computer Architecture 2nd Edn., Galgotia Publ. Ltd. 1987.
8. Lorin, H. : Parallelism in Hardware and Software, Prentice-Hall, 1982.
9. Myers, G.J. : Advances in Computer Architecture, 2nd Edn. Wiley Inter Science, 1978.
10. Lorin, Harold, : Aspects of Distributed Computer systems, Wiley-Inter science, 1980.

CS-203 THEORETICAL COMPUTER SCIENCE.

(L : 4, P : 0)

Formal Models of Computation: Finite automata, Pushdown Automata, Turing machines, Partial recursive functions, recursive and recursively enumerable set.

Analysis of formal computational models: Turing machines complexity measures, Introduction to NP Hard and NP completeness.

Program verification: Introduction to predicate calculus and axiomatic systems, Manna and Hoare program verification systems. Formal languages: Chomsky hierarchy, Language acceptors.

Reference Books:

1. Zohar Manna, Mathematical theory of Computation. (McGraw Hill) , 1974.
2. W.S. Brainerd and L.H. Landweber Theory of Computation. John Wiley , 1974.
3. J.M.Brady, The Theory of Computer Science: A programming approach (Chapman and Hall), 1977.
4. J.E. Hopcraft and J.D. Ullman, Formal Languages and Their relation to Automata, Addison-Wesley, 1969.
5. A.V. Aho, J. E. Hopcraft and J.D. Ullman, Design and Analysis of Algorithms, (Addison-Wesley), 1974.

CS-204 COMPUTER BASED OPTIMIZATION TECHNIQUES.

(L : 4, P : 4)

1. Linear Programming- Mathematical model, assumptions of linear programming, graphical solution of LPP, principles of simplex method, Revised simplex method, Applications, Duality, dual simplex method, sensitivity analysis. Special cases like unbounded solution, degeneracy etc.,
2. Special types of Linear Programming problems- transportation and Assignment problems.
3. Integer Programming- Introduction, Branch and bound Techniques, Binary Linear programming, Assignment & Travelling salesman problems.
4. Dynamic Programming- Deterministic & Probabilistic Dynamic programming.

5. Decision Theory & Games - Decisions under risk, decision trees, decision under uncertainty, game theory.

Reference Books:

1. Hillier, F.S. & Liberman G.J. : Introduction to Operations Research, 2nd Edn., Holden Day Inc. London, 1974.
2. Tara, H.A. : Operations research, 3rd Edn., McMillan Publishing Company, 1982.
3. Beightler, C.S. & Phillips, D.P. : Foundations of Optimisation, 2nd Edn., Prentice - Hall, 1978.
4. McMillan Claude Jr. : Mathematical Programming, 2nd Edn., Wiley Series, 1979.
5. Srinath, L.S. : Linear Programming, East-West, New Delhi.
6. Churchman, C.W. & Arnchoff, E.L. : Introduction to Operation Research, John Wiley and sons.
7. Gillett, B.G. : Introduction to Operation Research- A Computer oriented Algorithms approach. McGraw-hill Book Comp, 1976.
8. Hiller, F.S. & Liberman, G.T. : Introduction to Operation Research Holden Day Inc. 1967.

CS-205 BUSINESS DATA PROCESSING

(CL : 4, P : 4)

1. Introduction to Data Processing: records and files; data collection, preparation, verification, editing and checking.
2. Business Files: Master and Transaction file, file generations, back-ups and file recovery procedures.
3. COBOL Programming : Language construction and structured program development.
4. File sorting, searching, merging, matching.

Reference Books:

1. Roy, H.K. and Dastidar Ghosh, D. : COBOL programming Tata-McGraw Hill Publ. Comp. Ltd., 1982.
2. Philippakis and Kazmier Information system Through COBOL, 2nd Edn., McGraw Hill Int. Editions.
3. Popkin, G.S. : Advanced Structured COBOL, 2nd Edn., Kent Publ. Comp, 1987.
4. Pierson & Horn : Structure COBOL Programming, Scott Foresman and Co., 1986.
5. Rajaraman, v. & Sahasrabudde, H.v. : Computer Programming in COBOL, Prentice Hall India.
6. Grover, P.S. : Programming with Structured COBOL, Mcamillan, 1983.

CS-206 SYSTEM SOFTWARE

(CL : 4, P : 4)

1. Review of machine architecture, instruction set, addressing modes of the chosen machine.
2. Distinction between system software and application software Layered organisation of system software.

3. Review of machine and assembly language programming, C-language programming, data structures in C, Control Structures of C, Programming exercises.
4. Assemblers, cross assemblers, Macro processors, linking/loading, relocating, compilation and interpretation (lexical and syntax analysis), Use of automation tools.
5. Editors, debuggers, interactive programming environments.
6. Programming examples for text handling, File management interface and device driver programming, multiple precision arithmetic and logic operations, floating point operations, interrupt handling.
7. Brief discussion on a few O.S. routines and their implementation : such- as single tasking and multi tasking I/O managements, memory managements file management.
8. Typical current operating systems such MS-DOS, UNIX their use.

Reference Books:

1. Donovan, J.J. : Systems Programming, McGraw Hill, 1972.
2. Dhamdhare, D. M. : Introduction to system software, Tata McGraw Hill, Publ. Comp., 1986.
3. Jones, Robin and Stewart : The art of C Programming, Narosa Publ. House, New Delhi.
4. Cooper, Mullish : The Spirit of C, An Introduction to Modern programming, Jaico Publ. House, New Delhi, 1987.
5. Kenneth, A. : C Problem Solving and Programming, Prentice-Hall International India.
6. Kernighan, B.W. & Ritchie, D.M. : The C programming Language, Prentice-Hall India.
7. Schildt, H. : C made Easy, McGraw Hill Book Comp, 1987.
8. Raicker, s. : Programming with C (McMillan India, 1989).

**CS-301 STOCHASTIC MODELS
(L : 4, P : 0)**

1. Elements of Renewal Theory and its applications.
2. Theory of Queues :
 - Queueing systems M/M/1, M/M/∞, M/G/1 and GI/M/1.
 - Finite time solution for the system M/M/1, use of combinatorial methods in obtaining P(t) for M/M/1.
 - Regenerating points and embedded Markov Chains for the systems M/G/1 and GI/M/1.
 - Stationary solution for M/M/1, M/M/s, and M/M/a ladder indices.
3. Inventory Models :
 - Single item static model with price breaks, multiple item model with storage limitation: single item n-period dynamic model, newsboy problem, (s,S) policy, application of renewal theory to the (s,S) inventory model, daman's dam, Rosenblatt's grain storage model.

Reference Books:

1. Prabhu, N.O. : Queues and Inventories, Wiley.
2. Prabhu, N.O. : Stochastic storage Processes, Springer Verlag.
3. Taha, H.A. : Operations Research- An Introduction, Hemilian Publ. Comp.
4. Tijms, H.C. : Stochastic Modelling and Analysis.
5. Madni, J. : Stochastic Processes, Wiley Eastern, New Delhi.

CS-302 DATABASE MANAGEMENT SYSTEMS.

(L : 4, P : 4)

Data independence, data models; network model, DBTG proposal data definition and manipulation languages; hierarchical and relational models; storage organisation for relations, relational algebra and calculus; relational query languages, query processor and optimizer; functional dependencies; normal forms, multivalued dependancies; decomposition, integrity, protection, security, concurrency, recovery; distributed data bases; available data base system.

Reference Books:

1. Date, C.J. : An Introduction to database Systems volumes I & II. Addison-Wesley, 1981, 1983, 1983.
2. Ullman, Jeffrey D. : Principles of Database Systems, 2nd Edn. Galgotia Publ Pvt. Ltd., 1982.
3. Simpson, A. : Understanding dBASE-III, B.P.B., Publications, Delhi., Delhi.
4. Whittington, R.F. : Data Base system Engineering, Clavendon Press, Clavendon Press.
5. Pratt, P. : Data Base Systems Management and Design, Bod and Fraser Publ. comp, 1987, 1987.
6. Kroenke, D.H. : Database, Processing : Fundamentals, Design, Implementation, 2nd Edn. Galgotia Publ., Pvt., Ltd.
7. Wiederhold : Database Design, McGraw-hill Book Company.

CS-303 OPERATING SYSTEMS.

(L : 4, P : 4)

Review of Batch, Operating System Concepts: User job, resources, termination file process systems.

Memory Management: Address protection, segmentation, virtual memory, paging, page replacement algorithms, cache memory, hierarchy of memory types, associative memory.

Support for concurrent process: Mutual exclusion, shared data, critical sections, busy form of waiting, lock and unlock, primitives, synchronization, block and wakeup.

Scheduling: Process states, virtual processors, interrupt mechanism, scheduling algorithms, implementation of concurrency primitive.

System Deadlock: Prevention, detection and avoidance.

Multiprogramming system : Queue management, I/O supervisors, memory management. File system, disk scheduling.

Reference Books:

1. Bach, M.: Design of the UNIX operating systems.
2. Peterson, James. L. and Silberschatz, A. : Operating system concepts. Addison-wesley. Publ. comp. 1985.
3. Deitel, H.M.: An Introduction to Operating system, Addison-wesley Publ. comp., 1984.
4. Milenkovic, M.: Operating system- concepts and Design, McGraw-Hill International Editions, 1987.
5. Wang, P. : An Introduction of Berkley Unix. Wadsworth Publ., comp. 1988.
6. Silverster, P.P.: The Unix System Guidebook, Narosa Publ. House, New Delhi.ew Delhi.
7. Hansen Per Erineh : Operating System Principles, Prentice-Hall India, 1978.
8. Madnic and Donavan : Operating systems. McGraw-Hill book company.
9. Hogan, t. : CP/M User Guide, McGraw-Hill Book Comp. 1986.

CS-304 DESIGN AND ANALYSIS OF ALGORITHMS.

CL : 4, P : 0)

Review of Basic Data Structures such as Stacks, Queues, Linked Lists, Trees and Graphs.

Concepts in algorithm analysis, asymptotic Complexity, Domain independent algorithms Design Techniques such as Divide and Conquer, Greedy method, Dynamic Programming, Backtracking, Branch and Bound techniques.

Examples Algorithms for above Techniques from sets, Graphs, Text Processing, Internal and External sorting, height balanced trees, B-Trees, Hashing Algorithms, Dynamic storage Allocation, Garbage collection, Lower Bound theory and NP-Hard Problems.

Reference books:

1. Aho, A.V., Hopcraft, J.E., Ullamn, J.D.: The Design and analysis of Computer Algorithms. Addison-Wesley Publishing Co., 1974.
2. Horowitz, E., Sahni, S.: Fundamentals of Computer algorithms, Galgotia publication, 1984.
3. Berlionx, P., Bizard, P.: Algorithms- The construction, Proof and analysis of Programs, John Wiley and sons, 1986.
4. Bentley, J.L.: Writing efficient programs, Prentice-hall India, Eastern Economy Edition, onomy Edition.
5. Goodman, S.E. & Hedetniemi. : Introduction to the design and analysis of Algorithms. McGraw-Hill Book Comp. 1977.
6. Knuth, D.E.: Fundamental of Algorithms: the Art of computer programming. Vol.1, Narosa Publ. House, 1985

CS-305 COMPUTER NETWORKS.

(L : 4, P : 0)

Distributed Processing Potential; Forms of distributed Processing strategies, Hexagon Diagrams.

Communication: Concepts of Data transmission, signal Encoding, Modulation methods, synchronization, multiplexing and concentration, coding method, Cryptography.

Networks: Communication system architecture-OSI reference Model, Topology types, Selections, design, Local area Networks(LAN), CSMA/CD, Token Bus, token ring Techniques, Link Travel control (LLC) Protocols, Medium Access Control (MAC) protocols, Wide Area Networks (WAN), Physical Layer Description (X.21), Data Link Layer Protocols, HDLC/ analysis of Protocols and Performance, concepting in Network Layer, Switching Techniques, routing methods.

Reference Books:

1. Tannanbaum, A.S.: Computer Networks, Prentice-Hall, 1985.
2. Martin, J.: Design and Strategy for Distributed Data Processing, Prentice-Hall, 1983.
3. Martin, J.: Computer Networks and Distributed Processing, Prentice-Hall, 1985.
4. Stallings, William : Local Networks; An Introduction Macmillan Publishing Co. Publishing Co.
5. Black, : Computer Networks; Protocols, Standards and Interfaces, Prentice-Hall International (Paperback Edition).
6. Black, : Data Networks : Concepts, Theory and Practice, Prentice-Hall International, 1988.
7. Comer, : Internetworking with TCP/IP: Principles, protocols and Architecture, Prentice-Hall International (Paperback Edition).
8. Crichlow, : Introduction to distributed and Parallel Computing : Prentice-Hall International (Paperback Edition).
9. Ahuja: Design and analysis of Computer Communication Networks, McGraw-Hill Book Comp.
10. Chorofas : Designing and Implementing Local Area Networks, McGraw-Hill Books, Comp.omp.

CS-306 PROGRAMMING LANGUAGES.

Comparison of different programming languages like ALGOL, ADA, PASCAL etc.

CS-401 COMPUTER GRAPHICS

(L : 4, P : 4)

Display Devices: Line and Point Plotting system; Raster, vector, pixel and point plotters, continual refresh and storage display, Digital frame buffer, Plasma pannel display, Very High resolution devices, High Speed Drawing, Display Processors, Character generators, Colour- Display Techniques (Shadowmask and penetration CRT, Colour Look-up tables, analog false colours, Hard copy colour printers)

Display Description: Screen coordinates, User coordinates, Graphical Data Structures (Compressed Incremental List, Vector List, Use of Homogeneous coordinates); Display code Generation; Graphical function; The View Algorithm, Two dimensional Transformation.

Interactive Graphics: Plotting and Positioning Devices(Cursor, Light Pen, Digitising Tablets, The mouse, Track Balls), Interactive Graphical Techniques; Positioning , Elastic Lines, Inking, Zooming, Panning, Clipping, windowing, Scissoring.

Graphic Languages: Primitives (constants, actions, operators, variables), Plotting, and Geometric Transformations, Display Subroutines.

3-D Graphics: Wire Frame perspective display, Perspective depth, Projective Transformations, Hidden lines and Surface elimination, Transparent solids, Shading, GKS is to be used as the standard teaching tool.

Reference Books:

1. Giloi, W.K.: Interactive Computer Graphics; Prentice-Hall, 1978.1, 1978.
2. Newman, W., Sproul, R.F.: Principles of Interactive Computer Graphics, McGraw-Hill, 1980.
3. Rogers, D.F.: Procedural Elements of Computer Graphics, McGraw-Hill, 1985.
4. Harrington, S. : Computer Graphics : A Programming Approach, Tata McGraw-Hill, 1983.1, 1983.
5. Foley, J.D., Van, Dam A. : Fundamentals of Interactive Computer Graphics, Addison-Wesley, 1982.
6. Hearn D., Baker F.M. : Computer Graphics, Prentice-Hall, 1986.
7. Tosijasu, L.K. : Computer Graphics, Springer-Verlag, 1983.

CS-402 PARALLEL COMPUTING

(L : 4, P : 0)

Introduction and classification of Parallel architectures. Pipeline and overlap processing. Array Processors. Interconnection structures, performance analysis and multiprocessing language.

Transputer and BISC architectures.

Data flow computing architecture. Demand Driven Architectures, Systolic Architectures, Languages and Software support for parallel processing .

Overview of Parallel algorithms:

Models of Parallel computation. Techniques for exploiting parallelism in algorithms. Paradigms for organising parallel computation. Paradigms for improving efficiency of parallel algorithms.

Parallel Algorithms for Problems like sorting, Matrix multiplication and matrix inversion

Reference Books:

1. Kai Huang and Fayae Briggs, Parallel Architectures and Parallel Processing, McGraw Hill, 1984.
2. V. Rajaraman, Elements of Parallel computing, PHI.

**CS-403 ARTIFICIAL INTELLIGENCE
(L : 4, P : 0)**

Introduction to Artificial Intelligence : Simulation of so called Intelligence Behaviour, in different areas; Problem solving : games , Natural Language, Question answering, Visual Perception , Learning ; Aim- Oriented (Heuristic) Algorithms Versus Solution guaranteed algorithms.

Understanding Natural Languages : Parsing Techniques, Context free and Transformational grammars, Transition nets, Augmented transition nets, fillmore's grammars, Shank's conceptual dependency, grammar free analysers, sentence generation , translation.

Knowledge Representation : First order Predicate Calculus, Horn's clauses; The Language PROLOG; Semantics nets, Partitioned nets; Minsky's frames, case-grammar theory; production rules, knowledge base, the inference system, forward and backward deduction.

Expert System : Existing systems (DENDRAL , MYCIN); domain exploration; meta knowledge, expertised transfer, self explaining system.

Pattern Recognition structured Description: Symbolic Description, Machine Perception, Line finding, Interpretation, Semantic and models, objective identification , speech recognition.

The language LISP and / or PROLOG is to be covered in this course.

Reference Books:

1. Charniak , e. : Introduction of Artificial Intelligence, Narosa Publishing house.
2. Winston, P.H. : LISP, Narosa Publishing house.
3. Milner . : Common LISP : A tutorial, Prentice-Hall Inc. 1988.
4. Mercecius, : Expert system programming in TURBO PROLOG, Prentice- Hall Inc. 1989.
5. Elaine R. : Artificial Intelligence, 1983.
6. Hunt, E.B. : Artificial Intelligence, Academic Press, 1975.
7. Lloyd , J. : Foundation of Logic Programming. Springer Verlag. 1982.
8. Clark, R.L. & McCabe, F.G. : Micro PROLOG, Prentice Hall India, 1987.
9. Clocksin, W.F. and Mellish , G.S. : Programming in PROLOG, Narosa Publishing House.

CS-404 SOFTWARE ENGINEERING.
(L : 4, P : 0)

Introduction to Software Engineering : Software development and life cycle; Project size and its categories; Planning a software project; Project-control and Project-team standards. Design of solution strategies; software cost estimation and evaluation techniques.

Software Design : Various design concept and notations; modern design techniques. Verification and validation methods. Documentation and implementation procedures; Performance of software systems. Software matrices and models. Documentation of project-systems, manuals and implementation.

Software Reliability: refinement and concept of Software reliability; software errors, faults, repair and availability; reavailability and availability models; Use of data base as a study tool.

Modern Programming Language features relevant to Software Engineering: A brief introduction of ADA (Modula II) Language and explanation and concept such as data abstraction, exception handling, concurrency mechanism, etc; Software development environments, ADA language facilities for handling large software projects.

Reference Books:

1. Fairley, R.E. Software Engineering Concepts, McGraw-Hill, 1985.
2. Lewis, T.G.: Software Engineering, McGraw-Hill, 1982
3. Kernighan, B., Flauger, F.: Software tools, Addison-Wesley, 1976.
4. Meyers, G.: The art of software testing, Wiley-Inter Science, 1979.
5. Shoeman, M.: Software Engineering, McGraw-Hill, 1983.
6. Ghehani, N.: Introduction of ADA, McGraw-Hill, 1983.
7. Chatree, : Software Engineering concepts.
8. Hibbard, Constructing quality softwares.
9. Shere, : Software Engineering and Management, Prentice-Hall, 1985.
10. Deutsch, Willis: Software quality Engineering. A total technical and Management approach, Prentice-Hall, 1988.
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