Section-I

**Mathematical Logic:** Propositional Logic; First Order Logic.

**Probability:** Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.

**Set Theory & Algebra:** Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.

**Combinatorics:** Permutations; Combinations; Counting; Summation; generating functions; recurrence relations; asymptotics.

Section-II

**Graph Theory:** Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

**Linear Algebra:** Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

**Numerical Methods:** LU decomposition for systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules.

**Calculus:** Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.

Section-III

**Digital Logic:** Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point).

**Computer Organization and Architecture:** Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O
interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Section IV

**Programming and Data Structures:** Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

**Algorithms:** Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes - P, NP, NP-hard, NP-complete.

Section V

**Theory of Computation:** Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.

**Compiler Design:** Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

Section VI

**Operating System:** Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

Section VII

**Databases:** ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Section VIII

**Information Systems and Software Engineering:** information gathering, requirement and feasibility analysis, data flow diagrams, process
specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

**Section IX**

**Computer Networks:** ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security - basic concepts of public key and private key cryptography, digital signature, firewalls.

**Section-X**

Definitions, AI approach for solving problems.
State space representation of problems, bounding functions, breadth first, depth first, A, A*, AO*, etc. Performance comparison of various search techniques. Frames, scripts, semantic nets, production systems, procedural representations, Prolog programming. Components of an expert system, Knowledge representation and Acquisition techniques, Building expert system and Shell. RTNs, ATNs, Parsing of Ambiguous CFGs, Tree Adjoining Grammars (TAGs). Systems approach to planning, Designing, Development, Implementation and Evaluation of MIS.
Decision-making processes, evaluation of DSS, Group decision support system and case studies, Adaptive design approach to DSS development, Cognitive style in DSS, Integrating expert and Decision support systems.

**Section-XI**

Hardwired and Microprogrammed processor design, Instruction formats, Addressing modes, Timer, Interfacing peripheral devices, Interrupts. Microprocessor architecture, Instruction set and Programming (8086 Microprocessor), (8051 Microcontroller), Microprocessor & microcontroller applications

**Section-XII**

Models for Information Channel: Discrete Memoryless Channel, Binary Symmetric Channel (BSC), Burst Channel, Bit-error rates. Probability, Entropy and Shannon’s measure of information, Mutual information, Channel capacity theorem, Rate and optimality of Information transmission. Variable Length Codes: Prefix Codes, Huffman Codes, Lempel-Ziev (LZ) Codes, Optimality of these codes, Information content of these codes. Error Correcting and Detecting Codes: Finite fields, Hamming distance, Bounds of codes, Linear (Parity Check) codes, Parity check matrix, Generator matrix. Decoding of linear codes, Hamming codes.
Section-XIII


Section-XIV
Linear Programming: Problem (LPP) in the standard form, LPP in canonical form, Conversion of LPP in standard form to LPP in Canonical form, Simplex-Prevention of cyclic computations in Simplex and Tableau, Big Method, dual simplex and revised simplex. Complexity of simplex algorithm(s) Exponential behaviour of simplex. Ellipsoid method and karmakar’s method for solving LPPs, Solving simple LPPs through these methods. Comparison of complexity of these methods. Assignment and Transportation Problems: Simple algorithms like Hungarian method, etc.


Section-XV
Data Warehousing and Mining:
Data Warehouse environment, architecture of a data warehouse methodology, analysis, design, construction and administration. Data Mining: Extracting models and patterns from large databases, data mining techniques, classification, regression, clustering, summarization, dependency modelling, link analysis, sequencing analysis, mining scientific and business data.


Section-XVI
Parallel Computing
Parallel virtual machine (pvm) and message passing interface (mpi) libraries and calls. Advanced architectures. Today’s fastest computers.

Mobile Computing
Mobile connectivity-Cells, Framework, wireless delivery technology and switching methods, mobile information access devices, mobile data internetworking standards, cellular data communication protocols, mobile computing applications, Mobile databases-protocols, scope, tools and technology, M-business.