SYLLABUS : COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

Section1: Engineering Mathematics

Discrete Mathematics: Propositional and first order logic, Sets, relations, functions, partial orders and lattices, Monoids, Groups, Graphs: connectivity, matching, coloring, Combinatorics: counting, recurrence relations, generating functions,

Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition,

Calculus: Limits, continuity and differentiability, Maxima and minima, Mean value theorem, Integration,

Probability and Statistics: Random variables, Uniform, normal, exponential, poisson and binomial distributions, Mean, median, mode and standard deviation, Conditional probability and Bayes theorem,

Section 2: Digital Logic

Boolean algebra, Combinational and sequential circuits, Minimization, Number representations and computer arithmetic (fixed and floating point),

Section 3: Computer Organization and Architecture

Machine instructions and addressing modes, ALU, data-path and control unit, Instruction pipelining, pipeline hazards, Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode),

Section 4: Programming and Data Structures

Programming in C, Recursion, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs,

Section 5: Algorithms

Searching, sorting, hashing, Asymptotic worst case time and space complexity, Algorithm design techniques: greedy, dynamic programming and divide-and-conquer, Graph traversals, minimum spanning trees, shortest paths

Section 6: Theory of Computation

Regular expressions and finite automata, Context-free grammars and push-down automata, Regular and contex-free languages, pumping lemma, Turing machines and undecidability,

Section 7: Compiler Design

Lexical analysis, parsing, syntax-directed translation, Runtime

environments, Intermediate code generation, Local optimisation, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination,

Section 8: Operating System

System calls, processes, threads, inter-process communication, concurrency and synchronization,

Deadlock, CPU and I/O scheduling, Memory management and virtual memory, File systems,

Section 9: Databases

ER-model, Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, normal forms, File organization, indexing (e,g,, B and B+ trees), Transactions and concurrency control,

Section 10: Computer Networks

Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email,