Syllabus for Computer Science / Computer Engineering / Computer Science and Engineering / Information Technology and Electronics and Communication / Electronics and Telecommunication)

1. Engineering Mathematics (Common across all streams)

Mathematical Logic: Propositional Logic, First Order Logic

Probability & statistics: Sampling Theorems, Conditional Probability, Mean, Median, Mode and Standard Deviation, Random Variables, Distributions, uniforms, normal, exponential, Poisson, Binomial, Correlation and Regression Analysis

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

Combinatorics: Permutations, Combinations, Counting, Summation, generating functions

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: Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and Minima, Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Strokes, Gauss and Green's theorems

2.1. Computer Science / Information Technology (CS/IT) Stream

(Computer Science / Computer Engineering / Computer Science and Engineering / Information Technology)

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

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

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.

Computer Programming: Programming in C, Statements, Functions, Recursion, Parameter passing, Scope, Binding, Arrays, Strings, Pointers, Structures, Unions, Enumerations, and Typedef, File I/O, Preprocessor and Comments, Object Oriented Programming Concepts - Object, Class, Inheritance, Polymorphism, Abstraction and Encapsulation, Object Oriented concepts and features of Java, Java Packages, Object oriented programming in Java.

Data Structures: Linear Data Structures, Non-Linear Data Structures, Arrays, Stacks, Queues, Linked Lists, Trees, Graphs, Binary search trees, Binary heaps, Hash Tables

Design and Analysis of Algorithms: Fundamental characteristics of an algorithm, Basic algorithm, Algorithmic Strategies and problem solving, Simple recursive, Backtracking, Brute Force, Greedy approach, Dynamic programming, Divide-and-conquer, Branch and bound, Tree and graph traversals, Connected competent, Spanning trees, Shortest paths; Hashing, Sorting, Searching**,** Notions of space and time complexity, Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concept of complexity classes –P, NP, NP-hard, NP-complete, Graph and Tree Algorithms, Depth and Breadth first traversal

Compiler Design: Lexical analysis, Parsing, Syntax directed translation, Basics of code optimization.

Operating System: Operating System Principles, Processes, Threads, Inter-Process communication, Scheduling and Dispatch, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security, Virtual Machines

Computer Networks: ISO/OSI stack, LAN technologies, topologies, Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), IP(v6), Application layer protocols, (ICMP, DNS, SMTP, POP, FTP, HTTP), Basic concepts of hubs, switches, gateways, and routers. Wireless technologies

Information Management Systems / Database Management Systems (DBMS): 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.

Information Systems and Software Engineering: Software Process models (Waterfall, Incremental, Evolutionary, Agile), Requirements Engineering, Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, Software Design, Software Construction, Testing, Verification, Validation, Maintenance, Quality Assurance, Technical Metrics for Software, Software Cost Estimation, Software Project Management

Internet Web Programming: Introduction to Web, HTML, Server side scripting Languages-JSP, Introduction to e-Commerce and e-Governance

Network and Cyber Security: Basics principles of Cyber Security – Confidentiality, Integrity, Availability and Non-repudiation, Basics of Vulnerability and Risk, Security Threats -Viruses, Worms, Trojan Horse, Logic Bombs, Backdoors, Spoofing, Denial of Services Attack and Distributed Denial of Services Attacks, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Cryptography - basic concepts of public key and private key cryptography, digital signature, Public Key Infrastructure. Security Technology-Firewall, VPN and IPSec, Intrusion Detection, Access Control.

2.2. Electronics and Communication (EC) Stream

(Electronics and Communication / Electronics and Telecommunication)

Basic of Electronics and Electronics Measurements: Basics of semiconductors; Diode/Transistor basics and characteristics; Diodes for different uses; Junction & Field Effect Transistors (BJTs, JFETs, MOSFETs); Transistor amplifiers of different types, oscillators and other circuits; Basics of Integrated Circuits (ICs); Bipolar, MOS and CMOS ICs; Basics of linear ICs, operational amplifiers and their applications-linear/non-linear; Optical sources/detectors; Basics of Opto electronics and its applications, Principles of measurement, accuracy, precision and standards; Analog and Digital systems for measurement, measuring instruments for different applications;

Analog and Digital Circuits: Small signal equivalent circuits of diodes, BJTS and FETs; Diode circuits for different uses; Biasing & stability of BJT & JFET amplifier circuits; Analysis/design of amplifier- single/multi-stage; Feedback& uses; Active filters, timers, multipliers, wave shaping, A/D-D/A converters; Boolean Algebra & uses; minimization of Boolean functions, Logic gates, Digital IC families (DTL, TTL, ECL, MOS, CMOS)., Combinatorial/sequential circuits; Basics of multiplexers, latches and flipflops, counters, registers, memories, microprocessors, design& applications

Analog and Digital Communication Systems: Random signals, noise, probability theory, Fundamentals of information theory and channel capacity theorem; Analog versus digital communication & applications: Amplitude Modulation (AM), Frequency Modulation (FM), Angle Modulation, transmitters/receivers, SNR comparison; Digital communication basics: Sampling, quantizing, coding, Pulse code modulation (PCM), Differential pulse code modulation (DPCM); Digital modulation: ASK, FSK, PSK; Fundamentals of error correction, Hamming codes, Basics of TDMA, FDMA, CDMA and GSM; Wireless Communication, Optical communication: fibre optics, theory, practice/standards.

Control Systems: Basic control system components; block diagrammatic description, reduction of block diagrams. Feedback systems-open &close loop types stability analysis of these systems, Signal flow graphs and their use in determining transfer functions of systems, Design of control systems, compensators, elements of lead/lag compensation, PID and industrial controllers

Network Theory: Network graphs & matrices; Solutions methods: nodal and mesh analysis. Network theorems: superposition, Thevenin's and Norton's maximum power transfer, Star-Delta transformation. State equations for networks; Steady state sinusoidal analysis.

Microprocessors & Micro controllers: Introduction to microprocessors and microcomputers: Function, architecture, programming of 8086 microprocessor, interfacing of RAM and EPROM, I/O addressing, I/O mapped I/O, and memory mapped I/O schemes, instruction execution, fetch/execute cycle, instruction timings and operation status. Memory organization, program memory, data memory, direct & indirect addressing area, addressing modes, instruction set – arithmetic, logical and data transfer instructions. Machine cycles – interrupts, interrupt handling, single step operation, port bit latches and buffers, port structures and operation, accessing external memory. Timers, serial interface, I/O ports, timing, Embedded Processing – Evolution, Issues and Challenges, Von Neumann, Harvard and their variants, Memory Architecture and Devices, Input, Output Devices and Mechanisms, PLA, PAL,PLDs.

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.

Network and Cyber Security: Basics principles of Cyber Security – Confidentiality, Integrity, Availability and Non-repudiation, Basics of Vulnerability and Risk, Security Threats -Viruses, Worms, Trojan Horse, Logic Bombs, Backdoors, Spoofing, Denial of Services Attack and Distributed Denial of Services Attacks, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Cryptography - basic concepts of public key and private key cryptography, digital signature, Public Key Infrastructure. Security Technology-Firewall, VPN and IPSec, Intrusion Detection, Access Control.

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