

Tamil Nadu Public Service Commission
Syllabus
Computer Science, Information Technology, Electrical, Electronics and Communication
and Mechanical Engineering
(Degree Standard)

Code: 566

Unit I: Programming In C, Python and Object Oriented Programming (20 Questions)

C Programming:

Data Types – Expressions – Input / Output Operations – Decision Making and Branching Statements – Looping Statements – Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String – string operations – String Arrays. Simple programs – sorting – searching – matrix operations – Function – Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic - Pointers and arrays – structure data type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives - File Handling.

Python Programming:

Python Interpreter and Interactive Mode-Data types-Statements- Expressions-Boolean Values and Operators-Strings-Arrays of Numbers- Lists-Tuples-Dictionaries-Functions-File Reading and Writing

Object Oriented Programming:

C++ Programming features – Data Abstraction – Encapsulation – Class – Object – constructors – static members – constant members – member functions – pointers – references – Role of this pointer – Storage classes – function as arguments – String Handling – Copy Constructor – Polymorphism – compile time and run time polymorphisms – Function overloading – operators overloading – dynamic memory allocation – Nested classes – Inheritance – virtual functions. Abstract class – Exception handling – File handling concepts.

Unit II: Data Structures and Algorithms (20 Questions)

List ADT – array based implementation – linked list implementation – singly linked lists – circularly linked lists – doubly-linked lists – applications of lists – Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal) – Stack ADT – Evaluating arithmetic expressions – other applications – Queue ADT – circular queue implementation – Double ended Queues – Priority Queues - application of queues – Trees: Binary Tree - Binary Search Tree-Tree Traversals – Sorting algorithms: Insertion sort – Selection sort – Shell sort – Bubble sort – Quick sort – Merge sort – Radix sort – Heap Sort - Searching: Linear search – Binary Search - Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing – Graph Algorithms: Minimum Spanning Tree – Shortest Path Algorithms - Graph Traversals -Directed Acyclic Graph- Topological Ordering-All Pair Shortest Path Algorithms- Floyd Warshall algorithm- Bellman Ford Algorithm-Network Flow Algorithms- Ford Fulkerson Algorithm- Algorithm Analysis: Asymptotic Analysis-Solving Recurrence Equations-Algorithm Design Techniques-Greedy Algorithms- Dynamic Programming-Divide and Conquer.

Unit III: Database Management Systems (10 Questions)

INTRODUCTION TO DBMS – File Systems Organization – Purpose of Database System – Database System Terminologies – Database Characteristics – Data models – Types of data models – Components of DBMS. LOGICAL DATABASE DESIGN: Relational DBMS – Codd's Rule – Entity – Relationship model – Extended ER Normalization – Functional Dependencies, Anomaly – 1 NF to 5 NF - SQL– SQL Standards – Data types – Database Objects – DDL – DML – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices.

Unit IV: Operating Systems and Computer Networks (30 Questions)

OPERATING SYSTEMS OVERVIEW – Computer System Overview – Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview – objectives and functions, Evolution of Operating System – Computer System Organization – Operating System Structure and Operations – System Calls, System Programs, OS Generation and System Boot – PROCESS MANAGEMENT – Processes – Process Concepts, Process Scheduling, Operations on Processes, Interprocess Communication; Threads – Overview, Multicore Programming, Multithreading Models; CPU Scheduling and Deadlocks – STORAGE MANAGEMENT – Main Memory – Contiguous Memory – Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory – Demand Paging, Page Replacement, Allocation, Thrashing; I/O SYSTEMS – Mass Storage Structure – Overview, Disk Scheduling and Management; File System Storage – File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation – File System Structure, Directory Structure, Allocation Methods, Free space Management; I/O Systems.

NETWORKING FUNDAMENTALS –Building a network- requirements – Layering and protocols – Internet Architecture - Performance; Link layer Services – Framing – Error Detection – Flow control – Media access control- Ethernet (802.3) – wireless LANs -802.11 – Bluetooth – switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)- ROUTING – Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), TRANSPORT LAYER – Overview of Transport layer – UDP- Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control, APPLICATION LAYER - Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services - DNS –SNMP.

Cloud Technologies: Cloud Characteristics-Cloud Service and Deployment Models-Virtualization-Virtual Machines-Server, Network and Storage Virtualization-Hypervisor.

Unit V: Signal Processing and communication systems (20 Marks)

Characteristics and classifications of Continuous and Discrete Time signals – CT signal analysis – Fourier Series, Fourier Transform and Laplace Transform. Sampling theorem, Discrete Time signal analysis – DTFT and Z-Transform. CT and DT systems – Impulse response and convolution, Frequency response, Transform domain analysis using FT, LT, DTFT, DFT, FFT and ZT – IIR filters: Butterworth and Chebyshev filters, Impulse invariant and Bilinear transformation methods, FIR filter: Linear phase design, Windowing techniques: Rectangular, Barlett, Hanning and Hamming, Digital Filter realization structures, Finite word length effects in IIR and FIR filters, Scaling, Decimation and interpolation.

Random Processes: Auto correlation, Power spectral density, White noise, Filtering of random signals through LTI systems. Analog Communication: Amplitude and angle modulation / demodulation, Spectral characteristics. Noise: Thermal noise, Noise figure and Noise temperature. Digital Communication: PCM, DPCM, ADPCM, DM, ADM, LPC. Line coding schemes, Bandpass signaling: Binary and M-ary versions of ASK, PSK, FSK, BER and spectral characteristics. Principles of QAM, OQPSK, MSK, GMSK. Link budget calculations, Eye diagram, ISI, Symbol and carrier synchronization, Frame synchronization.

Information Theory and coding: Entropy, Mutual information, Channel capacity (AWGN), Source coding and Channel coding techniques.

Unit VI: Analog and Digital Electronics (20 Questions)

Operation and Characteristics of electronic devices: PN Junction Diodes, Zener Diode, BJT, JFET, IGBT and MOSFET, Biasing circuits - BJT and MOSFET amplifiers - Small signal analysis and frequency response, Differential, Darlington, Cascade, Cascode amplifiers, Feedback amplifiers, Tuned amplifiers, RC and LC oscillators, Power amplifiers. Rectifiers and wave-shaping circuits, Operational amplifier characteristics and applications, CMRR, slew rate, waveform generators, active filters, timers, PLL, VCO, ADC, DAC, Regulators and Converters.

Number representations: Binary, Integer and Floating point numbers, Boolean Algebra and Logic Gates – Combinational logic circuits, Boolean algebra, Minimization of functions using Boolean identities and Karnaugh map, Logic gates and their static CMOS implementations, Arithmetic circuits, Code converters, Multiplexers, Decoders, Functional Units of a Digital Computer - Arithmetic operations : Addition and Subtraction – Binary Multiplication – Binary Division. Sequential logic circuits: Latches and flip-flops, Counters, Shift registers, Finite state machines, Propagation delay, Setup and hold time, Critical path delay. Data converters: Sample and hold circuit, ADC and DAC. Semiconductor memories: ROM, SRAM, DRAM.

Unit VII: Electrical Circuits, Machines and Measurements (20 Questions)

Ohm's Law - Kirchhoff's Laws – Solution of DC circuits with Independent sources only (Steady state), AC Fundamentals: Waveforms, Average value, RMS Value, Impedance, Instantaneous Power, Real Power, Reactive Power and Apparent Power, Power Factor – Steady State Analysis of RL, RC and RLC Circuits- three phase circuits.

Magnetic Circuits– DC Machines: Construction, Working Principle, Types and Applications of DC Generator and Motor, EMF and Torque equation. AC Machines: Construction, Working and Applications of Transformer, Three phase Alternator, Synchronous motor, Single and Three Phase Induction Motor, stepper motor, servo motor and BLDC motor.

Solenoids, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, Hall Effect, photo sensors, Strain gauge, LVDT, piezo electric crystals, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

Moving Coil and Moving Iron Instruments, Power Measurement, Energy Meter, Instrument Transformers - CT and PT, Multimeter- DSO- Data Acquisition Systems – A/D and D/A Converters – Data Transmission Systems – smart meters.

Single and Three Phase AC to DC Converters – uncontrolled and controlled rectifiers– Switched Mode Power Supplies – buck, boost and buck-boost converter topologies –switching losses – Inverters – Single and Three Phase Inverters – Voltage control –Pulse Width Modulation techniques – harmonic elimination techniques – Uninterrupted Power Supplies- Batteries – types and characteristics.

Unit VIII: Microprocessor and Embedded Systems (20 Questions)

8085 Architecture, Instruction set, addressing modes, Assembly language programming, Interrupts, timing diagrams, memory and I/O interfacing; 8086 Architecture, Instruction set, addressing modes, minimum and maximum mode configuration, assembler directives, assembly language programming, interrupts; 8051 Architecture, Special Function Registers (SFRs) instruction set, addressing modes, assembly language programming, I/O ports, Timers/counters, interrupts and serial communication.

Embedded System design process, Embedded processors – ARM Processor – Architecture, ARM Instruction sets – Addressing Modes – Pipelining – Embedded C Programming – Looping Structures – Register Allocation – Function calls – Pointer aliasing – Structure arrangement – bit fields – unaligned data and endianness – inline functions and inline assembly – portability issues. Profiling and cycle counting – instruction scheduling – optimized primitives. Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Exception and interrupt handling – Performance issues. Meeting real time constraints – Multi-state systems and function sequences – Embedded software development tools – Emulators and debuggers.

Unit IX: Mechanic of Materials and Material Science (20 Questions)

Basics of Mechanisms, Kinematics of Mechanisms, Gyroscope, Gears and Gear Trains, Fly Wheels, Friction in Machine Elements, Stress, Strain and Deformation of Solids, Design of Shafts and Couplings, Design of Bearings, Constitution of alloys and phase diagrams, Iron Carbide Phase Diagram, steels, cast iron, phase transformations- diffusion-TTT diagram, ferrous and nonferrous alloys, heat treatment of ferrous and non-ferrous metal, surface modification techniques, powder metallurgy, non-metallic materials, mechanical properties and testing, semi conducting materials, magnetic and dielectric materials, Engineering ceramics, Engineering and commodity polymers, composites, nano-materials.

Unit X: Manufacturing Process and Industrial Engineering (20 Questions)

Foundry Technology, Metal Forming Processes –Manufacturing of Thermo Setting and Thermo Plastic Products, Machinability machine tools - center lathe, drilling, milling, grinding, gear cutting and broaching, Machining Time Calculation, unconventional machining processes, CNC machine tools, Manual Part Programming - Machining and Turning Centre, Non Destructive Testing (NDT), Production Planning and Control, Cellular Manufacturing, Flexible Manufacturing System and Automated Guided Vehicle System, Additive Manufacturing, inventory control, ABC Analysis material handling systems, operations research, Linear Programming, simplex method, Transportation model, Assignment model Critical Path Method (CPM) and Program Evaluation Review Technique (PERT), Queuing Models.