

**TAMIL NADU PUBLIC SERVICE COMMISSION**

**POST OF PRINCIPAL / ASSISTANT DIRECTOR (TRAINING)**

**INCLUDED IN THE TAMIL NADU EMPLOYMENT AND TRAINING SERVICE**

**INFORMATION TECHNOLOGY (DEGREE STANDARD)**

**UNIT- I PROGRAMMING in C**

Introduction to IT- Problem Solving –C Programming- Constants-Variables-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.

**Unit - II 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 - Standard libraries - Generic Programming - templates – class template - function template – STL – containers – iterators – function adaptors – allocators - Parameterizing the class - File handling concepts.

### **Unit – III Data Structures and Algorithms**

LINEAR DATA STRUCTURES - Abstract Data Types (ADTs) – 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 – applications of queues- Algorithms -Sorting algorithms: Insertion sort - Selection sort - Shell sort - Bubble sort - Quick sort - Merge sort - Radix sort – Searching: Linear search –Binary Search Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing – Graph Algorithms – Minimum Spanning Tree – Shortest Path Algorithms

### **Unit -IV Digital Electronics and Computer Organization**

BOOLEAN ALGEBRA AND LOGIC GATES - Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations. COMBINATIONAL LOGIC - Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of Combinational circuits. - SEQUENTIAL LOGIC - Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits – Computer Organization - Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes - ALU - Addition and subtraction – Multiplication – Division – Floating Point operations - . PROCESSOR AND CONTROL UNIT - Basic MIPS

implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions - MEMORY AND I/O SYSTEMS - Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

### **Unit - V PROBABILITY AND QUEUEING THEORY**

RANDOM VARIABLES - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions. - TWO - DIMENSIONAL RANDOM VARIABLES - Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables - RANDOM PROCESSES - Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions - QUEUEING MODELS - Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

### **Unit - VI DATABASE MANAGEMENT SYSTEMS**

INTRODUCTION TO DBMS - File Systems Organization - Sequential, Pointer, Indexed, Direct - Purpose of Database System- Database System Terminologies- Database characteristics- Data models – Types of data models – Components of DBMS- Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization – Functional Dependencies, Anomaly- 1NF to 5NF- Domain Key Normal Form – Denormalization. - SQL & QUERY OPTIMIZATION - SQL Standards - Data types - Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static Vs Dynamic SQL - QUERY

OPTIMIZATION: Query Processing and Optimization - Heuristics and Cost Estimates in Query Optimization - TRANSACTION PROCESSING AND CONCURRENCY CONTROL - Introduction-Properties of Transaction- Serializability-Concurrency Control – Locking Mechanisms- Two Phase Commit Protocol-Dead lock - TRENDS IN DATABASE TECHNOLOGY - Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing - Introduction to Distributed Databases- Client server technology- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Data Warehouse-Mining- Data marts.

## **UNIT- VII OPERATING SYSTEMS**

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 Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; 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; Allocating Kernel Memory, OS Examples - **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.

## **UNIT - VIII SOFTWARE ENGINEERING**

### **SOFTWARE PROCESS AND PROJECT MANAGEMENT**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis - Risk Management - REQUIREMENTS ANALYSIS AND SPECIFICATION - Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets-Data Dictionary - SOFTWARE DESIGN - Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components - TESTING AND IMPLEMENTATION - Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques: Coding practices-Refactoring - PROJECT MANAGEMENT – Cost Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II - Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM - Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA - Process and Project Metrics.

## **UNIT- IX WEB TECHNOLOGY**

SCRIPTING LANGUAGES - Web page Designing using HTML, Scripting basics- Client side and server side scripting. Java Script-Object, names, literals, operators and expressions- statements and features- events - windows - documents - frames - data types - built-in functions- Browser object model - Verifying forms.-HTML5- CSS3- HTML

5 canvas - Web site creation using tools - JAVA PROGRAMMING - Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces –Exception Handling – Multithreaded Programming – Input/Output – Files – Utility Classes – String Handling - JDBC - JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– InetAddress class – URL class- TCP sockets - UDP sockets, Java Beans –RMI - APPLETS - Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking.

## **UNIT- X COMPUTER NETWORKS**

NETWORKING FUNDAMENTALS & LINK LAYER - Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control - MEDIA ACCESS & INTERNETWORKING - 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), Multicast – addresses – multicast routing (DVMRP, PIM) - TRANSPORT LAYER - Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements - APPLICATION LAYER - Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP - Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes - MOBILE INTERNET

PROTOCOL AND TRANSPORT LAYER - Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.-

MOBILE AD-HOC NETWORKS - Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks ( VANET) – MANET Vs VANET – Security – Cryptographic Algorithms – Caesar Cipher – Hill Cipher – Vignere cipher – LFSR Sequences – Number Theory – GCD – Chinese Remainder Theorem – Fermat's Theorem and Euler's Theorem – Symmetric key Cryptography- DES – AES Algorithms – Public Key Algorithms – RSA- Diffe- Hellman Algorithm – ElGamal System – Elliptic Key Cryptography – Digital Signatures – Digital Certificates – Hashing – MD5 – SHA1 – Key Management – Kerberos – PKI – IP Security – Email Security – SSL – SET – OS Security- Database Security.