GOVERNMENT OF TAMILNADU

DIRECT RECRUITMENT FOR THE POST OF POST GRADUATE ASSISTANTS / PHYSICAL EDUCATION DIRECTORS – GRADE-I

SYLLABUS

2024-2025

State Council of Educational Research and Training

Chennai - 600 006.

SUBJECT : COMPUTER SCIENCE

SYLLABUS

Unit I — COMPUTER SYSTEM ARCHITECTURE

Number Systems: Introduction, Conversion from One Number System to another, Digital Codes, Introduction – Weighted Binary Code, Non-Weighted Binary Code, Alphanumeric Code, Error Detection and Error Correction Codes.

Boolean Algebra: Introduction, Boolean Logic, Boolean Operations, Operator Precedence, Laws of Boolean Algebra, Representation of Boolean Function, Simplification methods in Boolean algebra.

Digital Logic Circuits and Components: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit.

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Interrupt.

Programming the Basic Computer: Machine Language, Assembly Language, Assembler, Program Loops, Subroutines, Input-Output Programming.

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication.

Memory Hierarchy: Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Unit II — DATABASE MANAGEMENT SYSTEM

Database System Concepts and Architecture: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity Relationship Diagrams, Relational Model, Constraints, Languages, Design and Programming, Relational Database Schemas, Relational Algebra and Relational Calculus, Codd Rules.

Normalization for Relational Databases: Functional Dependencies and Normalization, Algorithms for Query Processing and Optimization, Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases, Database Security and Authorization.

Constraints and Views: Constraints and its types, Integrity constraints, Check constraints, Referential constraints, Introduction to views, updates on views, comparison between tables and views.

Transaction management and Concurrency control: Transaction management, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.

Unit III SYSTEM SOFTWARE AND OPERATING SYSTEM

System Software: Machine, Assembly and High-Level Languages, Compilers and Interpreters, Loading, Linking and Relocation, Macros, Debuggers.

Basics of Operating Systems: Operating System Structure, Operations and Services, System Calls, Operating-System Design and Implementation, System Boot.

Process Management: Process Scheduling and Operations, Inter-process Communication, Communication in Client-Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization.

Threads: Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.

CPU Scheduling: Scheduling Criteria and Algorithms, Thread Scheduling, Multiple Processor Scheduling, Real-Time Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock.

Memory Management: Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

Unit IV DATA STRUCTURES AND ALGORITHMS

Data Structures: Abstract data types, Arrays and their Applications, Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists.

Trees and Graphs: Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Graphs, Sorting and Searching Algorithms, Hashing.

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities, Asymptotic Notation, Recurrence Relations.

Design Techniques: Divide and Conquer, Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees.

Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

Unit V DATA COMMUNICATION AND COMPUTER NETWORKS

Data Communication: Components of a Data Communication System, Simplex, Half Duplex and Duplex Modes of Communication, Analog and Digital Signals, Noiseless and Noisy Channels, Bandwidth, Throughput and Latency, Digital and Analog Transmission, Data Encoding and Modulation Techniques, Broadband and Baseband Transmission, Multiplexing, Transmission Media, Transmission Errors, Error Handling Mechanisms.

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Network, Wireless Networks, Internet.

Network Models: Layered Architecture, OSI Reference Model and its Protocols, TCP/IP Protocol Suite, Physical, Logical, Port and Specific Addresses, Switching Techniques.

Functions of OSI and TCP/IP Layers: Framing, Error Detection and Correction, Flow and Error Control, Sliding Window Protocol, HDLC, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA, Network Devices, Backbone Networks, Virtual LANs.

World Wide Web (WWW): Uniform Resource Locator (URL), Domain Name Service (DNS), Mapping Names to Addresses and Addresses to Names, Electronic Mail Architecture, SMTP, POP and IMAP, TELNET and FTP.

Unit VI PROGRAMMING WITH C++

Language Design and Translation Issues: Programming Language Concepts, Paradigms and Models, Programming Environments, Virtual Computers and Binding Times, Programming Language Syntax, Stages in Translation, Formal Transition Models.

Elementary Data Types: Properties of Types and Objects, Scalar and Composite Data Types.

Object Oriented Programming: Class, Object, Encapsulation, Inheritance, Abstract Class, Polymorphism.

Basics of C++: Tokens, Identifiers, Variables and Constants, Data types, Operators, Control statements.

Functions: User-defined Functions, Parameter Passing, Virtual Functions.

Class and Objects: Constructors and Destructors, Overloading, Inheritance, Templates.

Files and Event Handling: Streams and Files, Multi-file Programs, Exception and Event Handling.

Unit VII PYTHON PROGRAMMING

Basics: Python interpreter and interactive mode, debugging, values and types: int, float, Boolean, string and list, variables, expressions, statements, tuple assignment, precedence of operators, comments.

Python libraries: Numpy, Pandas and Matplotlib, SciPy.

Conditionals: Boolean values and operators, conditional statements, Iteration: statement, while, for, break, continue.

Functions: Functions types, return values, parameters, local and global scope, function composition, recursion.

Strings: string slices, immutability, string functions and methods, string module, Lists as arrays.

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters.

Tuples: tuple assignment, tuple as return value, Dictionaries: operations and methods, advanced list processing – Iterator and generator.

Unit VIII WEB DEVELOPMENT

HTML: Introduction – Basic Tags-formatting and fonts, Working with colour.

Elements of HTML: Working with Tables, Working with Images, Working with Links, List and Tables, Frame and Frameset, Forms and Controls.

CSS: Introduction to Cascading Style Sheet, using CSS background images, colour and properties, Manipulating texts using fonts, border and boxes margins, padding lists, positioning using CSS.

Menu and Division: Types of Style Sheets, Class and ID, selector, Inline Menu, DIV and CSS layout.

JavaScript: Introduction to JavaScript, Understanding Variables, Loops and Arrays, Functions, Working with alert, confirm and prompt boxes, Creating Rollover image, Working with Operators, Events.

Unit IX PHP AND MYSQL

Basics of PHP: Evaluation of PHP, Basic Syntax, Defining variable and constant, PHP Data type, Operator and Expression, Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with HTML.

Functions: Defining a function, Call by value and Call by reference, Recursive function.

String Handling: Creating and accessing, String Searching and Replacing String, Formatting String, String Related Library functions.

Array: Anatomy of an Array, Index based and Associative array, Accessing array, Element Looping with Index based array, Looping with associative array.

Working with file and Directories: Understanding file and directory, Opening and closing a file, Copying, renaming and deleting a file, working with directories, Creating and deleting folder, File uploading and downloading.

MySQL: MySQL database connection, Creating a table with key constraints, dropping a table, adding, retrieving, updating data, deleting data, Performing additional queries (Joins and subqueries), Connecting to MySQL, Accessing MySQL using PHP, Querying MySQL database with PHP.

Unit X CYBER SECURITY

Cyber Crime: Introduction to Cyber Crime, Malware type, Kinds of Cyber Crime.

Cyber Security Techniques: Authentication, Encryption, Digital Signatures, Antivirus, Firewall, Steganography.

Password Management: Guidelines for Secure Password, Two Step verification, Generating Secure password, Using Password Manager, Enabling Two-step verification, Securing Computer using antivirus.

Cryptography: Symmetric cipher model, cryptographic system, substitution techniques, Caesar cipher, mono alphabetic ciphers, Hill ciphers, Transposition techniques, steganography, Data encryption standard, The strength of DES.

Attacks: Investigating DoS Attacks, Types of DoS Attacks, Classification of DoS Attacks, Techniques to Detect, DoS Attacks.