

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER
SCHEME & SYLLABUS FOR THE POST OF ASSISTANT
CONSERVATOR FOREST & FOREST RANGE OFFICER GRADE Ist
COMPETITIVE EXAMINATION, 2018
FOREST DEPARTMENT

OPTIONAL SUBJECT - COMPUTER ENGINEERING

- 1. Computer Architecture :** Propositional (Boolean) Logic, Predicate Logic, Well-formed formulae(WFF), Satisfiability and Tautology. Logic Families, Boolean algebra and Minimization of Boolean functions. Flip-flops-types. Combinational Circuit Design, Sequential Circuit Design, Hardwired and Micro Programmed processor design, Instruction formats, Addressing modes, Memory types and organization, Interfacing peripheral devices, Interrupts, cache memory, I/O interface (interrupt and DMA mode).
- 2. Data Base :** Database Concepts, ER diagrams, Data Models, Design of Relational Database, Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands. Database objects like-Views, indexes, sequences, synonyms, data dictionary. Normalization, Query Processing and Optimization, Centralized and Distributed Database, Security, Concurrency and Recovery in Centralized and Distributed Database Systems, Object Oriented Database Management Systems, SQL Commands and Query, SQL. Integrity constraints.
- 3. Programming in C and C ++ :** Programming in C: Elements of C-Tokens, identifiers, data types in C. Control structures in C. Sequence, selection and iteration. Structured datatypes in C-arrays, struct, union, string, and pointers. O-O Programming Concepts: Class, object, instantiation. Inheritance, polymorphism and overloading. C ++ Programming: Elements of C ++ Tokens, identifiers. Variables and constants, Datatypes, Operators, Control statements. Functions parameter passing. Class and objects. Constructors and destructors. Overloading, Inheritance, Templates, Exception handling. Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps. File Structures: Fields, records and files. Sequential, direct, index-sequential and relative files. Hashing, inverted lists and multi-lists. B trees and B + trees.

4. **Algorithms** : Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Sorting and Searching Algorithms, Analysis of Algorithms, Interpolation and Binary Search, Asymptotic notations-big ohm, omega and theta. Average case analysis of simple programs like finding of a maximum of n elements. Recursion and its systematic removal. Quick sort - Non recursive implementation with minimal stack storage. Design of Algorithms (Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound). Lower bound theory, Non-deterministic algorithm-Non-deterministic programming constructs. Simple non-deterministic programs. NP-hard and NP-complete problems. Graph search, minimum spanning trees, shortest paths.
5. **Computer Networks** : Network fundamentals: Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks. Reference Models: The OSI model, TCP/IP model. Data Communication: Channel capacity. Transmission media-twisted pair, coaxial cables, fibre-optic cables, wireless transmission-radio, microwave, infrared and millimeter waves. Light wave transmission. Cellular Radio, Communication satellites geo synchronous and low-orbit. Internetworking: Switch/Hub, Bridge, Router, Gateways, Concatenated virtual circuits, Tunneling, Fragmentation, Firewalls. Routing: Virtual circuits and datagrams. Routing algorithms. Congestion control.
Cryptography-public key, secret key. Domain Name System (DNS) -Electronic Mail and Worldwide Web (WWW). The DNS, Resource Records, Name servers. E-mail-architecture and Serves. Digital signatures and certificates.
6. **Compilers and Theory of Computation** : Phases of compilation process. Lexical analysis. Context free grammars. Parsing and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Bottom up parsers-shift-reduce, operator precedence, and LR. Top down parsers-left recursion and its removal. Intermediate codes-Quadruples, Triples, Intermediate code generation, Code generation, Code optimization. Finite Automata, Pushdown Automata. NFA, DFA, Non-regular languages, and Pumping lemma. Pushdown Automaton (PDA), Deterministic Pushdown Automaton (DPDA), Context free Grammars: Greibach Normal Form (GNF) and Chomsky Normal Form (CNF), Cook-Kassami-Younger (CKY), and Tomita's parsing. Turing Machine (TM).
7. **Artificial Intelligence** : Definitions, AI approach for solving problems. Automated Reasoning with propositional logic and predicate logic-fundamental proof procedure, refutation, resolution, refinements to resolution (ordering/pruning/restriction strategies). State space representation of problems, bounding functions, breadth first, depth first.

8. **Operating Systems** : Main functions of operating systems. Multi Programming, multiprocessing, and multitasking. Memory Management: Virtual memory, paging, fragmentation. Concurrent Processing: Mutual exclusion. Critical regions, lock and unlock. Scheduling: CPU scheduling, I/O scheduling, Resource scheduling. Deadlock and scheduling algorithms. Banker's algorithm for deadlock handling. Unix File system, process management, shell variables, command line programming. Filters and Commands: Pr, head, tail, cut, paste, sort, uniq, tr, join, etc. grep, egrep, fgrep, etc. sed, awk, etc. System Calls (like): Create, open, close, read, write, isseek, link, unlink, stat, fstat, umask, chmod, exec, fork, wait, system.
9. **Software Engineering** : Concepts of Software Engineering, Software Characteristics, Software Engineering: System Development Life Cycle (SDLC): Steps, Water fall model, Prototypes, Spiral model. Software Metrics: Software Project Management. Software Design: System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics. Coding and Testing: Testing level metrics. Software quality and reliability. Clean room approach, software reengineering.
10. **Graphics** : Line Algorithm, circle generating algorithm, ellipse generating algorithm, polynomial and spline curves, parallel curve algorithms, clippings, clipping lines. 2D transformation, composite transformation, translation, rotation, scaling, parallel projection, perspective projection, surface rendering, polygon surface, meshes, splines, cubic spline interpolation, Bezeir Curves and surfaces, B-spline and surfaces, Beta-spline, 3D transformation, rotation, scaling.
11. **Image Processing** : Image Registration, Spatial Fourier Transforms, Discrete Spatial (2 dimensional) Fourier Transforms, Restoration, Lossy Compression of images (pictures). Data Compression Techniques: Representation and compression of text, sound, picture, and video files (based on the JPEG and MPEG standards).
12. **Data Warehousing and Mining** : Data Warehouse environment, architecture of a data warehouse methodology, analysis, design, construction and administration. data mining techniques, classification, regression, clustering, summarization, dependency modelling, link analysis, sequencing analysis

Note :- **Pattern of Question Paper**

1. **Objective type paper**
2. **Maximum Marks : 200**
3. **Number of Questions : 120**
4. **Duration of Paper : Three Hours**
5. **All questions carry equal marks.**
6. **There will be Negative Marking.**