

## प्राविधिक अधिकृत (Software Engineer)

### 1. Computer Fundamentals

computer systems introduction, Definition of Hardware and software , Input and output devices Arithmetic logical unit (ALU), Control Unit (CU), Memory unit (MU) , Primary and Auxiliary Memory, Network card, Modem, Sound card , Introduction to computer software, Operating system, Programming Languages and Application software, BIOS, Firmware and cache memory, computer viruses and remedies, introduction to Multimedia, Hypermedia

### 2. Procedural and Object Oriented Programming

Procedural Programming Language -Types of data, Data representation, Data structure, Arrays, Operators, Variables and assignments, Control structures

Object Oriented Programming Language-Object and Classes, Method, Polymorphism, Inheritance, Modularity, Encapsulation, Abstraction, Operator Overloading

### 3. Digital Logic

Digital and Analog Systems, Number Systems ,Boolean Algebra ,Combinational and Sequential Logic, MSI Logic circuits , Counters and Registers, IC logic families, Memory Devices

### 4. Microprocessor and Computer Architecture

Microprocessor-Machine languages, Interpreters and Compilers, 808X and Intel microprocessors, programming and Instruction sets and addressing modes, assembly language programming, I/O and interrupt servicing, Microprocessor organization

Computer Architecture

computer organization and Architecture, Computer Instruction, Timing and control ,Execution of instruction, Input-output and Interrupt, Addressing modes ,Processor bus organization , Stack organization , Control Unit design , RISC / CISC architecture ,Asynchronous data transfer, I/O organization, Memory system, multiprocessor

### 5. Data Structure and Algorithms

Abstract Data Types, Arrays , Stacks , Queues, Linked Lists, Trees, General and binary trees, Representations and traversals ,Binary search trees ,Balancing trees ,AVL trees ,Indexing Methods, Hashing Trees, Suffix Trees ,Analysis of Algorithms, Asymptotic Notation ,Notions of Space and Time Complexity, Worst and Average Case Analysis ,Algorithm Design, Greedy Approach, Dynamic Programming ,Divide-and-Conquer ,Backtracking ,.Graph Traversals ,Connected Components ,Spanning Trees ,Shortest Paths, Hashing ,Sorting, Searching, Merging, Depth-first Search and Breadth-first Search

### 6. Operating Systems

Introduction to operating system, Processing and Threads, Symmetric Multiprocessing, Micro-kernels, Concurrency, Mutual Exclusion and Synchronization, Deadlock ,Scheduling ,Memory Management ,Input Output and Files, I/O devices and its organization, Principles of I/O software and hardware, Disks, Files and directories organization, File System Implementation ,Distributed Systems, Distributed Message passing ,Client/Server architecture, Clusters , characteristics of modern operating, Linux, Windows

### 7. Database Management System

The relational model, ER model, SQL, Functional dependency and relational database design ,File structure ,Transaction Management and Concurrency Control ,Concurrent execution of the user programs ,Transactions ,Concurrency control techniques Crash Recovery Types of failure , Recovery techniques ,Query Processing and Optimization ,Distributed Database Systems and Object oriented database system

## **9. Computer Networks and information Security**

Network fundamentals, OSI model, Network protocols, TCP / IP services (DNS, SMTP, FTP, DHCP, etc, Network infrastructures (LAN and WAN including IEEE 802. standards) VAN and remote access, Internet and WWW, Distributed system, Privacy and security issues.

Cyber Security, Intrusion Detection and Prevention, Cryptography and Network Security, Computer Security, Network Security, Virus Protection, Local Security, Network Access, Internet Security. , Encryption, Decryption, Asymmetric / Symmetric Algorithms, RSA Algorithm, Firewalls, Proxies, Security- Confidentiality, Integrity and Authentication, The need for Disaster Recovery, Disaster Recovery plan, Data backup, Fault Tolerance, Advanced Data Storage Techniques, Enterprise Data Storage, Clustering, Network Attached Storage, Storage Area Networks, Network Troubleshooting, Systematic Approach to Troubleshooting, Network Support Tools, Utilities, The Network Baseline, Network Access Points (NAP), Common Network Component, Common Peripheral Ports, Cyber Forensics

## **10. Software Engineering**

Entity Relationship Diagram, Data Flow Diagram, Software Development Life Cycles, MIS , Decision Support System, User-Interface Design Considerations, Context diagram, Top level DFD, Expansion Level DFD, Conversions of Data ,Object -Oriented Concept, Object Structure, Object Feature, Class and Object Association and Composition, Inheritance, Multiple Inheritances ,Use Case Diagram, State Diagram, Event Flow Diagram

Software Engineering-Software process and the software lifecycle models , Risk-driven approaches Software project management , Software requirements , Software design, Software issues and challenges, Formal methods, Tools and environments for software development , software maintenance, Process maturity and improvement, ISO standards, CASE tools, software re-engineering, reverse engineering, forward engineering, verifications and validation, software testing, Software evolution, software quality assurance

## **11. Data Communications**

Block Diagram of analog/ digital communication system, Analog and Digital modulation techniques , Data communications, including signals, modulation and reception, Error detecting and correcting codes, Circuit and Packet switching, Multiplexing, including time, frequency and code division multiplexing. 7.68. Digital networks: ISDN, frame relay and ATM

## **12. Artificial Intelligence**

Artificial intelligence fundamentals, Machine learning, Intelligent systems for pattern recognition, Architecture of expert systems, Roles of expert systems, knowledge representation, Knowledge Acquisition ,Meta knowledge, Heuristics. Expert systems shells, Introduction to knowledge –based, logic programming, and programming language for AI, Rule based and object based system

## **13. Emerging technology**

Cloud computing, E-commerce, Internet of things, e-Government system, Data warehouse & data mining.

## **14. त्रि.वि.ऐन, नियम सम्बन्धी**

## प्राविधिक अधिकृत (System Analyst)

### 1. Computer Fundamentals

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Object Oriented Programming Language-Object and Classes, Method, Polymorphism, Inheritance, Modularity, Encapsulation, Abstraction, Operator Overloading

### 3. Computer System Architecture

computer organization and Architecture, Computer Instruction, Timing and control ,Execution of instruction, Input-output and Interrupt, Addressing modes ,Processor bus organization , Stack organization , Control Unit design , RISC / CISC architecture ,Asynchronous data transfer, I/O organization, Memory system, multiprocessor

### 4. IT Project Management

IT Project planning & Execution, Rational Unified Process, Unified Modeling Language, software Analysis & Design, Concepts of OOPs, Object Oriented Analysis and Design, Cost & Benefit Analysis, Software Change Management, IT Vendor Management, client/ server architecture, deployment of web based applications.

### 5. Data Structure and Algorithms

Abstract Data Types, Arrays , Stacks , Queues, Linked Lists, Trees, General and binary trees, Representations and traversals ,Binary search trees ,Balancing trees ,AVL trees ,Indexing Methods, Hashing Trees, Suffix Trees ,Analysis of Algorithms, Asymptotic Notation ,Notions of Space and Time Complexity, Worst and Average Case Analysis ,Algorithm Design, Greedy Approach, Dynamic Programming ,Divide-and-Conquer ,Backtracking ,.Graph Traversals ,Connected Components ,Spanning Trees ,Shortest Paths, Hashing ,Sorting, Searching, Merging, Depth-first Search and Breadth-first Search

### 6. Operating Systems

Introduction to operating system, Processing and Threads, Symmetric Multiprocessing, Micro-kernels, Concurrency, Mutual Exclusion and Synchronization, Deadlock ,Scheduling ,Memory Management ,Input Output and Files, I/O devices and its organization, Principles of I/O software and hardware, Disks, Files and directories organization, File System Implementation ,Distributed Systems, Distributed Message passing ,Client/Server architecture, Clusters , characteristics of modern operating, Linux, Windows

### 7. Database Management System

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Cyber Security, Intrusion Detection and Prevention, Cryptography and Network Security, Computer Security, Network Security, Virus Protection, Local Security, Network Access, Internet Security. , Encryption, Decryption, Asymmetric / Symmetric Algorithms, RSA Algorithm, Firewalls, Proxies, Security- Confidentiality, Integrity and Authentication, The need for Disaster Recovery, Disaster Recovery plan, Data backup, Fault Tolerance, Advanced Data Storage Techniques, Enterprise Data Storage, Clustering, Network Attached Storage, Storage Area Networks, Network Troubleshooting, Systematic Approach to Troubleshooting, Network Support Tools, Utilities, The Network Baseline, Network Access Points (NAP), Common Network Component, Common Peripheral Ports, Cyber Forensics

## **9. Internet & Web Technologies**

HTML, Java Script, JSON, AJAX, XML, Web Servers: Tomcat, Apache, WAMP, IIS etc, Server Programming Language- C++, Java, .Net , PHP, Web Design Tools, Mail clients, Browser Configuration, DNS & Web Hosting, Static & Dynamic Web Development

## **10. Information system**

Information System development , Project management ,System analysis methods System analysis, requirement analysis, Use cases, dataflow diagrams, Entity relationship diagrams, Process modeling, Unified modeling language, Feasibility analysis

System design, application architecture, Database design, input and output design and prototyping, User interfaces, Object Oriented system development

System Implementation, software applications testing, installations, documenting the system, training and supporting, maintaining information systems, conducting system maintenance

## **11. Software Engineering, tools and techniques**

Software Engineering-Software process and the software lifecycle models , Risk-driven approaches Software project management , Software requirements , Software design, Software issues and challenges, Formal methods, Tools and environments for software development ,.Process maturity and improvement, ISO standards, CASE tools, reverse engineering, forward engineering, verifications and validation, software testing, , Software evolution, software quality assurance , Content Management System (CMS), Software Installation & Configuration, Database design, Data Analyst, Database Client: SQL Yog, SQL Developer, Database Server- My SQL, Oracle, SQL Server Object Relational Mapping (ORM) Tools .

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knowledge –based, logic programming, and programming language for AI, Rule based and object based system

**14. Emerging technology**

Cloud computing, E-commerce, Internet of things, e-Government system, Data warehouse & data mining.

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Procedural Programming Language – Identifiers, Keywords, Data types, Data representation, Data structure, Arrays, Operators, Variables and assignments, Control structures, Structure, Functions, File handling

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### 3. Computer System Architecture

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### **9. Internet & Web Technologies**

**Introduction:** The Internet; Basic Internet Protocols; the World Wide Web; HTTP (HTTP Request and Response Messages); Web Clients and Web Servers; Web Page and Web Site (Static and Dynamic); Client Side and Server Side Scripting; Web 1.0, Web 2.0, and Web 3.0

**HTM and CSS:** HTML Introduction; HTML Documents; HTML Elements and Attributes; Introduction to CSS; CSS Syntax; Three Ways to Insert CSS; CSS Combinators, Pseudo-classes, and Pseudo-elements; CSS Attribute Selectors; Responsive Web Design

**Client Side Scripting:** Introduction, Basic Syntax, Variables and Data Types, Statements, Operators, Literals, Control Statements, Functions, Objects, Arrays, Built-in Objects, Strings, Forms and Regular Expressions; Cookies; Introduction to JavaScript HTML DOM, JavaScript Browser BOM, XML, AJAX , JQuery, and JSON

**Server Side Scripting:** Introduction; Syntax; Variables; Data Types; Operators; Control Statements; Functions; Arrays; Strings; Superglobals; Forms; File Handling; Cookies; Session; Error and Exception; Database Handling

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