Syllabus for written exam System Manager

Time: 2 Hrs

1. Computer Fundamentals & Information Processing : Computer Fundamentals: Definition of an Electronic Digital Computer, History, Generations, Characteristics, and applications of computers, Classification of computers. Elements of Computer Processing System, Hardware, CPU, Peripherals, Storage Media, Software definition, its role and categories, Firmware and Human-ware. Information Concept & Processing : Data concepts and Data Processing, Data RepresentationNumber System, Definition of Information, Need of Information, Quality of Information, Value of Information, Categories and Levels of Information in Business Organization. Programming Language Classification: Computer Languages, Generation of Languages, Translators-Interpreters, Compilers, Assemblers, Introduction to 4G Languages.

2. Computer Organisation and System Programming : Computer Organization: General organization of a digital computer, functional blocks, data representation, fixed and floating point decimal arithmetic, bit slice microprocessor (introduction), Adders & its types, Generators & its types, multiplication and division circuits, an arithmetic unit, Instruction cycle, Instruction sequencing, formats and its interpretation, micro program concepts and control unit design. Semiconductor memory and memory organization, virtual memory, segments, pages, paged segments, cache memory and interleaved memory. Concepts of I/O organization, data transfer methods, programmed I/O, DMA, interrupt-based transfer, I/O channels, I/O processors, serial transmission and synchronization.

3. Introduction to assembly level programming – concepts of assemblers, macros, linkers, and loaders, linking loaders. Multiprogramming and time-sharing, introduction to advanced computer architecture (pipelining, array processors & multiprocessors). Boolean Algebra and Logic Gates: Boolean algebra basics, Boolean algebra theorems, reduction of logic expressions using Boolean algebra, Truth tables, SOP and POS forms. Standard SOP and POS forms. Basic and universal logic gates, control aspect of gates, enabling and disabling of gates. K map representation of logical functions, simplification of logic functions using K-maps. Combinational Logic Circuits and Sequential Circuits.

4. Systems Programming : Fundamentals, Editors, loaders, linkers, assemblers, phases of a compiler and their function, lexical analyzers and parsers, parsing techniques, symbol table, code generation.

5. System Concepts & Software Engineering : System Concepts: Definition, integrated system, sub system, modules, characteristics / objectives / types of systems, Introduction to Software engineering, Importance of Software, role of Software, Software

characteristics, Software Components, Software Applications, Software Crisis, Software engineering problems, Software Development Life Cycle, Software Process. Software Requirement Specification: Analysis Principle, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of metrics and Measurement, Problem analysis, Requirement specification. Monitoring and Control.

6. Software-Design : Design principles, problem partitioning, abstraction, top down and bottom up specifications and verification, Monitoring and control, Cohesiveness, coupling, Fourth generation techniques, Functional independence, Software Architecture, Transaction and Transform Mapping, Component-Level Design. Coding: Top-Down and Bottom- up programming, structured programming, information, hiding, programming style and internal documentation. Testing: Testing principles, levels of testing, functional testing, and structural testing, test plan, test case specification, reliability assessment, software testing strategies, Verification & validation, Unit testing, Integration Testing, Alpha & Beta testing, system testing and debugging. Software Project Management: The Management spectrum, cost estimation, project scheduling, staffing, Software configuration management, quality assurance, project monitoring, risk management. Software quality. Reliability: Reliability issues, Reliability metrics, Reliability growth modeling.

7. Data Structure & Alogrithms : Data Structure : Basic Terminology, Elementary Data Organization, Data Structure operation Algorithm Complexity and Time-Space Trade-off, Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Array as Parameters. Ordered List, Sparse Matrices, and Vectors, representation and Implementation of Singly lists, Twoway Header list, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to / from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction. Stacks, Queues and Recursion: Array Representation and Implementation of stack, operations on stacks: Push & Pop, Linked Representation of Stack, operations Associated with stacks, Application of stack, Array and Linked representation and implementation of queues, Operations on queue: Create, add, Delete, Full and Empty.

8. Circular queue, De-que and Priority Queue, Recursive definition and processes, recursion , example of recursion, Tower of Hanoi Problem, simulating recursion Backtracking recursive algorithms, Principles of recursion, tail recursion, removal of recursion. Trees: Basic terminology, Binary tree representation, Algebraic Expressions, Complete Binary Tree, Extended Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary tree, Threaded Binary trees. Traversing Threaded Binary trees, Huffman algorithm. Searching and Hashing: Sequential search, binary search,

comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

9. Searching and Sorting: Insertion Sort, Bubble Sorting, Quick Sort, Two way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting. Binary Search Trees: Binary Search Tree (BST) Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-Trees. Algorithms: Analysis of algorithms, Growth of Functions, Master's Theorem, Designing of Algorithms. Sorting and order Statistics: Heap sort, Quick sort, Sorting in Linear time. Design and Analysis: Design issues, Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithms, Amortized Analysis, Back Tracking.

10. Operating Systems : Operating System: Functions, multiprogramming, multiprocessing, & multitasking, process: process description, process states, process control, threads, memory management, virtual memory, paging, fragmentation, concurrent processing: Mutual exclusion, critical regions, lock & unlock. Scheduling: CPU scheduling, I/O scheduling, Scheduling algorithms, Deadlock: avoidance & prevention; UNIX: structure & commands of UNIX, interfacing with UNIX, editors & compilers for UNIX, LEX & YACC, File system, System calls, Filters, Shell programming.

11. Distributed Systems : Introduction to H/W and S/W concepts in distributed systems, network operating systems and NFS, NFS architecture and protocol, distributed file systems. Information Storage & Management: Complexity of Information Management-Proliferation of Data, Data Center Evolution, Managing Complexity, I/O and the five pillars of technology, Storage Infrastructure, Evolution of Storage. Storage Systems Architecture: Modern Storage Systems, Storage Systems, Intelligent Disk Subsystems, Physical Disks , Back End ,Cache ,Front End, Host Environment.

12. Relational Database Management System : Database definition, Data independence, Architecture for a Database system. Storage structures, possible representations for sample data, Data structures and corresponding operators. Relational approach, Hierarchical approach, Network approach. Relational Data structure, Relations, Domains and attributes, Keys, Extensions and Intentions, Relational Algebra, Traditional set operations, Attribute-names for derived relations, Special Relational operations, Relational calculus. Normalizations of relations. Normal forms, functional dependence, 1 NF, 2 NF and 3 NF, Further Normalization. SQL, Query and optimizer, Decomposition of relation scheme. Security, Concurrent operations on Databases, Recovery, Distributed Data base machines, comparisons of database systems.

13. Data Communication and Computer Networks : Basic concepts of data communication system : Communication channel and their characteristics. Modeling of Information sources: Measure of information, source coding techniques like Huffman code, Block Code & Cyclic Redundancy codes. Modulation: its need, its various types. Analog to Digital Communication, Digital to Analog Communication. Computer Network: Definition, Goals and Applications, Networks structure and architecture, OSI reference

model, services, topology, transmission media, Switching, Multiplexing , Client-Server model , IEEE standards, FDDI, TCP/IP Model, Integrated services digital networks, Multipoint Protocol Layer Switching (MPLS). Physical Layer and basic functions , Data Link Layer functions , DLL Sublayers -MAC Sublayer, LLC Sub layer and its various protocols.

14. Network Layer : its functions, routing algorithms, congestion control algorithms, internetworking, IP addressing, Subnetting,IPv4. Transport Layer and its Protocols. Application layer and its various protocols , compression Techniques, IPv6 , DNS System. Security: Security Concepts- Attacks, Services & Mechanisms, Conventional Encryption: Classical Techniques. Conventional Encryption Model and Steganography, Classical Encryption Techniques. Modern Techniques : Simplified DES, Block Cipher Principles, DES standard, DES Strength Differential & Linear Cryptanalysis, Block Cipher Design principles, Block cipher Modes of Operation. Public Key Encryption: Public- Key Cryptography: Principles of Public –Key Cryptosystems, RSA Algorithm, Key Management.

15. System Security : Authentication Applications; Kerberos directory authentication Service Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine. Web Security : Secure Socket Layer Security, Secure Electronic Transaction (SET). System Security : Intruders, Viruses, Firewall Design Principles. Internet: Basics, various types of internet connections, choosing an ISP, Mail Services concepts, Voice and Video Conferencing, Web Browsers and Web Servers ,VPN, Voice Over Internet Protocol (VOIP). IT Act 2000 & its Amendments & Provisions: Provisions of Act, types of offences, fines, imprisonment, cyber crime, cyber law, e-commerce basics , online transactions.

16. Programming Languages : OOPS Concepts: Object oriented programming viz-a-viz traditional programming. Objects, classes, Private and public, data encapsulation, Inheritance and reusability polymorphism and overloading, Constructors, destructors and member functions derived classes and dynamic binding, virtual functions, Input and Output streams. Arrays, Pointers and pointer arithmetic, Modeling object oriented systems, Class design issue. Core Java: Introduction, operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String Handling, Networking, Event handling, Introduction to AWT, AWT controls, Layout Managers, Menus, Images, Graphics.

17. Java Swing : Creating a Swing Applet and Application, Programming Using Panes, Pluggable Look and Feel, Labels, Text fields, Buttons, Toggle buttons, Checkboxes, Radio Buttons, View ports, Scroll Panes, Scroll Bars, Lists , Combo box, Progress Bar, Menus of Tool bars, Layered Panes, Tabbed Panes, Split Panes, Layout Windows, Dialog-Boxes, Inner Frame. JDBC: Concepts, Connectivity Model, JDBC, ODBC Bridge, Java. SQL package, connectivity to remote database, navigating through multiple rows retrieved from a database. Java Beans: Concepts. Application Builders tools, the bean

developer kit (BDK), JAR files, Introspection, Developing a simple Bean, using bound properties, the Java being API, Session Bean, Entity Beans, Introduction to Enterprise Java Beans (EJB).

18. Introduction to RMI (Remote Method Invocation : A Simple Client-server application using RMI. Java Servlet : Servelets Basics, Servlet API Basic, Life Cycle of a Servlet, Running Servlet, Debugging Servelets, Thread-safe Servelets, HTTP Redirects, Cookies, Introduction to Java Server pages (JSP). HTML: Structural elements of HTML documents, Logical styles, Physical Styles, Managing images in html, Image format ,Importing images , documents, Hypertext and Link in HTML, URL / FTP / HTTP, Types of links, Rotating messages Counters Calling CGI scripts for modifying entered data, CGI Primer, Handling Form Output with CGI. PHP: PHP Basics, Stream manipulation, control structures, functions, files, working with forms and files, regular expressions, cookies and sessions. ASP.net: Basics, name spaces, net framework classes, Web forms and various controls, asp.net Web services, security and roles.

19. Compression Techniques : Lossless and Lossy compression, Run length coding, Statistical Coding, Transform Coding, JPEG, MPEG, Text compression using static Huffman technique, Dynamic Huffman Technique. Animation: Introduction to Animation, Principles of Animation, Types of Animation, Types of Animation Systems: Scripting, Procedural, Representational, Stochastic, etc. Animation Tools: Hardware – SGI, PC's Amiga etc. Software: Adobe Photoshop, animation, CIF Construction, GIF motion etc. GKS : GKS Standards, GKS Primitives-Polyline, Playmaker, GKS Workstation and Metafiles.

20. Advanced Computing : Mobile Computing: Wireless Communication Concepts, Mobile Computing Framework, Wireless Delivery Technology & Switching methods: Radio Based Systems, Cellular Communications, Wireless packet Data Network, Satellite Networks, Very Small Aperture Terminals (VSAT), Infrared or Light Based Mobile Computing, Mobile Information Access Devices: Portable Computers, Hybrid Pen Computer, Personal Digital Assistants (PDAs), Personal Communicators, Palmtops, Cellular Modems, Mobile Data Internetworking Standards, Mobile IP, Global Positioning System.

21. Cloud Computing : History of Cloud Computing, Cloud Architecture, Cloud Storage, Why Cloud Computing Matters, Advantages of Cloud Computing, Disadvantages of Cloud Computing, Cloud Services. Web-Based Application, Pros and Cons of Cloud Service Development, Types of Cloud Service Development. Grid Computing: Overview of Grid Business areas, Grid applications- schedulers, resource broker, load balancing, grid portals. Green Computing: Green computing concepts and its applications.

22. Artificial Intelligence: History of AI, Intelligent agents – Structure of agents and its functions, Problemspaces and search - Heuristic Search techniques – Best-first search, Problem reduction -Constraint satisfaction - Means Ends Analysis.Knowledge Representation: Approaches and issues in knowledge representation, Knowledge

23. Based Agent, Propositional Logic, Predicate logic – Unification – Resolution, Weak slot – fillerstructure, Strong slot - filler structure.

24. Big Data: Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

25. Free and Open Source Software