SYLLABUS FOR THE POST OF ASSISTANT DIRECTOR (SOFTWARE)
(ERSTWHILE SOFTWARE ENGINEER)

Qualification	: MCA or M. Sc. in Comp. Sc./IT
Mode of Recruitment	: Multiple Choice Questions (MCQ)
Total No. of Questions	: 100
Total Marks	: 100
Time duration	: 1½ Hours (90 minutes)
Additional time for SCRIBE	: 10 Minutes Per Hour

(On behalf of VH candidate)

Note: There will be negative marking of 0.25 marks for each wrong answer

Section – I (MCQ)
SYLLABUS

	TOPICS	DETAIL SYLLABUS	DISTRIBUTION OF MARKS
1.	General Intelligence & Reasoning	1. Analogy 2. Coding and Decoding 3. Correct Mathematical Sign 4. Distance and Direction Sense Test 5. Human relation 6. Inserting Correct Mathematical Sign 7. Mathematical Operation 8. Mutual Relation Problem 9. Non-Verbal Reasoning 10. Number Ranking 11. Odd Man Out 12. Similarities and Differences 13. Tallest Youngest Relation 14. Time Sequence Test 15. Data sufficiency	20
2.	Numerical Aptitude	1. Arithmetical Operations 2. Averages 3. Computation of Whole Numbers 4. Decimals and Fractions 5. Discount 6. Interest 7. Mensuration 8. Number System 9. Percentage 10. Profit/Loss 11. Ratio & Proportions 12. Ratio & Time 13. Relationship B/w Numbers 14. Tables and Graphs 15. Time and Distance	20
3.	General Awareness	**(A) Environmental Awareness** 1. Environment: concept; natural and man-made environment; concept of biosphere; urban and rural environment. 2. Natural Resources: types; what makes them continually available; their conservation aspects; renewable, non-renewable resources; biodegradable, non-biodegradable and very slow degrading substances; bio-geo-chemical cycles in nature; water cycle. 3. Environment and Society: development related issues; sustainable development; health problems due to the degradation of environment. 4. Environmental Issues and Concerns: air, water, soil, noise and radiation pollution; outdoor and indoor pollution; global warming and climate change; loss of biodiversity; emerging environmental problems – radio frequency radiation pollution; pollution at higher altitudes; pollution in the outer space, marine pollution. 5. Environmental Management: disposal of hazardous wastes; eco-friendly practices; environmental legislations and laws; environment impact assessment (EIA) studies; eco-labels; ISO 14000 standards.	20
		(B) Computer Awareness **Basics of Computer Hardware** 1: Functioning of a Computer Components of a computer and their role e.g. CPU, ALU, Number system Codes ASCII Unicode Concept of Instruction 2: Memory System Type of memories and their characteristics Need of memory hierarchy Concepts of Main Memory, Cache, Secondary Memory 3: I/O devices and their functions I/O devices Current trends in I/O **Basics of Computer Software** 1: Different type of software System and application software Utility software Perverse software – Computer Virus Open Source software 2: Operating System Concepts Need and Functions 3: Computer Applications Concepts of Open Source Software Philosophy – licensing, copyright Project Management Software Timesheet system Introduction of Office Applications Word Processing, Spreadsheet, Database –data records, a form, a query and a report, Email – Sending mail to a number of people in a group.	**3: Internet Technologies** 1: Networking and Internet Basic of Networking Concepts, Advantages of Networking TCP/IP, Web addresses 2: Web Applications Browsing, E-mail, E-Learning and wiki 3: Cyber Law **4. Computer Application Software** 1: Operating System Basic Operations Windows, Linux 2. Word Processor Basic Operations (Font selection, Justification, Spell check, Table, Indentation) Table of Contents, Track Changes and Commenting. Mail Merge, Printing, Practice session. 3. Spread sheet Concept of Worksheet, Workbook and cell Data entry, Data editing and Formula Graphics 4. Presentation Software Basics operation, Animation and Sounds 5. E-mail Basic Operation, Address Book, Spam and Filtering 6. Browsing and Discussion Forum Browsing and Search, Discussion Forum, Wiki and Google Doc	

		(C) Distance Learning		

(C) Distance Learning

1. The definition and role of Distance Learning in India.
2. The multi-media approach of Distance Learning.
3. Difference between distance learning, correspondence course and conventional.
4. Advantages of distance learning.
5. Student Support Service in distance learning.
6. e-learning and m-learning
7. Internet based learning.

(D) Current Events

1. Sports Events	6. Fairs & Festivals
2. Science Events	7. Language of India
3. Discoveries	8. Technological Development
4. Indian Economy	9. Important International Events
5. Indian Politics	10. Health & Education
	11. Rural India Events & Schemes

---

4. General English — **20**

(A) Comprehension

A passage of 500 words with MCQs on

1. Inferring meaning of phrase	6. The author feels that…
2. Inferring theme of passage	7. The tone of the passage
3. Synonyms	8. Identifying the overall meaning of text
4. Antonyms	9. Questions testing reasoning
5. The reason why…	10. Topic of discussion from list

(B) Vocabulary

1. One word substitution	6. Make adjective from noun
2. Phrase closest in meaning to word	7. Choosing correct form of address
3. Make adverb from verb	8. Choosing ending to formal and informal letters
4. Make verb from adverb	9. Inserting correct article
5. Make noun from adjective	10. Choosing correct spelling of commonly mis-spelt words

(C) Grammar

1. Selecting the words which best express meanings of the given words	7. Completing the sentence by selecting the best option given below.
2. Selecting the word which best expresses opposite of the given words.	8. Inserting the correct word in a sentence from homonyms (beer, bier, bear)
3. Filling the blanks by selecting the appropriate words (Adverbs, Conjunctions, Prepositions, Verbs etc.) from the given words.	9. Inserting the correct conjunction from a list.
4. Finding out the correct passive form of phrase from a list.	10. Inserting the correct preposition from a list
5. Finding out the correct active form of phrase from a list	11. Inserting the correct punctuation from a list
6. Interpretation of meaning from a list	

OR

---

4. सामान्य हिन्दी — **20**

(क) अपठित गद्यांश

(ख)
- किया से किया विशेषण बनाना
- किया विशेषण से किया बनाना
- संज्ञा से विशेषण बनाना
- विशेषण से संज्ञा बनाना
- निम्नलिखित का एक शब्द दीजिए

(ग) व्याकरण

इस खंड में निम्नलिखित में से प्रश्न पूछे जाएंगे

(1) दिए गए कथन को एक शब्द में व्यक्त करना
(2) विलोम शब्द/विपरीतार्थक शब्द बताना
(3) रिक्त स्थान भरना (दिए गए शब्दों में से समुचित कियारूप/शब्द साधन (लिंग, वचन और कारक के अनुसार किया में रूपांतर) संबंधबोधक समुच्चय बोधक) चुनना
(कुछ विदेशी शब्दों में हिंदी लिंग का प्रयोग होता है यहाँ वे भी शामिल होंगे)
(4) रिक्त स्थान भर कर वाक्य को पूरा करना
(5) समुचित कारक चिन्ह का प्रयोग
(6) समुचित पुरुषवाचक सर्वनाम का प्रयोग (मैं, मेरा, अपना, आप, आपका वह, उसका, अपना)
(7) अशुद्धि शोधन
   i) वर्तनी संबंधी ii) वाक्य विन्यास संबंधी
(8) प्रत्यय–उपसर्ग
(9) संधि–समास

5.	Professional Section	1. DISCRETE MATHEMATICAL STRUCTURES 2. DIGITAL LOGIC 3. COMPUTER ORGANIZATION AND ARCHITECTURE 4. DATA STRUCTURES AND PROGRAMMING 5. OPERATING SYSTEMS 6. DATA BASE SYSTEMS 7. DATA COMMUNICATION AND NETWORKS 8. SOFTWARE ENGINEERING 9. WEB TECHNOLOGIES 10. DISTANCE EDUCATION AND ICT	20

Section – II   (Subjective)

Total number of questions	:	**10 (To attempt 05 questions only)**	
Total Marks	:	**50 marks**	
Time duration	:	**1½ Hours (90 minutes)**	
Additional time for <u>SCRIBE</u>	:	**10 Minutes Per Hour**	
(On behalf of VH candidate)			

<u>SYLLABUS</u>

DISCRETE MATHEMATICAL STRUCTURES

Mathematical logic: Prepositions-Logical operator-Equivalence and implication-Laws of logic- Normal forms-prepositional calculus-Quantifiers.
Relations: Binary relations-Relation matrix and graph of relation-Partition,covering a set-Equivalence relation-Partial ordering-Hasse diagram.
Combinatorics: Counting methods for arrangement and selections-Two basic counting principles-Arrangements and selections with repetition -Generating functions.
Recurrence relations: Recurrence relation models-Solution of linear recurrence relations-Solution of non-homogeneous linear relations.
Graph theory: Representation of graphs-Connectivity-Eulerian and Hamiltonian graphs-Trees-Binary tree traversal –Expression.

Group theory: Group axioms-Semi groups-Monoids-Applications to generation of codes using parity checks-Error recovery in group codes.
 Formal languages: Four classes of grammars-Definitions-Context free grammar-Derivation tree-Ambiguity.
Finite automata: Definition of deterministic finite state automaton(DFA),Non deterministic finite state automaton(NFA)- Equivalence of DFA and NFA.

DIGITAL LOGIC

Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number system & representation and computer arithmetic.

COMPUTER ORGANIZATION AND ARCHITECTURE

Boolean Algebra, K-Maps, Combinational circuits, Flip-flops(J-K, S-R, D), Registers
(Shift, Parallel), Counters (Ripple, Synchronous), Multiplexers and decoders

Principles of Computer Design: Software, hardware interaction layers in computer architecture, Organisation and Architecture ,Structure & Function. Design Levels - Gate, Register, Processor
Instruction Sets : Characteristics & Functions, Addressing Modes & Formats Instruction cycle and execution cycle. System Buses, Interconnection Structures including bus Interconnection.

Grey Code, Excess .3 code, Error detecting and correcting codes

Control unit: Data path and control path design, Microprogramming vs hardwired control, RISC vs CISC, Pipelining in CPU design, Superscalar processors.Overview of Parallel Processing

Memory system: Memory Hierarchy, Memory technologies- Memory array organization, Memory device characteristics, Random-access memories, Serial access memories , SRAM, DRAM.

High Speed memories : Interleaving, Cache , Associative memory, Advanced DRAM Organisation

External Memory : Magnetic Disk, RAID , Optical Memory.

Input-output devices and characteristics: Input-output processing, I/O Modules, Programmed I/O, Interrupt Driven I/O, DMA,I/O channels and Processors.

Performance evaluation: SPEC marks, Transaction processing benchmarks

DATA STRUCTURES AND PROGRAMMING

Introduction to data structures: Problem Solving using Computers – Abstraction - Abstract data types- Data Representation - Elementary Data types - Basic Concepts of Data Structures - Mathematical Preliminaries – Efficiency of algorithms - Time and space complexity – Asymptotic Notation - Performance measures for data structures- Examples and real life applications.

Stack: Definition- Array based implementation of stacks- Linked List based implementation of stacks- Introduction to Recursion. Applications: Infix, postfix, prefix representation, Conversions

Queues and Lists: Definition- Array based implementation of Queues / Lists- Linked List implementation of Queues / Lists- Circular implementation of Queues and Singly linked Lists- Linear / circular implementation of doubly linked Queues / Lists-Priority Queues - Applications.

Trees: Definition of trees and Binary trees- Properties of Binary trees- Binary Traversal pre-order, post order, Inorder traversal- Applications of binary trees – Huffmann coding - Binary Search Trees (recursive & non–recursive Algorithms)- Threaded trees- Balanced multi way search trees-AVL Trees - Implementations - Applications of Search trees – TRIE, 2-3 tree, 2-3-4 tree, Red-Black trees.

Graphs: Undirected and Directed Graphs and Networks- Array based implementation of graphs- Adjacency matrix- Path matrix implementation- Linked list representation of graphs - Graph Traversal – Breadth first Traversal, Depth first Traversal- Tables: Definition, Hash function, Implementations and Applications.

Sorting & Searching: Sorting Techniques : Bubble sort, Selection sort- Heap sort, Quick sort – Searching- sequential and binary- complexity analysis of all sorting & searching techniques

Programming: Programming constructs, functions, pointers, recursion, parameter passing and binding. Concepts of object-oriented programming, classes and objects, inheritance, polymorphism, overloading. Structured Programming

Algorithm Analysis & design paradigms: Asymptotic notation, Notions of space and time complexity ; Divide and Conquer: Merge Sort, Quick Sort, Greedy: Shortest path, MST, Dynamic programming: Multistage, optimal binary search tree, Backtracking: graph coloring, sum of subset problem – Complexity analysis. NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP- Complete classes, Cook's theorem.

OPERATING SYSTEMS

Introduction: Operating Systems-Objectives and Functions-Evolution of Operating Systems-Structure of Operating System- Components of Computers.

Memory management: Memory hierarchy-Partitioning-Buddy Systems-Paging-Segmentation-Virtual Memory.

Process management: Process Creation-Process states-Threads-Synchronization-Process Scheduling Algorithms-Concurrent Process –Deadlock.

File and I/O management: I/O functions-I/O devices-Disk Scheduling Algorithms, File Management Systems-File System Architecture-Functions of File Management-File Directories-Secondary Storage Management-File Allocation.

Vmware: Introduction- Virtualization- Virtual Data Center Operating System- Storage Virtualization -Virtual Networking- Virtual Security. Case study of Linux and Windows operating systems.

DATA BASE SYSTEMS

Database system concepts: File system – Storage structures - Database systems – Database systems architecture – Data models – Relational model, Hierarchical model, Network model, Object relational model, Object Oriented model– Data Dictionary – Database Administration. Relational database concepts: Codd's rule – Base tables – Views - Domains and Key concept – Integrity rules – Relational Algebra.

Software development lifecycle: Introduction to SDLC – Database development Lifecycle.

Design: Logical Database Design: ER model: Entity Relationship diagram - Extended ER diagram – Mapping ER diagram to relations. Normalization: 1NF to 5NF- Domain Key Normal Form – Denormalization.   Physical Database Design: Commercial query languages – SQL, Options for SQL Extensions, Embedded SQL, Call Level Interface.

Query processing and optimization: Query Processing - Heuristics Query Optimization - Cost Based Query Optimization.

Database system implementation issues: Transaction processing: Introduction - Properties of Transaction – Serializability- Concurrency Control – Locking Mechanisms- Two Phase Commit Protocol-Dead lock. Indexing and Hashing – Backup and recovery – Security and Integrity – Database Tuning.

Trends in DBMS: Client-Server computing and Distributed Databases - Web Databases – Mobile Databases – Active Databases – Temporal Databases – Spatial and Multimedia Databases – Statistical Databases – Deductive databases. OLTP and OLAP,

DATA COMMUNICATION AND NETWORKS

Introduction: Objectives of Computer Networks- Switching- Topologies- OSI Reference Model.

LAN access techniques: Transmission media- Polling-Contention-ALOHA-CSMA-CSMA/CD-Token bus and Token Ring Protocols.

Internetworking: Network Devices-Hubs, Switches, Bridges, Routers, Brouters, Gateways and Repeaters- Ethernet-FDDI- VLAN- Routing Algorithms- Congestion Control Algorithms.

Network protocols: Introduction - UDP - TCP- IP – IPv4 and IP v6 – IP Addressing- Subnetting- IP Routing- Routing Protocols- WAN Technologies.

Network management and applications: SNMP, V2, V3- RMON- Telnet- FTP- SMTP - DNS.

Advanced network architectures: Integrated Services in the Internet- Differentiated Services- Multimedia Networking-Blue tooth Technology-High speed networks.

Security: Risks and vulnerabilities, concepts on cryptography, digital signature, security devices

Concepts on Mobile computing, Grid computing, Cloud computing, Soft Computing Techniques

SOFTWARE ENGINEERING

Introduction: Characteristics of Software - Software Engineering vs other engineering disciplines – Software Myths – Software Life Cycle Models – Selection of Software Process models.
Requirement analysis: Prototyping – Specification – Analysis modeling.
Software design: Software design – Abstraction – Modularity – Software architecture – Effective modular design – Cohesion and Coupling – Architectural design and procedural design – Data flow oriented design.
User interface design: User Interface design – Human factors – Human computer interaction – Human – Computer interface design – Interface design – Interface standards. Programming languages and coding – Language classes – Code documentation – Code efficiency – Software configuration management.
Programming standards: Need for structured programming – Coding standards – Maintainability of programs.
Testing techniques: Software testing – Path testing – Control structures testing – Black Box testing – Unit, Integration, Validation and system testing – Software Maintenance.
Trends in software engineering: Reverse Engineering and Re-engineering – wrappers – Case Study of CASE tools.
Software Project Management and Software quality assurance

WEB TECHNOLOGIES

Concepts, Scripting languages, basic concepts of client-server computing, client-side and server-side technologies, skills on WAMP / LAMP Technologies, emerging web technologies.

DISTANCE EDUCATION AND ICT

ICT infrastructure for ODL, Quality teaching and Learning through ICT, ICT and skills development, E-Content Development, Design and Implementation of Technology for ODL