Madan Moha Malaviya University of Technology Gorakhpur

Syllabus of the Written Examination for the Post of Programmer

S. N.	Topics
1.	**Data Base Management Systems** ER Diagram, data models- Relational and Object-Oriented databases. Data Base Design: Conceptual data base design, Normalization Primitive and Composite data types, concept of physical and logical databases, data abstraction and data independence, data aggregation and Relational Algebra. Application Development using SQL: Host Language interface, embedded SQL programming, Stored procedures and triggers and views, Constraints assertions. Internal of RDBMS: Physical data organisation in sequential, indexed random and hashed files. Inverted and multi-list structures, B trees, B+ trees, Query Optimisation, Join algorithm. Transaction Processing, concurrency control and recovery management. Transaction model properties and state serialisability. Lock base protocols, two phase locking.
2.	**Software Engineering** Importance of Software Engineering Paradigms, Life Cycle Models-Waterfall Model,Prototyping Model, Spiral Model, RAD; Requirement Analysis, Design process,Software Project Planning, Cost Estimation, Software Quality Assurance, Software Testing
3.	**System Analysis and Design** **System concept**: Definition and characteristics, elements and boundaries, types of system development lifecycle, recognition of needs, feasibility study, prototyping, role of system analyst. System planning and tools like DFD, data dictionary, decision trees, structured analysis and decision tables. IPO charts, structured walkthrough, input output form design, requirement and classification of forms, layout considerations, form control, object-oriented Design Concepts and methods. Software Life Cycle, Software Engineering paradigms. **System analysis:** Feasibility study requirement analysis, Cost benefit analysis, Planning systems, Analysis tools and techniques. **System Design:** design fundamentals, Modular Design, Data and procedural design, object-oriented design.

	System Development: Code documentation, Program design paradigms, Efficiency Consideration. Verification, Validation and Testing: testing methods, Formal Program Verification, Testing Strategies. **Software Maintenance:** Maintenance Characteristics, Maintainability, Maintenance tasks and side effects.
4.	**Algorithms and Data Structures** Order Notation, Recurrence, Counting and Probability, Elementary Data Structures such as lists, stacks, queues, binary search trees. Sorting Algorithms: External SortingBranch & Bound Method Dynamic Programming
5.	**Networks, Network Security and Web Security** Overview of Networking LAN, VLAN, MAN, WAN, Internet and Intranet etc Server-Client based network, peer to peer networks, Network Hardware and Components,concept of Server, client, node, segment, backbone, host etc. Analog and Digitaltransmission, Functions of Network Interface Card (NIC), Repeaters, Hub, Switches,Routers, Bridges etc. Transmission Media and Topologies media types, Protocol andServices, OSI Model, Media Access Method, FTP, SMTP, HTTP, POP3, DNS, IMAP,MIME, WINS and RAS services, Web services , Proxy Services etc; Routing protocols,TCP/IP and Sub-nettings, TCP/IP Errors and Solutions, Network Management (SNMP,RMON, DHCP) Cryptography, Firewalls, Wireless and Mobile Data Services, WirelessTechnology, Mobile Communications, Network Security, Public Key encryption,Hashing,Digital Signature, Web Security, System Security, Intruders, MaliciousSoftware
6.	**Programming Concepts** **Introduction:** Internet, Java as a tool for internet applications, Byte Code and its advantages. **Object Oriented Programming and Design:** Review of Abstraction, Objects and other basics, Encapsulation, Information hiding, Method, Signature, Classes and Instances, Polymorphism, Inheritance, Exceptions and Exception Handling with reference to object modelling, Coupling and Cohesion in object oriented software. Object Oriented Design – Process, Exploration and Analysis. **Java Programming Basics:** Variables and assignments, Input and Output, Data Types and Expressions, Flow of control, Local variables, Overloading Parameter passing, this pointer, Java Object Oriented Concepts: Use of file for I/O, Formatting output with stream functions, Character I/O, Inheritance, Public and private members, Constructors for initializations, Derived classes, Flow of Control Arrays-Programming with

	arrays, arrays of classes, arrays as function arguments, Strings, Multidimensional arrays, Arrays of strings, vectors, Base classes. Static and Dynamic Web Pages, DHTML, CSS, Active Web Pages, Java Script, ServletAPI, The servlet life cycle, Cookies and Sessions, JSP, CGI, ODBC, JDBC, Java, J2EE, PHP, Python, ASP.NET, LAMP, WAMP, XAMP Introduction to JSP, RMI, Java Applets and servlets. Introduction to DotNet framework and visual programming interface. **PHP & Apache:** Dynamic Content, Server-Side Scripting, Installation, Configuration, Administration, Language Syntax, Built-in Functions, PHP and MySQL Connectivity, Installation, Web Server Conceptual Working, Web Browser, HTTP, Installation and Configuration; Httpd. Conf File; Logging; Security; Running Website
7.	**Search Engine Optimization** • Improving the overall user experience of a site (making your content easy forusers to find and engage with)-this will encourage repeat visits and links fromother sites, all of which increase search engine ranking. • Optimizing site architecture (the actual coding and design of a website) • Mobile friendly design –since the majority of users now view websites on aphone or other mobile device (opens in a new tab), Google rewards sites that are designedto be as easily viewed on a small screen as they are on desktop computer.
8.	**Mobile Application Development (Android and iOS Mobile Platforms)** • Android: Experience with Android SDK concepts, Android Studio etc. • iOS: Knowledge of Swift 3.0 programming language, Apple's Xcode IDE etc.
9.	**Knowledge on Advanced Technologies like Blockchain, Artificial Intelligence**

Syllabus and Sample List of Practical's for Skill Test for the Post of Programmer

S. N.	Syllabus for Skill Test
	A generalized practical skill test syllabus for a Web Developer that covers: 1. Front-end: HTML, CSS, JavaScript 2. Back-end: PHP, Node.js, ASP.NET 3. Databases: MySQL / MongoDB **Objective** To assess a candidate's ability to design, develop, and debug a full- stack web application using a combination of: 1. HTML, CSS 2. JavaScript 3. One or more back-end languages (PHP / Node.js / ASP.NET) 4. Relational and NoSQL databases (MySQL / MongoDB) 1. HTML & CSS a. Core Topics: i. Semantic HTML structure ii. Forms and validation (client-side) iii. Responsive design (media queries) iv. Flexbox & Grid layout v. Accessibility basics (alt text, ARIA labels) b. Practical Tasks: i. Create a multi-page website template with navigation. ii. Style using custom CSS (avoid frameworks in the test). iii. Build a responsive layout (e.g., 2-column layout that becomes single column on mobile). 2. JavaScript a. Core Topics: i. DOM manipulation ii. Event handling iii. ES6 syntax (let/const, arrow functions, template literals) iv. Fetch API / AJAX calls v. Basic form validation logic b. Practical Tasks: i. Implement interactive features (e.g., image carousel, accordion, etc,). ii. Validate form inputs in real-time. iii. Fetch JSON data and display dynamically. 3. Back-End Development a. Core Topics: i. Server setup and routing ii. CRUD operations iii. RESTful API development iv. Session management / authentication basics b. Practical Tasks: PHP: i. Create a form that saves submissions to MySQL.

	ii. Build a website to manage the sessions through PHP. Node.js: i. Set up Express server. ii. Create REST API endpoints to serve data and accept POST requests. ASP.NET: i. Develop an MVC project with at least 2 controllers. ii. Implement form submission and data persistence. 4. Database a. Core Topics: i. Data modelling CRUD operations ii. Writing queries (SELECT, INSERT, UPDATE, DELETE) iii. Indexing basics iv. Relationships (MySQL) / Collections & Documents (MongoDB) b. Practical Tasks: i. Create schema/table(s) ii. Populate sample data iii. Retrieve and display data via back-end API iv. Create Store Procedure or SQL Functions to perform specific task in MySQL 5. Topics mentioned in the Syllabus of Written Test for the Post Programmer
	Sample List of Practical's
1.	To find various kind of operations on the elements of an array like maximum / minimum /mean / median / k^{th} smallest or largest / duplicates etc.
2.	To convert a decimal number to an equivalent Roman number or vice versa, and extending to generalization.
3.	To perform various operations on strings like - for given two strings S1 and S2, check if S2 is a rotated version of the string S1.
4.	To perform various operations on arrays like rotations, shuffle, reverse, split etc.
5.	To print the matrix elements in various orders - row major, column major, spiral or any other pattern specified in the problem.
6.	To utilize the concepts of stacks for conversion of expressions into various forms like infix, postfix, prefix and solving the expressions.
7.	To utilize the binary tree concepts for various applications like Prefix tree codes, expression evaluation.
8.	To implement self-balancing search trees like AVL Tree, Red Black Tree, B-Tree etc.
9.	To implement n-ary tree data structures.
10.	To implement advanced forms of Heap data structure like Binomial Heap, Fibonacci Heap
11.	To perform the sorting using the advanced sorting algorithms like Radix Sort, Bucket Sort, Counting Sort, Shell Sort etc.
12.	To demonstrate the concept of the recursion and solve a problem based on it like finding the factorial or tower of Hanoi.
13.	To implement the read / write / update / append operations on a file.

14.	To process the homogeneous data collection and heterogeneous data collection for different operation like storing in file, searching the records, updating the records and converting the records from one format to another format.
15.	To implement the divide and conquer method.
16.	To perform the topological sorting in graphs.
17.	To find the maximal flow in graphs.
18.	To make the ER diagram for a database using the tables and relationships.
19.	To perform the simple query operations over the database.
20.	To perform various operations over the table like creating a table, deleting a table, updating a table etc.
21.	To implement the concepts of normalization in databases.
22.	To implement the object-oriented concepts like inheritance, polymorphism etc. using object-oriented programming.
23.	To implement the concept of objects and classes in object-oriented programming.
24.	To create a simple web page with different types of bullets, tables, alignments, font effects and rulers etc. through the programming constructs.
25.	To create web form for filling the various types of data and then sending the data through the programming constructs.
26.	To create simple web page using frames and different types of layouts techniques through the programming constructs.
27.	To create web pages that can execute different types of media files such as audio and video etc. through the programming constructs.
28.	To get the status of the networking system using the networking commands
29.	To get the details of the system configuration of a computer on a network.
30.	To find the issues in the network connectivity of a computer.
31.	To find and solve the issues in the windows security using firewall, antivirus and antimalware etc.
32.	To implement basic network security using cryptography techniques like Private and Public Key cryptography.
33.	Illustrate the setting and doing the configuration for the firewall using the networking-based system command.
34.	Configuring the network and setting the parameters of various systems on the network.
35.	Interpreting the results of the dump files for tracing the spammer and other phishing attacks.
36.	To implement the prototype of the digital signatures.
37.	To get the details of any user using the networking-based system commands.
38.	To get the details of the hard disk or any other drive usage by any user.

39.	To move the files and folders from one place to another place using the commands.
40.	To format an external device connected to the system using the commands.
41.	Making high level language-based tools for performing the day-to-day work.
42.	Creating the applications for the academic use in teaching using the programming language and tools.
43.	Creating the forms / tables / reports using the programming language which are based on the network / internet.
44.	To implement the various testing techniques.
45.	To estimate the software cost using the different techniques
46.	To implement the suitable software models for development.
47.	To implement the various phases of the development cycle.
48.	To implement various ways of Hashing and handling the collisions.
49.	To find the solution of various problems using Dynamic Programming Techniques.
50.	To find the solution of various problems using the Greedy approach.
51.	To find the solution of various problems using Branch and Bound strategy.
52.	To create a simple web page with different types of bullets, tables, alignments, font effects and rulers etc. through the programming constructs.
53.	To create web form for filling the various types of data and then sending the data through the programming constructs.
54.	To create simple web page using frames and different types of layouts techniques through the programming constructs.