Syllabus and Reference Links for Section I and II

Syllabus for Section I

- Money, measurement and relations
- Algebra
- Sequences and change
- Sets and Venn Diagrams
- Ratio and Proportion
- Volume and Surface Area
- Square Root and Cube Root
- Time and Work
- Approaching the problem using programmatic thinking techniques such as iteration, symbolic representation, and logical operations

Reference Books/Links for Section I

- Bible to Basic Mathematics by Pragati Agrawal, G.S.Publications
- Tricky Mathematics for General Competitions by R.K. Mishra, Competition Herald

Syllabus for Section II

1. Basic Programming Concepts - 20 Questions

- Variable declaration
- Basic syntax
- Data types and structures
  - String
  - Boolean (true or false)
  - Numbers, which includes integers (whole numbers from 1) and floating-point numbers (decimal-base)
  - Characters (includes single alphabets or numbers)
  - Arrays (a collection of data, usually of the same data type)
- Flow control structures
  - Sequential
  - Selection (conditionals)
  - Iteration (Loops).
- Functional programming
- Object-oriented programming
  - Inheritance
  - Polymorphism

    - Abstraction
    - Encapsulation
- Debugging

Resources

- https://www.aimt.edu.in/wp-content/uploads/2016/12/Basic-Programming.pdf
- https://www.educative.io/edpresso/what-are-the-basic-fundamental-concepts-of-programming
- https://chortle.ccsu.edu/java5/Notes/chap09A/ch09_3.html
- https://www.programiz.com/c-programming/list-all-keywords-c-language
- https://www.youtube.com/watch?v=zOjov-2OZ0E

2. Data Structure Concepts - 10 Questions

- Data structure Introduction
    - Complexity analysis
        - Time complexity
        - Space complexity
    - Bit manipulation
    - Recursion

- Array
    - 1-D arrays
    - Multi-Dimensional arrays

- Linked list
    - Singly linked list
    - Doubly linked list
    - Circular linked list
    - Circular doubly linked list

- Stack
    - Stack implementation by arrays and linked list

- Queue
    - Linear queue
    - circular queue
    - Priority queue
    - Dequeue
    - Array and linked list representation of queue

- Tree

- Binary tree
- Binary search tree
- AVL tree
- B tree
- B+ tree

- Graph
  - Implementation of graph
  - Dfs
  - Bfs
  - Minimum spanning tree

- Searching
  - Linear search
  - Binary search

- Sorting algorithms
  - Bubble sort
  - Insertion sort
  - Selection sort
  - Quick sort
  - Merge sort

Resources

- **Book**

- Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles by Narasimha Karumanchi

- **Videos**
  - Introduction of algorithm: https://youtu.be/S746R8hqNIo
- Data Structure: https://youtube.com/playlist?list=PLBlnK6fEyqRj9lld8sWIUNwlKfdUoPd1Y

- **Additional reference**
  - https://www.javatpoint.com/data-structure-tutorial
  - https://www.w3resource.com/java-exercises/basic/index.php

3. Database Concepts - 15 Questions

- Introduction to Database
- Database-System Applications

- Purpose of Database Systems
- Database Languages
  - Data-Manipulation Language
  - Data-Definition Language
  - Data control language
  - Transaction control language (TCL)

- Introduction to the Relational Model
  - Database Schema
  - Keys
  - Relational Query Languages

- Introduction to SQL
  - Overview of the SQL Query Language
  - SQL Data Definition
  - Basic Structure of SQL Queries
  - Additional Basic Operations
  - Set Operations
  - Null Values
  - Aggregate Functions
  - Nested Subqueries
  - Modification of the Database
  - Join Expressions
  - Views
  - Transactions
  - Integrity Constraints
  - SQL Data Types and Schemas
  - Accessing SQL From a Programming Language
  - Functions and Procedures
  - Triggers

- Database Design
  - The Entity-Relationship Model
  - Constraints
  - Normalization

- Transaction Management
  - Transaction Concept
  - ACID properties

- Overview of NoSQL Database (MongoDB)

Resources

- **Book**
  - DATABASE SYSTEM CONCEPTS by Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Sixth edition

- **DBMS tutorial**
  - https://www.w3schools.com/sql
  - https://www.javatpoint.com/dbms-tutorial

- **Mysql official docs**
  - https://docs.oracle.com/en-us/iaas/mysql-database/doc/getting-started.html
- Mongo Overview
  - https://www.tutorialspoint.com/mongodb/mongodb_overview.htm

4. Web Development Basics – 15 Questions

- Getting started with the Web
  Reference :
https://developer.mozilla.org/enUS/docs/Learn/Getting_started_with_the_web

- HTML
  - Multimedia And embedding
  - HTML Tables

Reference: https://developer.mozilla.org/en-US/docs/Learn/HTML

- CSS
  - Styling text
  - CSS layout
  - Box Model

Reference: https://developer.mozilla.org/en-US/docs/Learn/CSS

- Javascript
  - Client-side web API
  - Asynchronous Javascript
  - Events in Javascripts
  - Promises

Reference: https://developer.mozilla.org/en-US/docs/Learn/JavaScript

- Web Forms
  - Native form controls

- Styling forms
- Sending form data

Reference: https://developer.mozilla.org/en-US/docs/Learn/Forms

- Server Side website programming
- First Step

Reference: https://developer.mozilla.org/en-US/docs/Learn/Server-side

5. Software Development Life Cycle Basics – 5 Questions

- Software processes
- https://www.javatpoint.com/software-processes
- Software Development Life Cycle
- https://www.javatpoint.com/software-engineering-software-development-life-cycle
- SDLC Models
- Waterfall model
- Spiral model
- V-model
- Incremental model
- Agile model - Sprint

Reference : https://www.javatpoint.com/software-engineering-sdlc-models

6. Operating System Basics & Networking Basics – 5 Questions

- Introduction
  - What operating system do
  - Types of operating systems
  - Process and Program
- Process Management
  - Process concept
  - Concept of threads
  - Process and thread scheduling
  - Deadlocks
  - Inter-process communication
  - Environment Variables
- Memory management
  - Main memory and Registers
  - Logical addresses and physical addresses
  - Virtual-Memory Management

Reference : http://web.cse.ohio-state.edu/~soundarajan.1/courses/3430/silberschatz8thedition.pdf
https://jameskle.com/writes/operating-systems

Networking Basics

- TCP and UDP
    - Differences between TCP and UDP protocols

  Reference:
  https://www.geeksforgeeks.org/differences-between-tcp-and-udp/

- IP addressing
    - IPv4 and IPv6 address
      Reference:
      https://www.ibm.com/docs/en/ts3500-tape-library?topic=functionality-ipv4-ipv6-address-formats
    - Difference between private and public IP addresses
      Reference:
      https://www.geeksforgeeks.org/difference-between-private-and-public-ip-addresses/
    - Static IP vs. Dynamic IP
      Reference:
      https://www.educative.io/blog/static-ip-vs-dynamic-ip

- HTTP
  Reference:
  https://developer.mozilla.org/en-US/docs/Web/HTTP/Overview

- HTTP methods
  Reference:
  https://www.javatpoint.com/http-methods

- HTTPS
  https://www.cloudflare.com/learning/ssl/what-is-https/

- DNS
  https://www.cloudflare.com/en-in/learning/dns/what-is-dns/