

## 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://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](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](https://developer.mozilla.org/enUS/docs/Learn/Getting_started_with_the_web)
- HTML
  - Multimedia And embedding
  - HTML TablesReference: <https://developer.mozilla.org/en-US/docs/Learn/HTML>
- CSS
  - Styling text
  - CSS layout
  - Box ModelReference: <https://developer.mozilla.org/en-US/docs/Learn/CSS>
- Javascript
  - Client-side web API
  - Asynchronous Javascript
  - Events in Javascripts
  - PromisesReference: <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/>