

**SYLLABUS FOR TECHNICAL QUESTIONS IN COMPUTER
SCIENCE [100 Marks: 50 Questions]**

1. Digital Logic and Computer Organization

Digital Logic:

Logic gates, Boolean algebra and laws, Karnaugh maps, Combinational circuits (multiplexers, decoders, encoders, adders, subtractors), Sequential circuits (flip-flops, registers, counters), Minimization techniques, Digital components, State machines

Computer Arithmetic:

Number systems and conversions, Fixed-point representation, Floating-point representation, Error detection codes, Arithmetic algorithms (addition, subtraction, multiplication, division), Computer arithmetic operations

Computer Architecture:

Machine instructions and addressing modes, ALU organization, Data-path and control unit, Register organization, Register transfer language, Bus and memory transfers, Instruction formats, RISC vs CISC, Stack organization

Memory and I/O Systems:

Memory hierarchy (cache, main memory, virtual memory), Cache organization, Memory management hardware, Auxiliary memory, Associative memory, I/O interface (interrupt and DMA mode), Peripheral devices, Input-output programming

Advanced Architecture Concepts:

Instruction pipelining, Pipeline hazards (data, structural, control), Parallel processing, Vector processing, Array processors, Multiprocessors, Interconnection structures, Multicore processors

2. Programming and Data Structures

Programming Fundamentals (C):

Data types, Control structures, Functions, Arrays, Pointers, Structures, Unions, File handling, Command line arguments, Preprocessor directives, Recursion

Object-Oriented Programming:

Classes, Objects, Inheritance, Polymorphism, Encapsulation, Abstract classes, Constructors, Destructors, Virtual functions, Templates, Exception handling, Event handling

Data Structures:

Arrays (1D, 2D, sparse matrices), Stacks (array and linked implementations), Queues (simple, circular, priority), Linked lists (single, double, circular), Trees (binary, BST, binary heaps), Graphs (representation, traversal), Prefix codes, Tree traversals

Advanced Programming:

Web programming (HTML, DHTML, XML), Scripting, Java programming, Servlets, Applets, Multi-file programming, Stream handling, Event-driven programming

3. Algorithms and Complexity

Algorithm Analysis:

Asymptotic notation, Worst case time and space complexity, Performance analysis, Recurrence relations, Algorithm efficiency

Fundamental Algorithms:

Searching techniques, Sorting algorithms (comparison-based, linear), Hashing techniques, Pattern matching, String manipulation

Design Techniques:

Greedy algorithms, Dynamic programming, Divide-and-conquer, Backtracking, Branch and bound, Graph traversals (DFS, BFS)

Advanced Topics:

Minimum spanning trees, Shortest path algorithms, Network flow, String matching algorithms, NP-completeness, Approximation algorithms, Parallel algorithms

4. Theory of Computation and Compiler Design

Theory of Computation:

Regular expressions, Finite automata (DFA, NFA), Context-free grammars, Push-down automata, Regular and context-free languages, Pumping lemma, Turing machines, Undecidability

Lexical and Syntax Analysis:

Lexical analysis, Parsing techniques, Syntax-directed translation, Top-down parsing, Bottom-up parsing, LR parsers, LALR parsing

Semantic Analysis and Code Generation:

Runtime environments, Intermediate code generation, Code optimization, Local optimization, Data flow analyses, Constant propagation, Liveness analysis, Common subexpression elimination

5. Operating Systems

Process Management:

System calls, Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock (prevention, avoidance, detection), CPU scheduling algorithms

Memory Management:

Memory allocation, Virtual memory, Page replacement algorithms, Segmentation, Thrashing, Cache management, Working set model

Storage Management:

File systems, File organization, Directory structures, Secondary storage management, Disk scheduling, I/O systems, Device management

System Features:

Protection mechanisms, Security features, Virtual machines, Distributed systems, Linux operating system, Windows operating system

6. Database Management Systems

Database Concepts:

ER-model, Relational model, Relational algebra, Tuple calculus, SQL, Integrity constraints, Normal forms, Functional dependencies

Implementation Techniques:

File organization, Indexing (B and B+ trees), Query processing, Query optimization, Transaction processing, Concurrency control

Advanced Database Topics:

Recovery systems, Database security, Distributed databases, Object-oriented databases, Data warehousing, Data mining, Big data analytics, NoSQL systems

7. Computer Networks

Network Fundamentals:

Layering concepts, OSI and TCP/IP protocol stacks, Circuit switching, Packet switching, Virtual circuit switching, Network topologies

Data Link and Network Layer:

Framing, Error detection and correction, Flow control, MAC protocols, Bridging, IP addressing (IPv4, IPv6), Subnetting, CIDR, Routing protocols

Transport and Application Layer:

TCP/UDP protocols, Flow control, Congestion control, Socket programming, Application protocols (DNS, SMTP, HTTP, FTP)

Modern Networking:

Network security, Cryptography, Firewalls, Virtual private networks, Wireless networks, Mobile computing, Cloud computing, Internet of Things

8. Software Engineering and Project Management

Software Development:

Software process models, Requirements engineering, Software design, Design patterns, Testing methodologies, Quality assurance, Configuration management

Project Management:

Project planning, Cost estimation, Risk management, Project scheduling, Team management, Version control, Documentation

Quality and Standards:

Software quality factors, Quality control, Quality assurance, ISO standards, CMM levels, Software metrics, Process improvement

Test of Reasoning [15 Marks: 15 Questions]

Logical Reasoning

Statement and Conclusion, Statement and Assumptions, Statement and Arguments, Statement and Course of Action, Cause and Effect, Analytical Decision Making

Seating Arrangement

Circular Arrangement, Linear Arrangement (Single and Double Rows), Square and Rectangular Arrangements, Floor Puzzles, Box-Based Puzzles

Puzzles

Scheduling Puzzles, Blood Relations-Based Puzzles, Ranking and Order Puzzles, Age-Based Puzzles, Day/Month-Based Puzzles

Blood Relations

Family Tree and Relationship Chains, Coded Relationships.

Syllogisms

Categorical Syllogisms, Advanced Syllogisms (Reverse Syllogisms), Venn Diagram Applications in Syllogisms

Coding-Decoding

Alphanumeric Coding, Letter Coding, Number Coding, Symbol-Based Coding

Direction Sense Test

Cardinal Directions (North, South, East, West), Complex Directions with Turning and Distances

Quantitative Aptitude [15 Marks: 15 Questions]

Data Interpretation

- **Tabular Data Interpretation:** Interpretation of tables and data sets.
- **Line Graph:** Data representation and analysis using line graphs.
- **Bar Graph:** Interpretation of data presented in bar graphs.
- **Pie Chart:** Calculations based on data presented in pie charts.
- **Caselets:** Data interpretation with paragraph-based information.
- **Mixed Graphs:** Combining different types of graphs in a single question.
- **Radar Graph (Spider Web):** Less common but may appear.

Number Series

- **Missing Number Series:** Finding the missing term in a given series.
- **Wrong Number Series:** Identifying the incorrect term in a series.

Simplification and Approximation

- Questions based on basic mathematical operations to simplify expressions.
- Approximation questions require choosing the closest answer.

Quadratic Equations

- Solving quadratic equations to find roots.
- Comparison of roots between two quadratic equations.

Data Sufficiency

- Problems with multiple statements where you determine if the given data is sufficient to answer the question.

Arithmetic Topics

- **Percentages:** Basic calculations, profit and loss, and discounts.
- **Ratio and Proportion:** Problems based on direct and inverse proportions.
- **Average:** Calculating averages for different scenarios.
- **Simple Interest and Compound Interest:** Interest calculations over time.
- **Profit and Loss:** Calculation of gains, losses, and discounts.
- **Time and Work:** Problems involving work completion, efficiency, and combined efforts.
- **Time, Speed, and Distance:** Calculations with speed, distance, and time; includes boats and trains.
- **Mixtures and Alligations:** Mixing solutions, costs, and ratios.
- **Mensuration:** Basic geometry, areas, volumes of shapes, and perimeters.
- **Partnerships:** Sharing profits based on investments.
- **Probability:** Basic probability calculations and event outcomes.
- **Permutation and Combination:** Arrangement and selection problems.

Mathematical Inequalities

- Problems requiring the comparison of quantities using inequalities.

Miscellaneous Word Problems

- These cover real-life scenarios and test conceptual understanding.

General Awareness [15 Marks: 15 Questions]

Current Affairs

- Recent events of national and international importance
- Awards and Honors (Padma Awards, Nobel Prizes, etc.)
- Sports (major tournaments, winners, records)
- Government schemes and policies
- Important Summits and Conferences
- Economic and Banking Awareness (recent developments in banking and finance)
- Important Days and Themes

Indian History

- **Ancient History:** Indus Valley Civilization, Vedic Period, Maurya and Gupta Empires
- **Medieval History:** Delhi Sultanate, Mughal Empire, Bhakti and Sufi Movements
- **Modern History:** British Rule, Revolt of 1857, Indian National Movement, Independence

Geography

- **Physical Geography:** Landforms, Atmosphere, Climate, and Natural Vegetation
- **Indian Geography:** Rivers, Mountains, Plateaus, Deserts, Soil, Forests
- **World Geography:** Continents, Countries, Capitals, and prominent physical features

Indian Polity and Constitution

- **Constitutional Framework:** Preamble, Fundamental Rights and Duties, Directive Principles
- **Union and State Government:** Structure, Roles, and Functions of Executive, Legislature, and Judiciary
- **Important Amendments and Articles:** Key constitutional amendments and articles
- **Political System:** Panchayati Raj, Election Commission, Local Governance

Economics and Finance

- **Basic Concepts:** Micro and Macro Economics, Demand and Supply, National Income
- **Indian Economy:** Economic Reforms, Planning in India, Economic Terminology
- **Banking and Finance:** RBI, Money Market, Inflation, Economic Policies
- **Budget and Fiscal Policies:** Key points from the Union Budget and Economic Surveys

Science and Technology

- **Biology:** Human Body, Health and Diseases, Important Biological Terms
- **Chemistry:** Basics of Elements and Compounds, Acids and Bases, Metals and Non-Metals
- **Physics:** Laws of Motion, Work and Energy, Heat, Light, Sound, Electricity and Magnetism
- **Computer Awareness:** Basic terminology, Networking, Internet, Hardware and Software
- **Inventions and Discoveries:** Key scientific and technological developments

Environment and Ecology

- **Ecological Concepts:** Biodiversity, Conservation, Ecosystem, Food Chain
- **Environmental Issues:** Pollution, Climate Change, Global Warming, Renewable and Non-Renewable Resources
- **Important Organizations and Conventions:** UNEP, Kyoto Protocol, Paris Agreement

General Knowledge

- **Important Dams, Rivers, and National Parks**
- **Important Organizations:** UN, WHO, WTO, IMF, World Bank

- **Space Research:** Recent developments in ISRO, NASA, and space missions.

English Language [15 Marks: 15 Questions]

Reading Comprehension

- Passage comprehension with questions on main ideas, themes, and details
- Inference-based questions
- Vocabulary questions (synonyms, antonyms) based on the passage
- Tone of the passage

Grammar and Vocabulary

- **Error Spotting:** Identifying grammatical errors in sentences
- **Sentence Correction:** Correcting grammatically incorrect sentences
- **Fill in the Blanks:** Choosing the right words to complete sentences (single and double fill-in-the-blanks)
- **Cloze Test:** Passage with blanks where you choose the most suitable word for each blank
- **Phrase Replacement:** Replacing phrases in sentences to make them grammatically correct

Sentence Rearrangement (Para Jumbles)

- Arranging jumbled sentences in the correct order to form a coherent paragraph
- Identifying the correct opening and closing sentences in a set of jumbled sentences

Synonyms and Antonyms

- Questions based on commonly used synonyms and antonyms
- Word replacement questions to test vocabulary strength

Idioms and Phrases

- Understanding and applying the meaning of commonly used idioms and phrases
- Questions based on idiomatic usage in sentences

Word Association and Usage

- **Word Pairing:** Identifying relationships between pairs of words
- **Homonyms and Homophones:** Recognizing words that sound similar but have different meanings
- **Spell Check:** Questions based on identifying misspelled words

Sentence Completion and Paragraph Completion

- Choosing the most appropriate sentence or word to complete a paragraph
- Filling gaps in sentences to make logical and grammatically correct statements

Verbal Ability

- Questions based on verbal reasoning and critical thinking
- Questions on understanding of sentence meaning and logical progression