All candidates will be tested on the foundational aspects of computer science, its core subjects, programming ability, and specific topics related to the intended areas of interest.

The foundational topics belongs to the following subjects (GATE level): Data Structures, Algorithms (including Graphs), Discrete Mathematics, Probability, Databases, Operating System, Computer Networks.

The students will also tested for their programming ability. Every student is expected to be able to write simple 50-line programs (for example, performing linear algebraic operations on a matrix, implementing sorting algorithms, solving string-based problems).

Apart from the above, students may be asked advanced questions based on the areas that they show interest in. The area-wise topics are listed below.

| **Area of interest** | **Additional topics based on the area of interest** |
|---|---|
| Distributed Computing | OS, Computer Architecture, C/C++ Programming |
| Machine Learning | Statistics (A/B testing, distributions), Machine Learning (overfitting / underfitting, linear & logistic regression, decision trees) |
| Algorithms, Theoretical Computer Science, Graph Theory, Computational Geometry, Quantum Computing | **Specific topics in algorithms and data structures:** Basics of algorithms including sorting, searching, Knowledge of Binary Search Tree, Stacks, Queues, Linked List, divide and conquer, dynamic programming, basic graph algorithms.<br>**Specific topics in basic discrete maths:** Recurrence, induction, relations and functions, permutations and combinations including counting techniques, graph theory.<br>**Specific topics in mathematics:** Topics usually covered during XI-XII & UG curriculum, including probability, linear algebra, algebra, calculus.<br>**Specific topics in formal language and automata theory:** Regular languages, finite automata, context free languages, context free grammar. |
| Computer Networks | Basic network utilities like ping, traceroute, ssh, etc., Computer networks (networking stack (TCP/IP), networking protocols, routing algorithms, congestion control, networking delays, etc), OS (processes/threads, multithreading, scheduling, etc), DSA (time/space complexity, etc), DBMS (serializability, fault tolerance, etc.) |
| Human-Computer Interaction | Statistics, Programming - mobile/web systems (publisher-subscriber model, etc.), concepts related to design thinking, qualitative research methods |
| Speech and Audio Processing, | Linear Algebra, Signals and systems or DSP basics, Fourier Transform, ML or DL basics, Speech (Linear Prediction, MFCC, GMMs), NLP basics. |
| Machine learning | Linear Algebra, Statistics, programming in C/C++ |
| Computer Graphics | Linear algebra, Computer graphics, Computational geometry, C/C++ programming |
| Databases and Data Science | Linear Algebra, Statistics, DBMS (serializability, fault tolerance, etc.) |
| Natural Language Processing | NLP (n-gram language models), ML & DL basics / Speech (MFCC, GMMs) |
| Program analysis, Compilers | Compilers, Programming ability in C/C++/Java, Data structures and algorithms |

| | |
|---|---|
| Multimedia and Computer Vision | Linear Algebra, Image Processing, Machine Learning basics (overfitting/underfitting), Deep Learning basics (CNNs) |
| Cybersecurity, Privacy and Anonymity | Computer Networks, operating systems, C/C++ programming |
| Operating System | OS, Programming ability in C/C++/Java, Data structures and algorithms, Computer architecture |
| Autonomous Driving | C/C++ programming, Data Structures & Algorithms, Probability & Statistics, Linear Algebra |
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