Syllabus for the interview

We are planning to have an online interview where the candidate will be evaluated over the fundamentals of Computer Science to begin with (you may find the topics below for reference). Further, there will be another round of interview where the candidate's potential to do research in the so-communicated area will be evaluated. A follow-up email from the department will ask you to share *a research proposal statement* briefing your plan for your research career ahead at IIT Goa.

The topics in brief, for the first round, are as follows.

a. Data Structures & Algorithms

Fundamentals of Algorithm analysis using Big-O notation — Stacks, Queues & Linked Lists — Graphs & Trees — Binary Search Trees — BFS & DFS — Shortest Path Algorithms — Searching & Sorting Algorithms — Greedy Algorithms — Dynamic Programming

b. Linear Algebra Fundamentals

Solving system of linear equations — Matrices — Eigen values & Eigen vectors — Linear Transformations — Vector spaces — Bases

c. Discrete & Combinatorial Mathematics

Permutations and combinations - Fundamentals of boolean logic - Set theory, relations & functions - Probability theory - Graph theory - Finite state machines

d. Digital Systems Design

Binary numbers - Number base conversions - Normal forms - Combinational circuits - Adder - Comparator - Encoder & Decoder - Mux and Demux - Counters & Shift registers

e. Basics of C/C++ programming language

You may rely on the following books to prepare yourself for the preliminary selection

1. Data Structures, Algorithms and Applications in C++ *by Sartaj Sahni*
2. The C Programming Language *by Brian Kernighan and Dennis Ritchie*
3. Digital Design *by M. Morris Mano & Michael D. Ciletti*
4. Discrete and Combinatorial Mathematics *by Ralph P. Grimaldi*
5. Introduction to Linear Algebra *by Gilbert Strang*