STEMS 2025
Computer Science Syllabus

Section A

- Combinatorics(Counting, Recursion, etc)
- Graph Theory
- Elementary Number Theory
- Elementary Probability
- Basics of Algorithms(sorting, searching, bitwise operators, etc)
- Algorithmic reasoning and analysis

The focus will be on the following aspects:
- Systematically following, simulating, and reasoning about sets of instructions, protocols, structures, etc.
- Understanding the correctness of algorithms
- Assessing performance of algorithms
- Reasoning about discrete structures
- Reasoning about combinatorial games
- Understanding implications of logical statements

Section B

- Algorithms:
  - Graph algorithms (connectivity, spanning trees, matchings, flows etc.)
  - Number-theoretic algorithms (primality testing, factorization etc.)
  - Computational geometry
  - Divide and conquer, dynamic programming, greedy algorithms, and other common techniques.
  - Basic running time analysis
- Theory of Computation:
  - DFA/NFA and regular languages
  - Context-free grammars and pushdown automata
  - Turing machines / Oracle Turing machines
- Mathematics:
  - Graph theory
  - Enumerative combinatorics
  - Probability
  - Linear Algebra and its applications to combinatorics

The focus will be on the following aspects:
- Comprehensive understanding of algorithms and algorithmic paradigms such as greedy algorithms, dynamic programming, divide & conquer, and introductory graph algorithms. A preliminary knowledge of analysis of these algorithms is essential.
- Understanding of data structures and various discrete structures such as graphs, trees, heaps, stacks, and queues.

- An understanding of finite state machines, pushdown automata, and Turing machines, along with their properties and representations including grammars and computation models.