Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2024-2025
Course Handout – Part II

Date: 25-7-2024

In addition to Part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course Number	: *CS F222*
Course Title	: Discrete Structures for Computer Science
Instructor-in-Charge	: Prof. Venkatakrishnan Ramaswamy
Instructors	: Prof. N.L. Bhanu Murthy, Prof. Apurba Das, Mr. Suchit Bhai Patel, TBA.

Scope and Objectives of the Course:

Several areas of contemporary Computer Science have mathematical underpinnings, and therefore it is important to deeply understand the underlying mathematics to have a firm footing in them. This course introduces discrete mathematical structures that are used in topics such as Data Structures & Algorithms, Database Systems, Theory of Computation, Compilers, Cryptography, Operating Systems and indeed aspects of Deep Learning, more recently. In addition to learning about specific discrete mathematical structures, such as Sets, Relations, Functions, Graphs and so on, there will also be emphasis on formally reasoning with them, via the act of formulating and writing formal mathematical proofs. A related goal is to build what has been called *mathematical maturity*, which is the ability to think clearly and work in abstract mathematical terms and relate it to real-world situations. Building such ability is a core goal of any undergraduate Computer Science curriculum.

In particular, the objectives of the course are:

- Build mathematical foundations necessary for a deep understanding of several topics in Computer Science.
- Develop the ability to reason mathematically, understand, and write correct formal mathematical proofs.
- Understand commonly used discrete mathematical structures in Computer Science
- Understand advanced counting techniques and build the ability to correctly apply them.

Cour⊞ Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-6	To be familiar with basic techniques for writing proofs	Basics of propositional logic, conditionals, predicates and quantifiers, Introduction to Proofs, Proof Methods, and Strategy	1
7-9	To understand basic notions of sets, their cardinality, and functions	Sets and basic operations on Sets, Functions, Cardinality of Sets	2
10-14	To understand notions of relations	Relations, Equivalence Relations, partial orderings	9
15-20	To understand basics of graph theory	Graphs, graph representations, subgraphs, graph isomorphism, Euler and Hamilton paths, planar graphs, graph coloring.	10
21-24	To understand trees and spanning trees	Trees, Spanning Trees, Minimum Spanning Trees.	11
25-28	To understand rudimentary number theory & its application to cryptography	Number Theory & Cryptography	4
29-30	To understand the basics of counting, the pigeonhole principle, and its generalizations	Counting, Pigeonhole Principle and basics of Ramsey Theory	6
31-33	To be able to write proofs using mathematical induction	Mathematical Induction & Strong Induction	5
34-36	To be able to use certain advanced counting techniques	Advanced counting: Recurrence relations, generating functions, Inclusion-exclusion principle,	8
37-40	To understand basic Group Theory	Basics of group theory	R1: 11

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Quiz 1 (pre-midsem)	30 minutes	10%	TBA	Closed Book
Mid-Semester Test	90 minutes	30%	As announced in the Time Table	Closed Book
Quiz 2	30 minutes	10%	TBA	Open Book – Textbook only
Programming Assignment	Take-home	10%	TBA	Open Book
Comprehensive Exam	3 hours	40%	As announced in the Time Table	Closed Book