NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	BTech CSE, Integrated BTech (CSE)-MBA, BTech AI&ML
Course Code:	2CS802CC25
Course Title:	Mathematical Foundations for Computer Science
Course Type:	Core
Year of Introduction:	2025-26

L	T	Practical Component				C
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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to –
1. define preliminaries of discrete mathematics, concepts of sets, graphs, digraphs and trees (BL1)
2. identify properties of relations, functions, equivalence, partial order relations, and recurrence relations (BL2)
3. apply proof techniques, mathematical induction, and recurrence techniques (BL3)
4. examine logical propositions and algebraic structures. (BL4)

Unit	Contents	Teaching Hours (Total 30)
Unit-I	**Basic concepts of Discrete Mathematics:** Sets, Set Operations, Functions and their types, Sequences and Summations, Cardinality of Sets, Relations and their Properties, n-ary Relations and their applications, Closures of Relations, Equivalence Relations, Partial Orderings, Pigeon-hole principle, the principle of inclusion and exclusion	08
Unit-II	**Propositional Logic:** syntax, semantics, validity and satisfiability, basic connectives and truth tables, Applications of Propositional Logics, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Normal forms (CNF, DNF)	07
Unit-III	**Proof Techniques:** proof methods and strategies, direct proof, indirect proof (proof by contraposition), proof by contradiction, principles of mathematical induction, strong induction, the well-ordering principle	04
Unit-IV	**Algebraic Structures:** Introductions to groups, Examples of groups, basic algebra in groups, the order of group elements, cyclic groups and subgroups, cyclic groups, introduction to rings and fields	03
Unit-V	**Recurrence Relations:** Introduction to recurrence relations, Applications of Recurrence Relations, Solving linear homogeneous and non-homogeneous recurrence relations	03
Unit-VI	**Graphs:** Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Planar Graphs, Graph Coloring
Trees: Introduction to Trees, Applications of Trees, Spanning Trees, Minimum Spanning Trees, and its applications.	05

Self-Study:
The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:
1. C. L. Liu, Elements of Discrete Mathematics, McGraw Hill
2. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw Hill
3. Norman L. Biggs, Discrete Mathematics, Oxford Press
4. Tremblay, J.P. & Manohar, Discrete mathematical structures with application to computer science, McGraw Hill
5. Susanna S. Epp, Discrete Mathematics with Applications, Wadsworth Publishing.