DISCRETE MATHEMATICAL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)
SEMESTER – III

Subject Code	**15CS36**	**IA Marks**	**20**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**80**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to

- Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science.
- Understand and apply logic, relations, functions, basic set theory, countability and counting arguments, proof techniques,
- Understand and apply mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory
- Understand and apply graph theory and mathematical proof techniques.

Module -1	**Teaching Hours**
Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems, **Textbook 1: Ch 2**	**10Hours**
Module -2	
Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. **Fundamental Principles of Counting:** The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, **Textbook 1: Ch 4: 4.1, 4.2 Ch 1.**	**10 Hours**
Module – 3	
Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. **Properties of Relations**, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. **Textbook 1: Ch 5:5.1 to 5.3, 5.5, 5.6, Ch 7:7.1 to 7.4**	**10 Hours**
Module-4	

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. **Recurrence Relations:** First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. **Textbook 1: Ch 8: 8.1 to 8.4, Ch 10:10.1 to 10.2**	**10 Hours**
Module-5	
Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , **Trees**: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes **Textbook 1: Ch 11: 11.1 to 11.3, Ch 12: 12.1 to 12.4**	**10 Hours**

Course outcomes:

After studying this course, students will be able to:

1. Verify the correctness of an argument using propositional and predicate logic and truth tables.
2. Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
3. Solve problems involving recurrence relations and generating functions.
4. Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases, and mathematical induction.
5. Explain and differentiate graphs and trees

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Conduct Investigations of Complex Problems

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004.

Reference Books:

1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.