Mathematics Paper I
Discrete Mathematics
[CORE COURSE]

Semester: I	Credits: 2	Subject Code: BS12003	Lectures: 40

Course Outcomes:

At the end of this course, the learner will be able to:

- Demonstrate the skills of mathematical reasoning: Deduction, Proof and Recursive Thinking.
- Write an argument using logical notation and determine if the argument is or is not valid.
- Prove mathematical theorems using the Principles of Mathematical Induction.
- Construct a solid foundation in some of the new and different branches of Mathematics like Logic, Set Theory and Lattices.
- Distinguish among various counting principles and apply them accordingly.
- Determine properties of relations, identify equivalence and partial order relations, sketch relations.
- Know and understand the wide nature of the subject through various mathematical skills and techniques and apply them in different disciplines.
- Inculcate a positive attitude towards Mathematics and enjoy triumph of solving interesting problems from different areas of the subject.

Unit 1: Mathematical Induction	**4**
• **Mathematical Induction** o First Principle of Mathematical Induction o Second Principle of Mathematical Induction o Related Problems	

Unit 2: Logic	**7**
• Revision o Propositional Logic o Propositional Equivalences • Predicates and Quantifiers o Predicate, n-Place Predicate or n-ary Predicate o Quantification and Quantifiers - Universal Quantifier and Existential Quantifier • Rules of Inference o Argument in propositional Logic o Rules of Inference for Propositional Logic o Constructing Arguments o Validity of Argument using Direct and Indirect method	
Unit 3: Counting Principles	**9**

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• Cardinality of Set o Cardinality of a finite set • Basics of Counting o The Product Rule o The Sum Rule o The Inclusion- Exclusion Principle(with proof – for 2 sets and 3 sets) • The Pigeonhole Principle o Statement o The Generalized Pigeonhole Principle and its Applications • Problems based on all above mentioned Principles • Problems based on o Permutations & Combinations o Permutations with repetition & without repetition. o Combinations with repetition & without repetition.	

Unit 4: Lattices and Boolean Algebra	**12**
• Relations o Definition o Types of relations o Equivalence relations o Digraphs of relations, matrix representation and composition of relations. o Transitive closure and Warshall's Algorithm • Partial Order Relations o Definition o Poset o Hasse diagram • Lattices o Definition and terminologies o Properties of Lattices o Types of Lattices: Complemented Lattice, Bounded Lattice and Distributive Lattice • Boolean Algebra o Introduction to Boolean Variable and Boolean Function o Boolean Identities o Definition of Boolean Algebra o Representation of Boolean Functions: Minterm, Maxterm, Disjunctive Normal Form and Conjunctive Normal Form	

Unit 5: Recurrence Relations	**8**
• Recurrence Relations o Introduction and Formation o Linear Recurrence Relations with constant coefficients o Homogeneous Solution	

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○ Particular Solution ○ Total solution	

Reference Books:
• Kolman, Busby, Rehman, *Discrete Mathematical Structures*, Prentice Hall • C. L. Liu, *Elements of Discrete Mathematics*, Tata McGrawHill

E-Resources:
• https://www.tutorialspoint.com/discrete_mathematics/index.htm for Unit 1 to Unit 5 • https://nptel.ac.in • https://swayam.gov.in

Recommended Text Books:
• Kenneth Rosen, *Discrete Mathematics and its applications,* Tata McGraw Hill, Seventh Edition.

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Chairperson (HOD)	Ms. Gitanjali Phadnis	G.M.Phadnis 01/8/2020	
Faculty	Ms. Vrushali Paranjpe		1/8/2020
Subject Expert (Outside SPPU)	Dr. Machchhindra Gophane	1/8/2020	
Subject Expert (Outside SPPU)	Dr. Prashant Malavadkar		01-08-2020
VC Nominee	Dr. Vinayak Joshi	1/8/2020	
Industry Expert	Mr. Anup Manakeshwar		01-08-2020
Alumni	Ms.Jyoti Sharma	01/08/2020	

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