



**Mathematics Paper I**  
**Discrete Mathematics**  
**[CORE COURSE]**

<b>Semester: I</b>	<b>Credits: 2</b>	<b>Subject Code: BS12003</b>	<b>Lectures: 40</b>
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**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.

<b>Unit 1: Mathematical Induction</b>	<b>4</b>
<ul style="list-style-type: none"> <li>• <b>Mathematical Induction</b> <ul style="list-style-type: none"> <li>○ First Principle of Mathematical Induction</li> <li>○ Second Principle of Mathematical Induction</li> <li>○ Related Problems</li> </ul> </li> </ul>	

<b>Unit 2: Logic</b>	<b>7</b>
<ul style="list-style-type: none"> <li>• Revision <ul style="list-style-type: none"> <li>○ Propositional Logic</li> <li>○ Propositional Equivalences</li> </ul> </li> <li>• Predicates and Quantifiers <ul style="list-style-type: none"> <li>○ Predicate, n-Place Predicate or n-ary Predicate</li> <li>○ Quantification and Quantifiers - Universal Quantifier and Existential Quantifier</li> </ul> </li> <li>• Rules of Inference <ul style="list-style-type: none"> <li>○ Argument in propositional Logic</li> <li>○ Rules of Inference for Propositional Logic</li> <li>○ Constructing Arguments</li> <li>○ Validity of Argument using Direct and Indirect method</li> </ul> </li> </ul>	

<b>Unit 3: Counting Principles</b>	<b>9</b>
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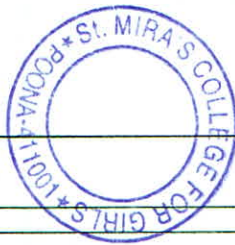


<ul style="list-style-type: none"> <li>• Cardinality of Set             <ul style="list-style-type: none"> <li>○ Cardinality of a finite set</li> </ul> </li> <li>• Basics of Counting             <ul style="list-style-type: none"> <li>○ The Product Rule</li> <li>○ The Sum Rule</li> <li>○ The Inclusion- Exclusion Principle(with proof – for 2 sets and 3 sets)</li> </ul> </li> <li>• The Pigeonhole Principle             <ul style="list-style-type: none"> <li>○ Statement</li> <li>○ The Generalized Pigeonhole Principle and its Applications</li> </ul> </li> <li>• Problems based on all above mentioned Principles</li> <li>• Problems based on             <ul style="list-style-type: none"> <li>○ Permutations &amp; Combinations</li> <li>○ Permutations with repetition &amp; without repetition.</li> <li>○ Combinations with repetition &amp; without repetition.</li> </ul> </li> </ul>	
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<b>Unit 4: Lattices and Boolean Algebra</b>	<b>12</b>
<ul style="list-style-type: none"> <li>• Relations             <ul style="list-style-type: none"> <li>○ Definition</li> <li>○ Types of relations</li> <li>○ Equivalence relations</li> <li>○ Digraphs of relations, matrix representation and composition of relations.</li> <li>○ Transitive closure and Warshall's Algorithm</li> </ul> </li> <li>• Partial Order Relations             <ul style="list-style-type: none"> <li>○ Definition</li> <li>○ Poset</li> <li>○ Hasse diagram</li> </ul> </li> <li>• Lattices             <ul style="list-style-type: none"> <li>○ Definition and terminologies</li> <li>○ Properties of Lattices</li> <li>○ Types of Lattices: Complemented Lattice, Bounded Lattice and Distributive Lattice</li> </ul> </li> <li>• Boolean Algebra             <ul style="list-style-type: none"> <li>○ Introduction to Boolean Variable and Boolean Function</li> <li>○ Boolean Identities</li> <li>○ Definition of Boolean Algebra</li> <li>○ Representation of Boolean Functions: Minterm, Maxterm, Disjunctive Normal Form and Conjunctive Normal Form</li> </ul> </li> </ul>	

<b>Unit 5: Recurrence Relations</b>	<b>8</b>
<ul style="list-style-type: none"> <li>• Recurrence Relations             <ul style="list-style-type: none"> <li>○ Introduction and Formation</li> <li>○ Linear Recurrence Relations with constant coefficients</li> <li>○ Homogeneous Solution</li> </ul> </li> </ul>	

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<ul style="list-style-type: none"> <li>○ Particular Solution</li> <li>○ Total solution</li> </ul>	
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**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](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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VC Nominee	Dr. Vinayak Joshi	<i>V Joshi</i> 11/8/2020	
Industry Expert	Mr. Anup Manakeshwar		<i>Anup Manakeshwar</i> 01-08-2020
Alumni	Ms. Jyoti Sharma	<i>Jyoti</i> 01/08/2020	

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