**Discrete mathematics & graph theory**

| Lecture | Tutorial | Practical | Self Study | Credit | Subject Type |
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| Course Type | Course Category | Mode of Assessment | Mode of Delivery |
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| Program Core | Graded (GR) | Theory Examination (ET) | Theory (TH) |

**Course Objectives**

**Introduce the concepts of mathematical logic and gain knowledge in sets, relations and functions and Solve problems using counting techniques and combinatorics and to introduce generating functions and recurrence relations. Use Graph Theory for solving real world problems.**

**Course Outcomes**

**After completion of the course, students will be able to**

| CO1 | Apply mathematical logic to solve problems |
| --- | --- |
| CO2 | Understand the concepts and perform the operations related to sets, relations and functions. |
| CO3 | Gain the conceptual background needed and identify structures of algebraic nature. |
| Co4 | Apply basic counting techniques to solve combinatorial problems. |
| Co5 | Apply Graph Theory in solving computer science problems |

| **Unit 1** | **20 Hours** |
| --- | --- |
| **Chapter 1.1** | **Mathematical Logic** Introduction, Statements and Notation, Connectives, Basic logical operation, truth tables, Tautologies, Contradictions, Algebra of Proposition, logical implications, logical Equivalence, Normal Forms, Functionally complete set of connectives |
| **Chapter 1.2** | Inference Theory of Statement Calculus, Predicate Calculus. Pigeon hole principle and its application. |
| **Unit 2** | **20 Hours** |
| **Chapter 2.1** | **Basic Structure**: Introduction to set theory, Set operations, Algebra of sets, Combination of sets, Finite and Infinite sets, Cardinality of sets,  Classes of sets, Powersets, Cartesian product, Principles of inclusion & exclusion. |
| **Chapter 2.2** | **Relations and functions**: Binary relations, types of relations, equivalence relations and partitions, partial order relations, functions and its types, composition of function and relations, inverse of relations and functions |

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| **Chapter 2.3** | **Algebraic structures**: Definition, elementary properties of algebraic structures, semi group, monoid, group, homomorphism, isomorphism and automorphism , subgroups, normal subgroups, cyclic groups. | |
| **Unit 3** |  | **20 Hours** |
| **Chapter 3.1** | **Graph Theory** : Introduction to graphs, directed and undirected graphs, homomorphism and isomorphic graphs, sub graphs multi graphs and weighted graphs, paths and circuits, , Eulerian paths and circuits, Hamiltonian paths and circuits, planer graphs Euler's formula,  Chromatic numbers (Coloring problems). graph traversal, Basics of Counting, Combinations and Permutations | |
| **Chapter 3.2** | **Trees**: Trees and Rooted Trees, Spanning Trees, Directed Trees, prefix codes, tree traversal. shortest path in weighted graphs | |
| **Chapter 3.3** | **Boolean algebra:** Boolean expression, representation & minimization of Boolean function | |

| CO1 | Apply mathematical logic to solve problems |
| --- | --- |
| CO2 | •Understand the concepts and perform the operations related to sets, relations and functions. |
| CO3 | •Gain the conceptual background needed and identify structures of algebraic nature. |
| Co4 | •Apply basic counting techniques to solve combinatorial problems. |
| Co5 | •Apply Graph Theory in solving computer science problems |

**Text Books**

1.Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.

2.J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.

3.C.L. Liu “Elements of Discrete Mathematics". McGraw Hill, 3rd Edition

**Reference Books**

1.Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.

2.Graph Theory with Applications to Engineering and Computer SciencebyNarsinghDeo.