

NATIONAL INSTITUTE OF TECHNOLOGY, JAMSHEDPUR
JHARKHAND-831014
Department of Mathematics

Autumn Semester 2019-2020

SEMESTER-I

Course Handout

Date: 23/07/2019

Course code : **MH31101**
Course title : **Mathematical Foundation of Computer Applications** **Credit-4(3-1-0)**
Instructor In-charge : **Dr. Snehasis Kundu**

Course Description

Sets, relations and function: Brief description of basic operations on sets, Cartesian products, disjoint union, and power of sets, arbitrary union, intersection and product. Finite and Infinite sets, countable and uncountable, Cantor's diagonal argument and power set theorem. Principle of mathematical induction. Introduction to recurrence relation, generating function.

Propositional Logic: Syntax and semantics, satisfiability, validity, completeness, deduction theorem etc. Decision problem of propositional logic, Introduction to first order logic. Predicate logic. Rules of inferences and its applications.

Partially ordered set: Complete partial ordering, chain, lattice, complete, bounded, distributive, complemented lattices. Hasse diagram, Boolean and pseudo Boolean lattices. Different sub-lattice, morphisms, isomorphic posets and lattices.

Introduction to Counting: Basic counting techniques, inclusion and exclusion principle, pigeon hole principle, Polya's counting theorem, permutation, combination, summation.

Graph theory: Graphs and their basic properties, degree, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk & graph. Coloring, planar graph, trees with applications. Shortest path problems, Network flow problems.

Algebraic structures: Algebraic structures with one binary operations – group, semigroup, monoid. Congruence relation and quotient structures. Morphisms. Cyclic groups, Abelian groups, Permutation groups. Algebraic structures with two binary operations, Concept of Ring and Field. Boolean Algebra.

Objectives

- ❖ To develop skills so that student might be able to handle problems arising in Engineering disciplines
- ❖ To strengthen fields like complex analysis to solve different problems arising in Computer science discipline
- ❖ To learn the mathematical foundations applicable to computing.

Course Outcome: Students will be able to

- ❖ Explain functions and related concepts and illustrate its direct application in Computer languages
- ❖ Solve problems using the concepts of Graphs and Trees
- ❖ Deduce complex task by various Mathematical Logic and solve recurrence relations for a given problem

Text Books (Also in Syllabus)

- A. Discrete Mathematics & its applications by K. H. Rosen (Tata McGraw Hill publications, 6th edition)
- B. Elements of Discrete Mathematics 4e by C L Liu & D P Mahapatra (Mc Graw Hill Education, 4th ed.)

Reference Books

- C. Discrete Mathematics by S. Lipshutz & M. Lipson (Tata McGraw Hill)

➤ **Course Plan:**

Lecture No	Learning objectives	Book reference
1-12	Sets, relations and function: Brief description of basic operations on sets, Cartesian products, disjoint union, and power of sets, arbitrary union, intersection and product. Finite and Infinite sets, countable and uncountable, Cantor's diagonal argument and power set theorem. Principle of mathematical induction. Introduction to recurrence relation, generating function.	Chapter 2 4 & 6
13~18	Propositional Logic: Syntex and semanties, satisfiability, validity, completeness, deduction theorem etc. Decision problem of propositional logic, Introduction to first order logic. Predicate logic. Rules of inferences and its applications.	Chapter 1
19~22	Partially ordered set: Complete partial ordering, chain, lattice, complete, bounded, distributive, complemented lattices. Hasse diagram, Boolean and pseudo Boolean lattices. Different sub-lattice, morphisms, isomorphic posets and lattices.	Chapter 7
23~26	Introduction to Counting: Basic counting techniques, inclusion and exclusion principle, pigeon hole principle, permutation, combination, summation.	Chapter 5
27~35	Graph theory: Graphs and their basic properties, degree, paths, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk & graph. Coloring, planar graph, trees.	Chapter 8
36~40	Algebraic structures: Algebraic structures with one binary operations – group, semigroup, monoid. Congruence relation and quotient structures. Morphisms. Cyclic groups, Abelian groups, Permutation groups. Algebraic structures with two binary operations, Concept of Ring and Field. Boolean Algebra.	Chapter 10 of Lui and Mahapatra book

Evaluation Scheme:

EC No	Evaluation Component	Duration	Weightage	Date and Time	
1	Mid Sem Exam	2 hour	30	As per Academic Calendar	
2	End Sem. Exam	3 hour	50	As per Academic Calendar	
3	Internal Assessment	N/A	20	Class Test	10
				Assignment	05
				Attendance	05

Notices: All notices regarding the course will be displayed only on the Notice Board of Department of Mathematics.

Instructor In-charge