II Year-I Semester		T	P	C
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MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (RT21052)				

Course Description and Objectives:

Acquaintance with the basic mathematical implication for computer science, applications of mathematics in computer science

Course Outcomes:

Upon completion of the course,the student will be able to achieve the following outcomes.

Cos	Course Outcomes	POs
1	Express the knowledge of mathematical principles and logic	2
2	Demonstrate knowledge of mathematical induction and number theory	2
3	Demonstrate skills in set theory, relations and functions	3
4	Manipulate and analyze data numerically and/or graphically	2
5	Express the knowledge of algebraic structures, permutations and combinations	4
6	Demonstrate skills in solving recurrence relations	2

Syllabus:

UNIT I:

Objective: Objective: Acquiring the relevance of statements,inferences and predicates in computer science Mathematical Logic :

Propositional Calculus: Statements and Notations,Connectives, Truth Tables, Tautologies, Equivalence of Formulas, Duality law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus,**Consistency of Premises, Indirect Method of Proof.**
Predicate calculus: Predicative Logic, Statement Functions,Variables and Quantifiers, Free & Bound Variables, Inference theory for predicate calculus.

UNIT II:

Objective: Objective: Overview of number theory, basic algorithms in number theory and mathematical induction

Number Theory & Induction: Properties of integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler 's Theorem)
Mathematical Induction: Principle of Mathematical Induction, exercises

UNIT III:

Objective: Focuses on sets and relations and their operations, relations and functions
Set Theory: Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations, Partition and Covering,Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams.
Functions: Bijective Functions, Composition of Functions,Inverse Functions, Permutation Functions, Recursive Functions

UNIT IV:

Objective: Exposure of graphs, their representation,types, trees and tree variants

Graph Theory:
Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices,Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, (Problems and Theorems without proofs) Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number,(Problems and Theorems without proofs) Trees, Directed trees, Binary Trees, Decision Trees,Spanning Trees: Properties, Algorithms for Spanning trees and Minimum Spanning Tree.

UNIT V:

Objectives: Overview of algebraic structures, Group theory, Binomial theorem, permutations and combinations
Algebraic Structures: Lattice: Properties, Lattices as Algebraic Systems, Algebraic Systems with one Binary Operation, Properties of Binary operations, Semi groups and Monoids: Homomorphism of Semi groups and Monoids,Groups: Abelian Group, Cosets, Subgroups (Definitions and Examples of all Structures) Algebraic Systems with two Binary Operations: Rings **Combinatorics:** Basic of Counting, Permutations, Derangements, Permutations with Repetition of Objects,Circular Permutations, Restricted Permutations, Combinations,Restricted Combinations, Pigeonhole Principle and its Application.
Binomial Theorem: Binomial and Multinomial Coefficients,Generating Functions of Permutations and Combinations, The Principles of Inclusion – Exclusion.

UNIT VI:

Objectives: Overview of generating functions, recurrence relations and solving recurrence relations

Recurrence Relation: Generating Function of Sequences, Partial Fractions,Calculating Coefficient of Generating Functions Recurrence Relations, Formulation as Recurrence Relations,Solving linear homogeneous recurrence Relations by substitution, generating functions and The Method of Characteristic Roots.
Solving Inhomogeneous Recurrence Relations

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science, Tremblay, Manohar, TMH
2. Discrete Mathematics for Computer Scientists & Mathematicians, 2/e, Mott, Kandel, Baker, PHI
3. Discrete Mathematics, Swapan Kumar chakrborthy,Bikash kanti sarkar, OXFORD
4. Discrete Mathematics and its Applications with combinatorics and graph theory, 7th ed, Rosen, TMH
5. Discrete Mathematics, Theory and Applications, Malik sen,Cengage
6. Discrete mathematics and Graph theory, 3rd ed, Biswal, PHI

REFERENCE BOOKS:

1. Discrete Mathematics, Proofs, Structures and applications,3rd ed, CRC Press
2. Discrete Mathematics, S.Santha, Cengage
3. Discrete Mathematics with Applications, Thomas Koshy,Elsevier
4. Discrete Mathematics,2/e, JK Sharma ,Macmillan