CS 202

DISCRETE STRUCTURES

Course objectives:

- To introduce fundamentals of logic to evaluate elementary mathematical arguments and identify fallacious reasoning.
- Use of mathematical and logical notation to define and formally reason about mathematical concepts such as sets, relations, functions, integers and algebraic structures
- Use of mathematical and logical notation to define and formally reason about discrete structures like trees, graphs and partial orders.
- To introduce generating functions and recurrence relations to find asymptotic growth rates of different functions.

UNIT-I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication, Use of Quantifiers, Definitions and the Proof of Theorems.

Set Theory: Set and Subsets, Set Operations, and the Laws of Set theory, Counting and Venn Diagrams.

Properties of the Integers: The well – ordering principle, Recursive definitions, the division algorithms, fundamental theorem of arithmetic.

UNIT-II

Relations and Functions: Cartesian Product, Functions onto Functions, Special Functions, Pigeonhole Principle, Composition and Inverse Functions, Computational Complexity.

Relations: Partial Orders, Equivalence Relations and Partitions.

Principle of Inclusion and Exclusion: Principles of Inclusion and Exclusion, Generalization of Principle, Derangements, Rock Polynomials, Arrangements with Forbidden Positions.

UNIT-III

Generating Functions: Introductory examples, definition and example Partitions of Integers, exponential generating function, summation operator. **Recurrence Relations:** First – order linear recurrence relation, second – order linear homogenous recurrence relation with constant coefficients, Non homogenous recurrence relation, divide and conquer algorithms.

UNIT-IV

Algebraic Structures: Algebraic System – General Properties, semi groups, Monoids, homomorphism, Groups, Residue arithmetic, group codes and their applications.

UNIT-V

Graph Theory: Definitions and examples, subgraphs, complements and graph Isomorpshim, Vertex degree, Planar graphs, Hamiltonian paths and Cycles, Graph Coloring.

Trees: Definitions, properties and Examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees.

Suggested Reading:

1.RalphP.Grimaldi, *Discrete and Combinatorial Mathematics,* 4th edition, 2003, Pearson Education.

2.J.P.Tremblay, R.Manohar, *Discrete Mathematical Structure with Applications to Computer Science*, McGraw Hill, 1987.

3.JoeL.Mott, A.Kandel, T.P.Baker, *Discrete Mathematics for Computer Scientists & Mathematicians,* Prentice Hall N.J., 1986.

4.ThomasKoshy, *Discrete Mathematics with Applications,* Elsevier Inc.2004.