UE18CS205

DISCRETE MATHEMATICS AND LOGIC (3-0-0-0-3)

Course Objectives:

The objective(s) of this course is to,

- Develop logical thinking and its application to computer science with emphasis on the importance of proving statements correctly.
- Introduce fundamental discrete structures like Sets, Functions and Relations.
- Introduce Combinational objects and counting techniques.
- Draw similarities between Mathematical Induction and Recurrences and use them to design recursive functions.
- Introduce algebraic structures like Groups, Ring and their usage in coding theory.

Course Outcomes:

At the end of the course, the student will be able to:

- Comprehend formal logical arguments.
- Specify and manipulate basic mathematical objects such as Sets, Functions and Relations and will also be able to verify simple mathematical properties that these objects possess.
- Apply basic counting techniques to solve combinatorial problems.
- Design a recursive function by developing a Recurrence and prove its correctness using Mathematical Induction.
- Apply the concepts of algebraic structures in coding theory.

Course Content:

1. **Logic:** Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference. (**10hours)**

2. **Sets, Functions and Relations:** Sets and Set Operations, Functions, Relations and Their Properties,Representing Relations, Equivalence Relations, Partial Orderings. (**7hours)**
3. **Counting:** The Sum and the Product Rules, the Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients. (**7hours)**

4. **Induction, Recursion and Recurrence Relations:** Mathematical Induction, Strong Induction, Recurrence Relations.**Graphs:** Definition, Complete Graphs, Regular Graphs, Paths, Connectivity, Euler and Hamilton Graphs. (**8hours)**

5. **Algebraic Structures:** The Structure of Algebras, Semi Groups, Monoids and Groups, Homeomorphisms, Normal Subgroups, Coding Theory, Hamming Codes. (**10hours)**

Pre-requisite Courses: **None.**

Reference Book(s):

1. “Discrete Mathematics and its Applications”, Kenneth H Rosen, Tata McGraw-Hill, 7 th Edition (Indian adaptation by Kamala Krithivasan), 2011.
2. “Discrete and Combinatorial Mathematics: An Applied Introduction”, Grimaldi,Ramana, Pearson, 5 th Edition, 2011.