MATH-272 Discrete Mathematics and Applications

Credit Hours: 3-0

Prerequisites: None

Course Objectives:

To introduce students to language and methods of the area of Discrete Mathematics.

To help students in gaining the understanding of mathematical reasoning and to developtheir problem solving skills.

To show students how discrete mathematics can be used in modern computer science.

Core Contents: Logic and proofs, sets and functions; Algorithms and their analysis; Mathematical reasoning, induction and recursion; Counting; Relations; Graphs and Trees.

Detailed Course Contents: Fundamentals: Logic, Propositional Equivalences, Predicates andQuantifiers, Nested Quantifiers, Methods of proof, Sets, Functions

Algorithms and their analysis: Algorithms, The growth of functions, Complexity of algorithms. Mathematical reasoning, induction and recursion: Proof Strategy, Sequences and summations, Mathematical induction, Recursive definitions and structural induction, Recursive algorithms,Program correctness.

Counting: The basics of counting, the pigeonhole principle, Recurrence relations, Generatingfunctions, Inclusion-exclusion

Relations: Relations and their properties, n-ary relations and their applications, representing relations, Closure of relations, Equivalence relations, and Partial orderings

Graphs and Trees: Introduction to graphs, Graph terminology, Graph Isomorphism,Connectivity, Euler and Hamilton paths, Trees, Application of trees.

Course Outcomes: Upon successful completion of the course, students should have the following skills:

- Use of mathematical and logical notation to define and formally reason about mathematical concepts such as sets, relations, functions and discrete structures like trees, graphs, and partial orders;
- Evaluate elementary mathematical arguments and identify fallacious reasoning
- Construct inductive hypothesis and carry out simple induction proofs;
- Compare the asymptotic growth rates of basic functions; derive asymptotic bounds, and limits, for simple series and recurrence relations
- Reason mathematically about basic (discrete) structures (sets, graphs, and trees) used in computer science.

Text Book: Kenneth H. Rosen: Discrete Mathematics and its Applications, 5th Edition,McGraw-Hill

Reference Book: Susana S. Epp: Discrete Mathematics with Applications, fourth edition,Cengage Learning.

Weekly Breakdown		
Week	***Section***	***Topics***
1	1.1-1.3	Logic, Propositional Equivalences, Predicates, Quantifiers
2	1.4,1.5	Nested Quantifiers, Methods of Proof
3	1.6-1.8, 2.1	Sets and Functions, Algorithms
4	2.2, 2.3	The Growth of Algorithms, Complexity of Algorithms
5	3.1 ~ 3.3	Proof Strategy, Sequences, Summations, Mathematical Induction
6	3.4, 3.5	Recursive, Structural Induction, Recursive Algorithms
7	3.6	Program Correctness
8	4.1 ~ 4.2	Basics of Counting, The Pigeonhole Principal
9	**Mid Semester Exam**	
10	4.3 ~ 4.4	Permutations, Combinations, Binomial Coefficients
11	6.1-6.2	Recurrence Relations, Solving Recurrence Relations
12	6.4, 6.5	Generating Functions, Inclusion-Exclusion
13	7.1 ~ 7.3	Relations, n-ary Relations, Representing Relations
14	7.4 ~ 7.6	Closures of Relations, Equivalence Relations, Partial Orderings
15	8.1 ~ 8.3	Introduction to Graphs, Graph Terminologies, Graph Isomorphism
16	8.4, 8.5	Connectivity, Euler and Hamilton Paths
17	8.7	Planar Graphs
18	**End Semester Exam**	