Discrete Mathematics

Code: MATH-161	Credit Hours: 3-0

Course Description

This course covers concepts and application of Logic Elements, Combinatorial, Functions, Relations, Graphs, and Trees. The successful completion should develop understanding of the concepts which strengthen mathematical reasoning. Further, it should equip the students with mathematical techniques to assist them in tackling logic components of computing systems.

Text Book:

(a) K.H. Rosen, Discrete Mathematics and its Applications, (4th Edition)

(b) Susanna S. Epp, Discrete Mathematics with Application (3rd Edition)

Reference Books:

B Kolman, R.C. Busby & S.C. Ross, Discrete Mathematical Structures, (5th Edition) Pearson Education.

ASSESSMENT SYSTEM

Quizzes	10%
Assignments	10%
Mid Terms	30%
ESE	50%

Teaching Plan

Week	Topics	Learning Outcomes
		Introduction to Discrete Mathematics

Week 1	Introduction to Discrete Mathematics, Propositional logic	Propositional logic, logical connectives, conditional statements, examples
		several forms of conditional statements, converse, inverse contrapositive statements, bi conditional statements
Week 2	Applications of propositional logic	Applications of Propositional logic, Translations from formal to informal and vice versa, System specification,
		Logic Puzzles, Logic circuits, Introduction to Boolean Algebra and Boolean functions
		Logical equivalence of propositions, D. Morgan's law, negation of conditional statement, Equivalence identities, tautology, and contradiction
Week 3	Logical equivalence of Propositions	Use of Equivalence identities, their connection with Set identities and Boolean identities, Applications to logic circuits
		Argument forms, determining validity of argument form with Truth tables, introduction to Rules of inference
		Reasoning by using rules of inference, converse error, inverse errors and applications, Introduction to first order logic
Week 4	First order logic	Predicates, Universal and Existential Quantifiers, Universal conditional statements and their negation, translation/expression formal to informal language
		rules of expression and translation and further examples of Predicates and Quantifiers, Multiple Quantified statements
		Negation of Quantified statements, conversion from informal to formal

Week 5	Boolean ALgebra	rules of inference of Quantified statements, Boolean Algebra, literals and minterms,
		solving and representing Boolean functions, Sum of Product expansions,
		Modeling Word problems related to circuit design using logic gates and sum of product expansions, minimization of circuits
Week 6	K Maps	K-maps for circuit minimizations, rules of grouping in K-maps of 2 and 3 variable functions
		K-maps of 4 variable function,
		Sets, Logical interpretation of various concept in set theory, Union, intersection, Subset etc.
Week 7	Counting	Counting techniques, Addition and Multiplication rules
		Pigeonhole principle
		Generalized Pigeonhole Principle and introduction to Methods of Proofs, direct-indirect proof, proof by contradiction
Week 8	Methods of Proof	Proof by counter example, Mathematical induction
		Introduction to Algorithms, Algorithm that returns the maximum element from the list
		Searching algorithms, Linear and Binary search
Week 9		**Mid Term Exam**
Week 10	Relations	Paper showing and discussion
		Bubble sort Algorithm, Intro to Complexity of an Algorithm
		Relations on Sets, Cartesian Product, Binary Relations, and examples
Week 11	Types of Relations	Relation on a Set, Reflexive, Symmetric, Anti-Symmetric, Transitive relations

		Representation of relations, Union and intersection of relations, Equivalence relations and Equivalence classes
		Partial order relations, Hasse's Diagram, Minimal/Maximal elements,
Week 12	Functions	Minimum /maximum elements, n-ary relations and applications to relational databases
		Functions: As a binary relation, Domain range of a function, composition of function, Image of a set
		Injection, Surjection, bijection, inverse of a function
Week 13	Graphs	Introduction to Graphs, Graph Terminologies: Adjacent, incident, isolated, Adjacency matrix, incidence matrix, walk, trail path and circuit
		Types of Graphs, Connected Graphs, Directed Graphs, sub-Graph, degree of Graph, Handshake Theorem
		Graph Isomorphism, Graph invariant properties
Week 14	Graph Algorithms	Euler's and Hamiltonian Graphs
		Graph invariant revisited, Counting walk of length n between vertices, shortest path problem
		Dijkstra Algorithm working and applications
Week 15	Tree	Introduction to Trees, Rooted tree, binary Tree, Terminologies, and examples
		Binary search tree, Pre-order, In-order and Post-order Tree traversal
		Binary Expression tree, Spanning Tree, Minimum Spanning Tree
Week 16	Tree Algorithms	Kruskal algorithm working and applications
		Prim's Algorithm working and applications
		Revision