CS 3653: Discrete Mathematics for Computer Science

Required Course: Required
Course Number: CS 3653
Course Name: Discrete Mathematics for Computer Science
Credit Hours: 3
Lecture Hours: 3
Lab Hours: 0
Instructors: Dr. Manaswini Pradhan

Book Title(s): *Discrete Mathematics and its Applications*: 7th edition
Book Author(s): Kenneth H.Rosen
Book Year(s): 2011

Course Description: Theory and applications of discrete mathematical models fundamental to analysis of problems in computer science. Set theory, formal logic and proof techniques, relations and functions, combinatorics and probability, undirected and directed graphs, Boolean algebra, switching logic.

Course Prerequisites: MATH 2144 (Calculus I(A))

Course Goals: Students should be able to blend and balance learning the five themes:

- *Mathematical Reasoning*: Students understand mathematical reasoning in order to read, comprehend, and construct mathematical arguments including mathematical logic, methods of proofs, mathematical induction.
- *Combinatorial Analysis*: Performing combinatorial analysis to solve counting problems and analyze algorithms
- *Discrete Structures*: Students learn to work with the abstract mathematical discrete structures including set, permutation, relations, graphs, trees to represent discrete objects and relationships
- *Algorithmic Thinking*: Be able to describe an algorithm, which include the specification of the algorithm, the verification that it works properly, and analysis of the computer memory and time required to perform it, for final implementing of a computer program
- *Applications Modeling*: Be able to develop problem-solving skill to model with discrete mathematics for many applications to computer science and data networking, as well as applications to other diverse areas as chemistry, biology, business and internet

Student Outcomes:
This class addresses the following outcomes of learning discrete mathematics course from the criteria for accrediting:

Student Outcome	Course Outcome
1	• Developed concepts and techniques of set of mathematical facts and clarity of how to apply them, understanding the relevance and practicality of discrete mathematics with valid proof techniques • Understand mathematical logic, address both the science and the art of constructing proofs and methods of developing the skill to think logically and mathematically for their future studies to applications
2	• Use combinatorial analysis to solve counting problems, and analyze algorithms, not on applying formulae.
3	• Appropriately use abstract mathematical structures like set, relations, graphs, trees to represent discrete objects and relationships between these objects.
4	• Solve the problems by the specification of an algorithm. After an algorithm is described, a computer program can be constructed implementing it.
6	• Learns to apply discrete mathematics for problem-solving, developing and constructing own models and use in many other areas of related study to find solutions of real-world problems.

Course Topics:

Knowledge Area	Total hours of coverage
DS (Discrete Structures)	39

Knowledge Area	Knowledge Unit	Topics	Hours of Coverage
DS	Sets, Relations and functions	Sets, Relations, Functions	7
DS	Basic Logic	Propositional Logic, Logical connectives, Truth tables, Normal forms, validity of well- formed formula, propositional inference rules, predicate logic, limitations of propositional and predicate logic	7
DS	Proof techniques	Notions of implication, equivalence, converse, inverse, contrapositive, negation, and contradiction, the structure of mathematical proofs, direct proofs, Disproving by counter example, proof by contradiction, induction over natural numbers, structural induction,	9

		weak and strong induction, recursive mathematical definitions, well orderings	
DS	Basics of counting	Counting arguments, the pigeonhole principle, permutations and combinations, solving recurrence relations, basic modular arithmetic	6
DS	Graph trees	Trees, undirected graphs, directed graphs, weighted graphs	4
DS	Discrete Probability	Finite probability space, events, Axioms of probability and probability measures, conditional probability, Bayes theorem, independence, integer random variables, exception, including linearity of expectation, variance	6