

Course Title	Discrete Structures		
Course Code	GE-167		
Credit Hours	3 (3,0)		
Category	General Education		
Prerequisite	None		
Co-Requisite	None		
Follow-up	None		
Course Learning Outcomes (CLOs)	At the end of the course, the students will be able to:	BT	PLO
	CLO1: Understand the key concepts of Discrete Structures such as Sets, Permutations, Relations, Graphs and Trees etc.	C2 (Understand)	1,3
	CLO2: Apply formal logic proofs and/or informal, but rigorous, logical reasoning to real problems, such as predicting the behavior of software or solving problems such as puzzles.	C3 (Apply)	1,3
	CLO3: Apply discrete structures into other computing problems such as formal specification, verification, databases, artificial intelligence, and cryptography.	C3 (Apply)	1,2,3,4
	CLO4: Differentiate various discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular	C4 (Differentiate)	1,2,3,4
Course Description	<p>Mathematical Reasoning: Propositional and predicate logic. Propositional Logic: Logical operators, translations between symbolic expressions and formal English expression, logical equivalences. Predicate Logic: Quantifiers, Nested quantification, equivalences, translations between symbolic forms and formal English. Rules of Inference: Proof methods and strategies, Direct proof, Proof by contraposition, proof by induction, proof by implication, Existence proof, Uniqueness proofs, trivial proofs, vacuous proofs. Sets: Notations, set operations, Venn diagrams, countable and uncountable sets, relations, equivalence relations and partitions, partial orderings, recurrence relations, functions, mappings. Functions: Injective, surjective, bijective, special types of functions, function composition, inverse functions, recursive functions, compositions, number theory, sequences, series, counting, inclusion and exclusion principle, pigeonhole principle, permutations and combinations. Integers and Divisibility: Division theorem, modular arithmetic, LCM, GCD, Euclidean and Extended Euclidean method, finding solutions to congruence. Primes: Fundamental theorem of arithmetic, characterizations of primes, Mersenne primes. Induction: Weak induction, strong induction. Recursion and Recurrences: Formulation of recurrences, closed formulas, Counting: product rule, sum rule, principle of inclusion-exclusion, combinations and permutations, binomial coefficients, Pascal's identity and Pascal's triangle, binomial theorem, pigeonhole principle. Relations: Reflexive, symmetric, transitive, antisymmetric, equivalence relations and equivalence classes, partial orders. Graph Theory: Terminologies, elements of graph theory, planar graphs, graph coloring, Euler graph, Hamiltonian path, rooted trees, traversals, handshaking lemma and corollary, special families of graphs, isomorphism, planarity, Eulerian and Hamiltonian graphs, trees.</p>		
Suggested Instructional/ Reading Material	<ol style="list-style-type: none"> 1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 7th Edition, McGraw Higher-Ed, 2011, ISBN: 0073383090. 2. Susanna S. Epp, Discrete Mathematics with Applications, 4th Edition. 3. Richard Johnsonbaugh, Discrete Mathematics, 7th Edition. 4. Kolman, Busby & Ross, Discrete Mathematical Structures, 4th Edition. 5. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition. 		