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	**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.		
Suggested Instructional/ Reading Material	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 Johnson Baugh, 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.		