CSET106 - Discrete Mathematical Structures

Course Type - Core L-T-P Format 3-1-0 Credits - 4

COURSE SUMMARY

Discrete mathematical structures deal with discrete mathematical foundation of computer science. The main topics include-Propositional logic, Sets, Functions and Relations, Number Theory, Counting Techniques, Group, Monoid, Ring, Field, Graph, Tree, Euler graph, Hamiltonian circuit, Clique and Matching.

COURSE-SPECIFIC LEARNING OUTCOMES (CO)

CO1: To explain logical notation to illustrate sets, relations, functions, and integers.

CO2: To examine induction hypotheses and prove elementary properties of modular arithmetic.

CO3: Experiment and solve critical examples of algebraic structures and graph theory.

Detailed Syllabus

Module 1 (Contact hours: 11)

Introduction and applications of Discrete mathematical structures, Proposition, Logical operators, Converse, Inverse, Contrapositive, Compound propositions, Precedence of logical operators, Tautology, Contradiction, Logical Equivalence, Derived implications, Well-formed formula, Tautological Implication, Logical equivalence laws, Rules of inference, Predicates and Quantifiers, Nested quantifiers, English to logic conversion, Direct proof, Proof by contradiction, Proof by induction, Russell's paradox.

Module 2 (Contact hours: 11)

Representation of Sets, Types of Sets, Power Set, Venn Diagrams, Operations on Sets, Partition of Sets, Fuzzy Sets. Functions, Types of Functions, Sum and Product of Functions, Relation, Relation vs Function, Different Types of Relations, Graphical Representation of Relations, Matrix Representation of Relations, Closure of relations.

Module 3 (Contact hours: 10)

Representation of integers, Binary operations, Divisibility, Euclidean Theorem for GCD, Residue classes, Linear congruence, Chinese remainder theorem, inclusion-exclusion principle, Binomial coefficients, Permutation, and combination, Pigeonhole principle, Recurrence relations and generating functions, semi-group, Monoid, and group, Abelian group, Cyclic group, Addition modulo m, Multiplication modulo m, Ring, Field, and integral domain.

Module 4 (Contact hours: 10)

Partially ordered set, Elements of Posets, properties of lattices, Bounded, distributive, Complemented Lattice, Graphs, Homomorphism and Isomorphism, Euler graph, Hamiltonian circuit, Handshaking lemma (Havel Hakimi theorem), Graph Score Theorem, Bipartite graphs, Kionig's Theorem, Graph coloring, Chromatic number, Clique, Matching, Trees, forest, rooted trees, Binary trees, height of trees.

TEXTBOOKS/LEARNING RESOURCES:

a) Kenneth and H. Rosen, Discrete Mathematics, and Its Applications (8^{th} ed.), McGraw Hill, 2021. ISBN 978-9390727353.

b) Bisht, R.K. and Dhami, H.S, Discrete Mathematics (1^{st} ed.), Oxford University Press, 2015. ISBN 978-0199452798.

REFERENCE BOOKS/LEARNING RESOURCES:

a) Jon Pierre Fortney, Discrete Mathematics for Computer Science (1^{st} ed.), Oxford University Press, 2020. ISBN 9781000296806.