DISCRETE MATHEMATICAL STRUCTURES

III Semester: CSE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS013	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Describe the logical and mathematical foundations, and study abstract models of computation.
II. Illustrate the limitations of predicate logic.
III. Define modern algebra for constructing and writing mathematical proofs.
IV. Solve the practical examples of sets, functions, relations and recurrence relations.
V. Recognize the patterns that arise in graph problems and use this knowledge for constructing the trees and spanning trees.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand logical connectives and compound prepositions for building compound statements.
2. Learn the formal symbols and use the preposition logic and predicate logic to solve problems on logical equivalences and implications.
3. Memorize different scientific notations to simplify the logical statements.
4. Prepare valid arguments from the given propositional statements by using rules of inference.
5. Identify ordered pairs to form a binary relation from the given sets.
6. Construct directed graph and a matrix representation using a binary relation on finite order pairs.
7. Identify the properties of relations to check for equivalence relation and partial order relation and compute relations using operations on relations.
8. Construct a hasse diagram to recognize the relevant partial ordered sets from the given binary relation.
9. Describe the types of functions (one to one, on-to, bijective, Identity and constant function).
10. Implement the concept of the inverse and recursive functions to get solution for an appropriate problem.
11. Use the concept of lattices (Greatest Lower Bound (GLB) and Least Upper Bound (LUB) to represent a defined finite set in multi-dimension applications.
12. Explain about the properties and types of lattices (bounded and distributive lattice)
13. Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.
14. Understand binomial and multinomial theorems to compute the coefficients for the given expansions.
15. Understand the concept of homomorphism and isomorphism of semi-groups.
16. Analyze the given sets by using inclusion and exclusion principle.
17. Identify the different counting techniques (permutations) related to mathematics and computer science.
18. Solve discrete probability and set problems by using permutations and combinatorics.
19. Identify the series of expansion to represent the sequence by using generating functions.
20. Identify the general solution for first-order and second-order linear homogeneous recurrence relations.
21. Identify the roots of second and higher order linear non-homogeneous recurrence relations.
22. Understand the use of graphs and trees as representation tools in a variety of context
23. Identify Euler's and Hamilton rule for a simple connected graph in NP-complete problems.
24. Construct a spanning tree by using search techniques (Depth First Search and Breadth First

Search).

25. Construct a minimal spanning tree by using Kruskal's and Prim's algorithm to obtain a solution for a real time problem.
26. Possess the knowledge and skills for employability and to succeed in national and international level competitive exams.

UNIT-I	MATHEMATICAL LOGIC AND PREDICATES	Classes: 09

Mathematical logic: Statements and notations, connectives, well-formed formulas, truth tables, tautology, equivalence implication; Normal forms: Disjunctive normal forms, conjunctive normal forms, principle disjunctive normal forms, principle conjunctive normal forms; Predicate calculus: Predicative logic, statement functions, variables and quantifiers, free and bound variables, rules of inference, consistency, proof of contradiction, automatic theorem proving.

UNIT-II	RELATIONS, FUNCTIONS AND LATTICES	Classes: 09

Relations: Properties of binary relations, equivalence, compatibility and partial ordering relations, lattices, Hasse diagram; Functions: Inverse function, composition of functions, recursive functions; Lattices: Lattices as partially ordered sets; Definition and examples, properties of lattices, sub lattices, some special lattices.

UNIT-III	ALGEBRAIC STRUCTURES AND COMBINATORICS	Classes: 09

Algebraic structures: Algebraic systems, examples and general properties, semi groups and monoids, groups, sub groups, homomorphism, isomorphism, rings.
Combinatory: The fundamental counting principles, permutations, disarrangements, combinations, permutations and combinations with repetitions, the binomial theorem, multinomial theorem, generalized inclusion exclusion principle.

UNIT-IV	RECURRENCE RELATIONS	Classes: 09

Recurrence relation: Generating functions, function of sequences calculating coefficient of generating function, recurrence relations, solving recurrence relation by substitution and generating functions, characteristics roots solution of homogeneous recurrence relation.

UNIT-V	GRAPHS AND TREES	Classes: 09

Graphs: Basic concepts of graphs, isomorphic graphs, Euler graphs, Hamiltonian graphs, planar graphs, graph coloring, digraphs, directed acyclic graphs, weighted digraphs, region graph, chromatic numbers; Trees: Trees, spanning trees, minimal spanning trees.

Text Books:

1. J. P. Tremblay, R. Manohar, ―Discrete Mathematical Structures with Applications to Computer Science‖, Tata Mc Graw Hill, India, 1st Edition, 1997.
2. Joe L. Mott, Abraham Kandel, Theodore P. Baker, ―Discrete Mathematics for Computer Scientists and Mathematicians‖, Prentice Hall of India Learning Private Limited, New Delhi, India, 2nd Edition, 2010.

Reference Books:

1. Kenneth H. Rosen, ―Discrete Mathematics and Its Applications‖, Tata Mcgraw-Hill, New Delhi, India, 6th Edition, 2012.
2. C. L. Liu, D. P. Mohapatra, ―Elements of Discrete Mathematics‖, Tata Mcgraw-Hill, India, 3rd Edition, 2008.
3. Ralph P. Grimaldi, B. V. Ramana, ―Discrete and Combinatorial Mathematics - An Applied Introduction‖, Pearson Education, India, 5th Edition, 2011.
4. D. S. Malik, M. K. Sen, ―Discrete Mathematical Structures: Theory and Applications‖, Thomson Course Technology, India, 1st Edition, 2004.

Web References:

1. http://www.web.stanford.edu/class/cs103x
2. http://www.cs.odu.edu/~cs381/cs381content/web_course.html
3. http://www.cse.iitd.ernet.in/~bagchi/courses/discrete-book
4. http://www.saylor.org/course/cs202/
5. http://www.nptel.ac.in/courses/106106094/

6. http://www.tutorialspoint.com/discrete_mathematics
7. http://www.dmtcs.org/dmtcs-ojs/index.php/dmtcs

E-Text Books:

1. https://people.eecs.berkeley.edu/~daw/teaching/cs70-s05/
2. http://home.anadolu.edu.tr/~eakyar/dersler/ayrik/kitap/kitap.pdf
3. http://45.63.83.30/graph-theory-keijo-ruohonen-pdf-tut.pdf
4. http://www.zib.de/groetschel/teaching/WS1314/BondyMurtyGTWA.pdf