DISCRETE MATHEMATICAL STRUCTURES

III Semester: CSE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACSB04	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The course should enable the students to:

I. Describe the logical and mathematical foundations, and study abstract models ofcomputation.
II. Illustrate the limitations of predicatelogic.
III. Define modern algebra for constructing and writing mathematicalproofs.
IV. Solve the practical examples of sets, functions, relations and recurrencerelations.
V. Recognize the patterns that arise in graph problems and use this knowledge for constructing the trees and spanningtrees.

COURSE OUTCOMES (COs):

CO 1 : To understand the concepts associated with Mathematical Logic and Predicate calculus
CO 2 : Ability to learn the basic concepts about relations, functions and to draw different diagrams like Lattice, Hasse diagrams.
CO 3 : To understand the concepts of Algebraic Structures and combinatorics.
CO 4: To describe various types of recurrence relations and the methods to find out their solutions.
CO 5 : To understand the basic concepts associated with Graphs and Trees.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand logical connectives and compound prepositions for building compoundstatements.
2. Learntheformal symbolsandusetheprepositionlogicandpredicatelogictosolveproblemson logical equivalences andimplications.
3. Memorize different scientific notations to simplify the logicalstatements.
4. Prepare valid arguments from the given propositional statements by using rules ofinference.
5. Identify ordered pairs to form a binary relation from the givensets.
6. Construct directed graph and a matrix representation using a binary relation on finite orderpairs.
7. Identify the properties of relations to check for equivalence relation and partial order relationand compute relations using operations onrelations.
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 constantfunction).
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-dimensionapplications.
12. Explain about the properties and types of lattices (bounded and distributivelattice)
13. Construct different algebraic structures by using concepts of groups, sub groups, monoidsand rings.
14. Understandbinomialandmultinomialtheoremstocomputethecoefficientsforthegiven expansions.
15. Understand the concept of homomorphism and isomorphism ofsemi-groups.
16. Analyze the given sets by using inclusion and exclusionprinciple.
17. Identify the different counting techniques (permutations) related to mathematics andcomputer science.
18. Solve discrete probability and set problems by using permutations andcombinatorics.
19. Identify the series of expansion to represent the sequence by using generatingfunctions.
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 recurrencerelations.
22. Understand the use of graphs and trees as representation tools in a variety ofcontext
23. Identify Euler's and Hamilton rule for a simple connected graph in NP-completeproblems.
24. Construct a spanning tree by using search techniques (Depth First Search and BreadthFirst Search).
25. Construct a minimal spanning tree by using Kruskal's and Prim's algorithm to obtain a solutionfor a real timeproblem.
26. Possess the knowledge and skills for employability and to succeed in national andinternational level competitive exams.

MODULE-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,freeandboundvariables,rulesofinference,consistency,proofofcontradiction,automatictheoremproving.		
MODULE-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.		
MODULE-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.		
MODULE-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.		
MODULE-V	**GRAPHS AND TREES**	**Classes: 09**
Graphs:Basicconceptsofgraphs,isomorphicgraphs,Eulergraphs,Hamiltoniangraphs,planargraphs,graphcoloring, 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 McGraw Hill, India, 1st Edition,1997.
2. JoeL.Mott, AbrahamKandel,TheodoreP. Baker, –Discrete Mathematics forComputer Scientists and Mathematicians‖, Prentice Hall of India Learning Private Limited, New Delhi, India, 2nd Edition, 2010.

Reference Books:

1. Kenneth H. Rosen, –DiscreteMathematics 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