SIR C.R.REDDY COLLEGE OF ENGINEERING, ELURU

DEPARTMENT OF INFORMATION TECHNOLOGY

LESSON PLAN

SUBJECT: CSE 2.1.3DISCRETE MATHEMATICAL STRUCTURES

CLASS: II/IVB.Tech,I SEMESTER, A.Y.2017-18

INSTRUCTOR: Sri G. Vihari

SIR C.R.REDDY COLLEGE OF ENGINEERING, ELURU

DEPARTMENT OF INFORMATION TECHNOLOGY

Programme:B.Tech

Semester:II/IV1st Semester

Academic Year: 2017-18

Course: CSE 2.1.3DISCRETE MATHEMATICAL STRUCTURES

Instructor: G. Vihari

Course Contents

Category of Course	Course Title	Course Code	Credits- 4	Theory Paper
Departmental CSE 2.1.3	DISCRETE MATHEMATICAL STRUCTURES	CSE 2.1.3	L-3 T-1	Max.Marks-70 Duration-3hrs.

Course objectives:

1. To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic and truth tables.

2. To understand about permutations and combinations.

3. To understand various types of relations and discuss various properties of the relations.

4. To study the graphs, graph isomorphism and spanning trees.

5. To study about Boolean algebra and Finite State Machines.

Course Outcomes:

1. Understand the mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic.

2. Identify and give examples of various types of relations and describe various properties of the relations

3. Ability to solve problems using permutations and combinations.

4. Determine isomorphism of graphs and spanning tree of a given graph using BFS/DFS algorithms. Also determine minimal spanning tree of a given graph.

Online References:

1. http://nptel.ac.in/courses/106106094/
2. http://www.cse.iitd.ac.in/~bagchi/courses/CSL105_06-07/

Prerequisite: NIL

Internal Assessment Details:
Attendance: 5 Marks
Internal Test 1& 2: 15 Marks
Assignment-1: 5 Marks
Assignment-2: 5 Marks

Total: 30 Marks

CSE 2.1.3DISCRETE MATHEMATICAL STRUCTURES **Credits:4**

Instruction: 3 Periods & 1 Tut /week **Sessional Marks: 30**

University Exam: 3 Hours **University Exam Marks: 70**

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1. The Foundations-Logic and Proofs: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers Rules of Inference, Introduction to Proofs, Proof Methods and Strategy, End-of-Chapter Material. Basic Structures-Sets, Functions, Sequences and Sums: Sets, Set Operations, Functions, Sequences and Summations, End- of-Chapter Material.

2. The Fundamentals-Algorithms, the Integers and Matrices: Algorithms, The Growth of Functions, Complexity of Algorithms, The Integers and Division, Primes and Greatest Common Devisors, Integers and Algorithms, Applications of Number Theory, Matrices, End-of-Chapter Material.

3. Induction and Recursion: Mathematical Induction, Strong Induction and Well- Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness, End-of-Chapter Material.
Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations, End-of-Chapter Material.

4. Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recursion Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion, End-of-Chapter Material.

5. Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings, End-of-Chapter Material.
Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring, End-of-Chapter Material.

6. Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees, End-of-Chapter Material.

7. Boolean Algebra: Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits, End-of-Chapter Material.
Modeling Computation: Languages and Grammars, Finite-State Machines with Output, Finite-State Machines with No Output, Language Recognition, Turing Machines, End-of- Chapter Material.

Text Book:
1. Discrete Mathematics & Its Applications with Combinatorics and Graph Theory by Kenneth H Rosen, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Reference Books:
1. Discrete Mathematics for Computer Scientists & Mathematicians by Joe L. Mott, Abraham Kandel, Theodore P. Baker, Prentice-Hall, India.
2. Discrete Mathematics by Richard Johnson Baug, Pearson Education, New Delhi.
3. Discrete and Combinatorial Mathematics by Ralph. G. Grimaldi, Pearson Education, NewDelhi

SIR C R REDDY COLLEGE OF ENGINEERING: ELURU

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE SCHEDULE

The schedule for the whole Course/Subject is:

Unit No	Description of the Chapter	Description of the Topics	Total no of periods (L+T)
1	The Foundations-Logic and Proofs	Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.	3+2
2.	Basic Structures-Sets, Functions, Sequences and Sums	Sets, Set Operations, Functions, Sequences and Summations	4
3.	The Fundamentals-Algorithms, the Integers and Matrices	Algorithms, The Growth of Functions, Complexity of Algorithms, The Integers and Division, Primes and Greatest Common Devisors, Integers and Algorithms, Applications of Number Theory, Matrices	5+2
4.	Induction and Recursion	Mathematical Induction, Strong Induction and Well- Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness	3+1
5.	Counting	The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations	4+1
6.	Advanced Counting Techniques	Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recursion	5+2

		Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion	
7.	Relations	Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings	5+1
8	Graphs	Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring	5+2
9	Trees	Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees	4+1
10	Boolean Algebra	Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits	4
11	Modeling Computation	Languages and Grammars, Finite-State Machines with Output, Finite-State Machines with No Output, Language Recognition, Turing Machines, End-of- Chapter Material.	4+2

Total no of instructional periods available for the course : 60 periods

Total no of estimated periods : 60 periods

Signature of the H.O.D **Signature of the Faculty**

Date:

	LECTURE PLAN
DEPARTMET	INFORMATION TECHNOLOGY
NAME OF LECTURER	Sri G. Vihari

S.No	**Topics to be covered**	**No. of Lecture Hours**	**Teaching method**	**Program Outcomes**
1	Introduction to DMS	1	BB	a,b,g,e
2	Algorithms	1	BB	f, l
3	The growth of combination of functions	2	BB	a, b, f, l
4	Complexity of Algorithm	1	BB	a, b, f, l
5	Arithmetic modulo m	1	BB	a, b, f, l
6	Integer and Algorithm representation	1	BB	a, b
7	Base conversions	2	BB	a, b, c
8	Addition algorithm	1	BB	a, b, c
9	Modular Exponentiation	1	BB	a, b, c
10	Primes, GCD, Euclidean Algorithm	1	BB	a, b, c
11	Number theory	2	BB	a, c
12	Sets	1	BB	a, b, c
13	Relations	1	BB	a, b, c
14	Graphical representation	1	BB	a, b, c
15	Matrix Representation of relations	2	BB	a, b, c

16	Equalance Relation	1	BB	a, b, c, d, l
17	Partial ordered sets	2	BB	a, b, c, d, l
18	Functions and Characteristic Functions	1	BB	a, b, c, d, l
19	Hashing function and Recursive functions	1	BB	a, b, c, d, l
20	Sequence and Summation	2	BB	a, b, c, d, l
21	Induction	1	BB	a, b, c, d, l
22	Strong Induction	1	BB	a, b, c, d, l
23	Recursively defined function	2	BB	a, b, c, d, l
24	Counting ,Pigeon hole Principal	1	BB	a, b, c, d, l
25	Permutation and Combinations	2	BB	a, b, c, d, l
26	Graph Introduction	1	BB	a, b, c, d, l
27	Graph terminologies	1	BB	a, c, l
28	Isomorphism of graphs	2	BB	a, c, l
29	Planar graph	2	BB	a, c, l
30	Dual planar graphs	1	BB	a, c, l
31	Euler's theorem	2	BB	a, b, c, l
32	Proof by Contradiction	1	BB	a, c, l
33	Hamiltonian graph	1	BB	a, c, l
34	Graph Coloring	2	BB	a, c, l
35	Trees, Application of trees	1	BB	a, c, l
36	Spanning trees	1	BB	a, b, d, l
37	BFS ,DFS	1	BB	a, b, d, l
38	Minimum Spanning Tree	2	BB	a, b, c, d, l
39	Boolean algebra	1	BB	a, l

40	Boolean function	1	BB	a, b, c. l
41	SOP,POS,K-maps	1	BB	a, b, c, d, l
42	Finite Automata, DFA	2	BB	a, b, c, d, l
43	NFA AND DFA	1	BB	a, b, c, d, l
44	Turing Machine	2	BB	a
45	Homogeneous and Non homogeneous Recurrence relation	1	BB	a, b
	Total classes	**60**		

Unit Wise Question Bank

UNIT-1

Q1: Define relation, domain and range of relation, composition of relation, injective and bijective functions.
Q2: Explain various types of relations with examples?
Q3: Explain matrix representation of relations with one example?
Q4: Explain graph representation of relations with one example?
Q5: Define characteristic, hashing, initial and primitive recursive functions?
Q6: Let x={1,2,3} and f,g,h and s be functions from x to x given as
f={(1,2)(2,3)(3,1)} g ={(1,2)(2,1)(3,3)} h ={(1,1)(2,2)(3,1)} s ={(1,1)(2,2)(3,3)}
then find a)fog b)gof c)fohog d)sog e)gos ?
Q7: Show that A∩ (BỤ C)= (A∩B)Ụ (A∩C) using characteristic function?
Q8: Show that the functions primitive recursive
1) f(x,y) =x+y 2)f(x,y) =x*y
Q9:Deduce encoding and decoding tables for n=6 and m=3?
Q10:Drawposet diagrams for [D_{70} /] ,[D_{36} , /]

UNIT-2

Q1:Show that x^3 is O(x^4) but that x^4 is not O(x^3) and

Show that $x^2 + 4x + 17$ is O(x^3)

Q2:Writethe Euclidean Algorithm. and Find the greatest common divisor of

414 and 662 using the Euclidean algorithm.

Q3:Define base Conversion with procedure with one example and

Construct Base b Expansions Algorithm

Q4:Define Addition ,Multiplication Algorithm with procedure and

Find the Sum and Product of $a = (110)2$ and $b = (101)2$.

Q5: Find the join and meet ,Boolean product of the zero–one matrices

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}, \qquad B = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}.$$

UNIT-3

Q1:By the Mathematical induction .Let P(n) be the statement that
$1^3+ 2^3+\cdots+n^3= (n (n + 1)/2)^2$ for the positive integer n.

Q2:Each user on a computer system has a password, which is six to eight characters long, Where each character is an uppercase letter or a digit. Each password must contain at least one digit. How many possible passwords are there?

UNIT-4

Q1: Solve the following recurrence relation by substitution method $a_n = a_{n-1} + f(n)$ where f(n) is function in n?

Q2:What is the solution of the Linear homogeneous Recurrence Relations with Constant Coefficients $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$?

Q3:Find all solutions of the non-Linear homogeneous Recurrence Relations with Constant Coefficients $a_n = 3a_{n-1} + 2n$. What is the solution with $a_1 = 3$?

UNIT-5

Q1 : Find transitive closure to the relation R={(a,a) (a,b)(b,c)(c,d)(c,e)(d,e)} ?
Q2: Define Equivalence Relation ?

Q3:Find transitive closure to the relation R={(a,b) (a,c) (b,c) (c,d) (d,b) (d,e) (e,d)} ?
Q4: Draw Hausse Diagrams to [A, /] where '/' means divides to the following
a) A={1,2,3,4,6,9} b)A={2,3,4,9,12,18} c) A={2,3,5,30,60,120,180,360}
Q5: Define lattice, semi-lattice, jion-lattice with examples?

GRAPHS
Q1: Define size of a graph, order of a graph, simple graph and multigraph ?
Q2: State and prove sum of degrees theorem?
Q3:Define degree sequence, path and k-regular graph?
Q4: If G is a simple connected planer graph then show that |E| <=3|V|-6 ?
Q5: Show that for a complete graph contains (n-1)!/2 hamiltonian cycles?
Q6: Define order of a graph, adjacency of vertices?
Q7:If G is a simple connected planer graph then show that |E| <=3|V|-6 ?
Q8: Define cut edge, cut vertex, cut set with examples?
Q9: If G is a simple connected planer graph then show that|V|-|E|+|R| =2 ?

UNIT-6
Q1: Define tree?
Q2: Every binary tree is 2-colourable?
Q3: Define tree, binary search tree, minimum spanning tree and height of a tree with example?

Q4: Draw a tree for the following expression A-(C/5*2)+ (D* 5% 4) ?

UNIT-7

Q1: Define semi group and monoid ?
Q2:Define group, subgroup, lagrange's theorem and kernel of homomorphism?
Q3: Verify homomorphism of semi groups with one example?
Q4: Define Boolean algebra?
Q5:List out various properties of Boolean algebra?
Q6:Define regular expression, regular language, properties of Boolean algebra and difference between NFA and DFA?

Q7: Determine which of the following are sub-boolean algebra of the Boolean algebra(D_{70},*,+,|,0,1)

a) S1={1,2,35,70}
b) S2= {1,2,7,14}
c) S3={1,2,7,35}

Q8: Find the sum-of-products and product-of-sum expansion for the function

$$F(x, y, z) = (x + y)\overline{z}.$$

Q9:Use K-maps to minimize these sum-of-products expansions

(a) $xy\overline{z} + x\overline{y}\,\overline{z} + \overline{x}yz + \overline{x}\,\overline{y}\,\overline{z}$
(b) $x\overline{y}z + x\overline{y}\,\overline{z} + \overline{x}yz + \overline{x}\,\overline{y}z + \overline{x}\,\overline{y}\,\overline{z}$

Q10:Construct deterministic finite-state automata that recognize each of these languages.
(i) the set of bit strings that begin with two 0s
(ii) the set of bit strings that contain two consecutive 0s

Q11:Find a deterministic finite-state automata that recognizes the same language as the nondeterministicfinite-state automata.