P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

Reaccredited at 'A+' level by NAAC

Autonomous&ISO 9001:2015 Certified

Title of the Course: DISCRETE MATHEMATICAL STRUCTURES

Semester : II

Course Code	22MA2D3	Course Delivery Method	Blended Mode
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2020-21	Year of offering : 2022-23	Year of Revision: ---	Percentage of Revision: ---

Course Objective : The main objective of the course to acquire knowledge on the basic concepts in Logic, Finite Machines, Lattices and their Applications.

CO-NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Construct truth tables of statements and apply rules of inference for conclusions.	**K3**	**1**	**2**
CO2	Construct state diagrams of finite machines	**K3**	**3**	**2**
CO3	understand the concepts of lattices and Boolean algebras.	**K3**	**1**	**1**
CO4	Compute minimal forms of Boolean polynomials.	**K3**	**3**	**2**
CO5	Construct switching circuits and understand Boolean algebras.	**K3**	**7**	**2**

Mapping of Course Outcomes:

CO-PO-PSO MATRIX										
	CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
22MA2D3	**CO1**	**3**								**3**
	CO2			**2**						**3**
	CO3	**2**							**2**	
	CO4			**2**						**3**
	CO5							**3**		**3**

UNIT –I

Logic : Logic, Tautology, Normal Forms, Logical Inferences, Predicate Logic, Universal Quantifiers, Rules of Inference, Recurrence Relations, Solution using generating functions (1.6 to 1.10 of Chapter 1 & 3.7,3.8 of chapter 3 of [3])

UNIT –II

Finite Machines : state machine, input-output machines**,** Introduction, state tables and state diagrams, simple properties , Dynamics, Behavior and Minimization. (Sections 5.1 to 5.5 of Chapter 5 of [1])

UNIT – III

Lattices: Properties and Examples of Lattices, Distributive Lattices, Boolean Algebras. (Sections 1 to 3 of Chapter 1 of [2]).

UNIT –IV

Lattices continued: Boolean polynomials, Ideals , filters and equations, Minimal forms of Boolean polynomials, (Sections 4,5,6 of Chapter -1 of [2])

UNIT –V

Application of Lattices: Switching circuits, Applications of switching circuits, More Applications of Boolean Algebras (Sections 7, 8 and 9 of Chapter -2 of [2]).

PRESCRIBED BOOKS

[1] "Application oriented Algebra" JAMES L FISHER , IEP, Dun- Downplay pub.1977.
[2] " Applied abstract algebra", Second Edition, R.LIDL AND G. PILZ, Springer,1998.
[3] " Discrete Mathematical Structures", RM. SOMASUNDARAM, Prentice Hall of India,2003

REFERENCE BOOK: "Discrete Mathematical Structures with Applications to Computer Science", J.P.TREMBLAY AND R.MANOHAR, Tata Mc. Graw Hill, 2002.

Course has Focus on : Foundation (Elective Paper)

Websites of Interest :1. www. nptel.ac.in

2. www.epgp.inflibnet.ac.in

3. www.ocw.mit.edu

P B SIDDHARTHA COLLEGE OF ARTS AND SCIENCE::VIJAYAWADA

(An autonomous college in the jurisdiction of Krishna University)

M. Sc. Mathematics

Second Semester

DISCRETE MATHEMATICAL STRUCTURES – 22MA2D3

Time: 3 hours **Max. Marks: 70**

SECTION-A

Answer all questions. **(5x4=20)**

1 a) Prove that $P \vee (Q \wedge R)$ and $(P \vee Q) \wedge (P \vee R)$ are logically equivalent. (CO1, L1)

(OR)

b) Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$, with $a_0 = 1$ and $a_1 = 6$ (CO1, L1)

2 a) Prove that state machine congruence is an equivalence relation. (CO2, L2)

(OR)

b) Let M=(S, I, O, δ, θ) be an i/o machine ,then show that there exists an out put machine M_1 and a one to one function $f : S \rightarrow S_1$ such that $\beta_s = \beta_{f(s)}$. (CO2, L2)

3 a) Define (i) distributive lattice (ii) Boolean algebra and give an example. (CO3, L1)

(OR)

b) State and prove De Morgan laws in a Boolean algebra. (CO3, L1)

4 a) Prove that an ideal M in a Boolean algebra B is maximal if and only if for any b Є B either b Є M or b' Є M but not both. (CO4, L2)

(OR)

b) Define a principle ideal. Show that a principle ideal (b) = {a € B/ a≤b}. (CO4, L2)

5 a) Show that the identity x(y+z)= xy+xz is valid. (CO5, L3)

(OR)

b) Construct circuits for (i) (x+y) $\bar{x}$ and (ii) $\bar{x}\,(\overline{(y+\bar{z})}$ (CO5, L3)

SECTION – B

Answer all questions. All questions carry equal marks. **(5X10=50)**

6 a) Define a tautology. Show that the expression $((P \wedge \sim Q) \rightarrow R) \rightarrow (P \rightarrow (Q \vee R))$ is a tautology.

b) Obtain DNF and CNF of the following formula $(\sim P \vee \sim Q) \rightarrow (P \leftrightarrow \sim Q)$. (CO1, L2)

(OR)

c) Solve $a_r - 2a_{r-1} = (r+1)2^r$. (CO1, L2)

7 a) Let f be a state homomorphism from the state machine $M=(S, I, \delta)$ onto the state machine $M_1=(S_1, I, \delta_1)$. Then show that there exists a state machine congruence on M such that M is isomorphic to M_1. (CO2, L3)

(OR)

b) Minimize the states of the following machine and write reduced machine. (CO2, L3)

states	δ		θ	
	0	1	0	1
1	2	5	1	0
2	5	5	1	1
3	1	8	1	1
4	8	2	1	0
5	6	5	1	1
6	1	5	1	1
7	2	3	1	0
8	3	5	1	1

8 a) Define atom and join-irreducible element in a Lattice. Show that every atom is join-irreducible.

b) State and prove the distributive inequalities in Lattices. (CO3, L3)

(OR)

c) State and prove Representation theorem in a Boolean Algebra. (CO3, L3)

9 a) Find CNF and DNF of the polynomial $x(y+z)' + (xy+z)'$. (CO4, L3)

(OR)

b) Minimize the following Boolean polynomial using Quiene- Mc Clusky method

$wx'y'z + w'xy'z' + wx'y'z' + w'xyz + w'x'y'z' + wxyz + wx'yz + w'xyz' + w'x'yz'$.

(CO4, L3)

10 a) Draw the diagram for the following switching circuit

$P = x_1(x_2(x_3+x_4)+x_3(x_5+x_6))$.

b) Determine the symbolic representation of the circuit given by

$P = (x_1+x_2+x_3)(x_1'+x_2)(x_1x_2+x_1'x_2)(x_2'+x_3)$. (CO5, L3)

(OR)

c) Explain the central lighting system in a room and draw its switching circuit. (CO5, L3)

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