Q. Code: 463853

Reg. No. | | | | | | | | | | | | | |

B. E/ B. TECH.DEGREE EXAMINATIONS, MAY 2024

Third Semester

MA22353 – DISCRETE MATHEMATICS

(Computer Science and Engineering and Information Technology)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

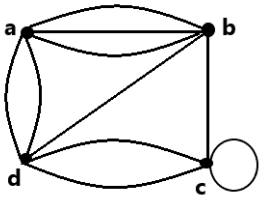
COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Acquire logic to convert from informal language to logic expressions and test the validity of a program..	**3**
CO 2	Apply the concepts of set theory and counting techniques to comprehend computer simulations.	**3**
CO 3	Develop graph theory tools to map day-to-day applications.	**3**
CO 4	Expose to the concepts and properties of algebraic structures which provide solutions in design and analysis of algorithms.	**3**
CO 5	Explore Boolean algebraic structures on numerous levels, the concepts needed to test the logic of a program.	**3**

PART- A(20x2=40Marks)

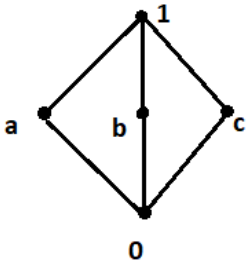
(Answer all Questions)

		CO	RBT LEVEL
1.	Construct a truth table for the compound proposition $p \oplus (p \wedge q)$.	**1**	**3**
2.	Find the bitwise OR and bitwise AND of the pair of bit strings: 1111 1000, 1011 1010.	**1**	**3**
3.	What rule of inference is used in the following argument? Linda is an excellent swimmer. If Linda is an excellent swimmer, then she can work as a lifeguard. Therefore, Linda can work as a lifeguard.	**1**	**2**
4.	Let *R(x,y,z)* denote the statement " $x + y = z$". What are the truth values of the propositions *R(2,4,6)* and *R(1,0,0)* ?	**1**	**2**
5.	Let $f:\{a,b,c,d\} \rightarrow \{1,2,3,4,5\}$ be a function defined by f(a) = 3, f(b) = 2, f(c) = 1 and f(d) = 5. Is f an onto function? Is f one-to-one?	**2**	**3**
6.	How many bit strings of length 8 are there?	**2**	**2**
7.	A group contains 6 men and 6 women. How many ways are there to arrange these people in a row if the men and women alternate?	**2**	**3**
8.	Among any group of 367 people, how many persons will have the same birthday at the minimum?	**2**	**3**
9.	How many edges are there in a graph with 5 vertices each of degree 4?	**3**	**2**
10.	If G is a simple graph with 15 edges and $\overline{G}$has 6 edges, then how many vertices does G have?	**3**	**3**

11.	Can a simple graph exist with 5 vertices each of degree 3?	**3**	**2**	
12.	Find the adjacency matrix of the following graph:	**3**	**3**	



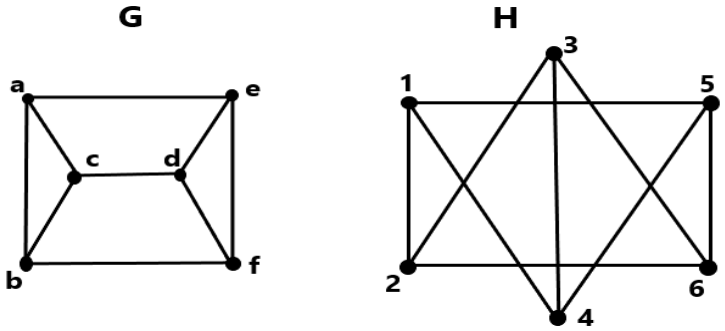
13.	Consider the set of natural numbers N under the binary operation * defined by $x*y=max(x,y), \forall x,y \in N$. Show that (N,*) is a semigroup.	**4**	**2**	
14.	In a group (G,*), prove that $(a^{-1})^{-1}=a, \forall a \in G$.	**4**	**2**	
15.	Find any two cosets of the subgroup $H=\{1,-1\}$ in $G=\{1,-1,i,-i\}$ under the binary operation multiplication.	**4**	**3**	
16.	Find the idempotent elements of $G=\{1,-1,i,-i\}$ under the binary operation multiplication.	**4**	**3**	
17.	Is there a Boolean Algebra with five elements? Justify your answer.	**5**	**2**	
18.	Let $(P,\leq)$ be a poset where $P=\{2,3,6,12,24,36\}$ under the relation "division". Find the upper bounds of $A=\{2,3,6\}$ in P.	**5**	**3**	
19.	Consider a relation $R=\{(1,1),$¿ defined on a set $X=\{1,2,3\}$. Is it symmetric?	**5**	**2**	
20.	Find the complements of the elements a,b,c in the following lattice:	**5**	**3**	



PART- B (5x 10=50Marks)

		Marks	CO	RBT LEVEL
21. (a)	Show that R→S can be derived from the premises P → (Q→S), ¬R∨P and Q.	**(10)**	**1**	**3**
	(OR)			
(b)	Verify the validity of the following arguments: "All humming birds are richly colored", "No large birds live on honey", "Birds that do not live on honey are dull in color", "Humming birds are small".	**(10)**	**1**	**3**

22. (a)	How many positive integers not exceeding 1000 are divisible by any of the integers 3,5,7,11?	**(10)**	**2**	**3**
	(OR)			
(b)	**(i)** Using mathematical induction, prove that $1^2-2^2+3^2-\ldots+(-1)^{n-1}n^2=(-1)^{n-1}\frac{n(n+1)}{2}$ where 'n' is a positive integer.	**(6)**	**2**	**3**
	(ii) How many bit strings of length 8 contain (i) exactly four 1s? (ii) utmost four 1s? (iii) at least four 1s? (iv) an equal number of zeros and ones.	**(4)**	**2**	**3**
23. (a)	Examine whether the following graphs are isomorphic? Justify your answer	**(10)**	**3**	**3**



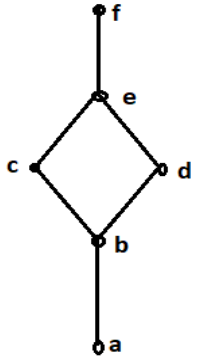
(OR)

(b)	Suppose that a company has 4 employees.: Alwin, David, Suman and Thejesh. Suppose that 4 jobs need to be done to complete a project: requirements, architecture, implementation and testing. Suppose that Alwin has been trained to do requirements and testing; David has been trained to de architecture, implementation and testing; Suman has been trained to do requirements, architecture and implementation; Thejesh has only been trained to do requirements (a) Model the capabilities of these employees using a bipartite graph. (b) Find an assignment of responsibilities such that each employee is assigned a responsibility and no employee is assigned more than one job	**(10)**	**3**	**3**
24. (a)	Show that ¿ is an abelian group where * is defined by $a*b=\frac{ab}{2}, \forall a,b \in Q^{+}$¿.¿	**(10)**	**4**	**3**
	(OR)			
(b)	**(i)** Find all the subgroups of ¿	**(6)**	**4**	**3**

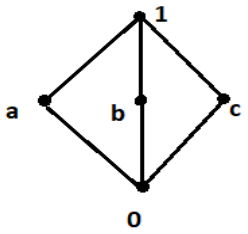
(ii) Let $G=\{1,-1,i,-i\}$ be a group under multiplication. Find the order of its elements. **(4)**

25. (a) Verify whether the following Hasse Diagrams represent lattices: **(10) 5 3**

(i)



(ii)



(OR)

(b) Let D_{42}= {1, 2, 3, 6, 7, 14, 21, 42}and the relation R be divisor on D_{42}. Find **(10) 5 3**
(i) All the lower bounds of 14 and 21.
(ii) The glb of 14 and 21.
(iii) All the upper bounds of 14 and 21.
(iv) The lub of 14 and 21.
(v) Draw the Hasse diagram

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Find the PDNF and PCNF of the following compound proposition: $[P \rightarrow (Q \wedge R)] \wedge [\neg P \rightarrow (\neg Q \wedge \neg R)]$.	**(10)**	**1**	**3**

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