Reg. No.															

Question Paper Code	13680

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Second Semester

Computer Science and Engineering

(Common to Artificial Intelligent and Data Science, Information Technology, Computer science and Engineering (AIML), Computer science and Engineering (IoT), M.Tech - Computer Science and Engineering (5 Years Integrated) & Computer science and Engineering (Cyber Security))

24BSMA201 - DISCRETE STRUCTURES

Regulations - 2024

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is the Negation of the statement "Sam is rich and happy"? (a) Sam is poor and unhappy (b) Either Sam is poor or happy (c) Either Sam is poor or unhappy (d) Sam is not rich and happy.	1	K1	CO1
2.	What is the logically equivalent statement to ¬ (∀x ∈ A) p(x)? (a) $(\exists x \in A)\neg p(x)$ (b) $(\exists x \in \neg A)p(x)$ (c) (∀x ∈ ¬A)p(x) (d) $(\forall x \in A)\neg p(x)$	1	K1	CO1
3.	If 100 houses are painted using 9 different colours. Demonstrate the minimum number of houses that must share the same colour. (a) 15 (b) 13 (c) 12 (d) 14	1	K2	CO2
4.	What is the total number of possible arrangements for 5 books placed in a row? (a) 25 (b) 10 (c) 120 (d) 100	1	K1	CO2
5.	Which of the following is not a property of a semigroup? (a) Closure (b) Associativity (c) Identity element (d) Binary operation	1	K1	CO3
6.	What condition must be satisfied for two cosets aH and bH to be equal? (a) $a = b$ (b) $a - b \in H$ (c) $ab \in H$ (d) $a^{-1}b \in H$	1	K1	CO3
7.	Find the number of elements in the adjacency matrix of a graph with 7 vertices. (a) 7 (b) 14 (c) 36 (d) 49	1	K2	CO4
8.	In a complete graph with 6 vertices, what is the degree of each vertex? (a) 1 (b) 3 (c) 5 (d) 6	1	K1	CO4
9.	Which of the following is NOT true for a lattice? (a) It is a poset (b) Every pair has a join and meet (c) It must be a total order (d) It can be visualized using Hasse diagrams	1	K1	CO5
10.	What is the result of a + 0 in Boolean Algebra? (a) a (b) 1 (c) 0 (d) a'	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

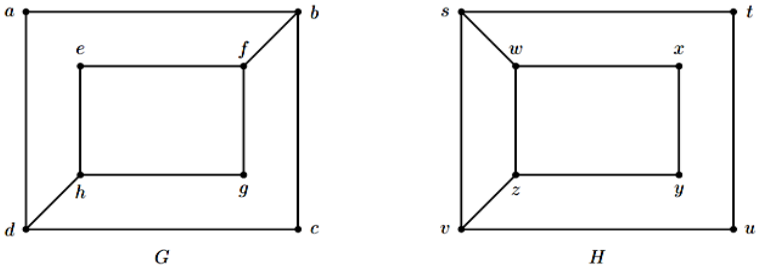
Answer ALL Questions

		Marks	K – Level	CO
11.	Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.	2	K2	CO1
12.	Define Conjunctive Normal Forms.	2	K1	CO1
13.	State the Well Ordering Principle.	2	K1	CO2
14.	Find the number of permutations of the word MISSISSIPPI.	2	K2	CO2
15.	Show that the identity element of a group is unique.	2	K2	CO3
16.	Define Normal Subgroup.	2	K1	CO3
17.	Define Self-Complementary graph.	2	K1	CO4
18.	Determine the number of vertices if G has 10 edges with two vertices of degree 4 and all others of degree 3.	2	K2	CO4
19.	Define Poset with an example.	2	K1	CO5
20.	Show that every interval of a lattice is a sublattice.	2	K2	CO5

21.	Show that the elements 0 and 1 of a Boolean algebra B are unique.		*2*	*K2*	*CO6*
22.	State identity laws in Boolean algebra.		*2*	*K1*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Apply logical laws to derive the PCNF and PDNF of $(\neg P \to R) \wedge (Q \leftrightarrow P)$.	*11*	*K3*	*CO1*
		OR			
	b)	Apply the indirect method to prove the given premises. $R \to 7Q, R \vee S, S \to 7Q, P \to Q \Rightarrow 7P$	*11*	*K3*	*CO1*
24.	a)	Apply Mathematical Induction to show that for all positive integers n, is $3^{2n+1} + 2^{n+2}$ divisible by 7.	*11*	*K3*	*CO2*
		OR			
	b)	From a committee consisting of 6 men and 7 women, find the number of ways to select a committee of (i) 3 men and 4 women. (ii) 4 members which has at least one women. (iii) 4 persons that has at most one man. (iv) 4 persons of both sexes. (v) 4 persons in which Mr. and Mrs. Kannan is not included.	*11*	*K3*	*CO2*
25.	a)	Let G $= \left\{\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}, \begin{bmatrix}-1 & 0\\0 & 1\end{bmatrix}, \begin{bmatrix}1 & 0\\0 & -1\end{bmatrix}, \begin{bmatrix}-1 & 0\\0 & -1\end{bmatrix}\right\}$, show that G is a group under the operation of matrix multiplication.	*11*	*K3*	*CO3*
		OR			
	b)	State and prove Lagrange's theorem on finite Group.	*11*	*K3*	*CO3*
26.	a)	Examine whether the following pair of graphs are isomorphic or not. Justify your answer.  	*11*	*K3*	*CO4*
		OR			
	b)	Illustrate with examples of graphs that are (i) Eulerian but not Hamiltonian (ii) Hamiltonian but not Eulerian (iii) Both Hamiltonian and Eulerian (iv) Neither Hamiltonian nor Eulerian.	*11*	*K3*	*CO4*
27.	a)	Let $(L, \leq)$ be a lattice. For any a,b,c∈ L the following properties are called isotonicity hold. If $b \leq c$ then prove that (i) $a * b \leq a * c$ and (ii) $a \oplus b \leq a \oplus c$	*11*	*K3*	*CO5*
		OR			
	b)	Prove that every chain is a distributive lattice.	*11*	*K3*	*CO5*
28.	a)	State and prove Boundedness laws in Boolean algebra.	*11*	*K3*	*CO6*
		OR			
	b)	In a Boolean algebra, prove that the following statements are equivalent. $(i) a + b = b \quad (ii) a.b = a \quad (iii) a' + b = 1 \quad (iv) a.b' = 0$	*11*	*K3*	*CO6*