Reg. No.															

Question Paper Code	14232

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Second Semester

Computer science and Engineering

(Common to Information Technology, Artificial Intelligence and Data Science & Computer science and Engineering (IoT))

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.	Which of the following is a tautology? (a) $p \wedge \neg p$ (b) $p \vee \neg p$ (c) $p \rightarrow \neg p$ (d) $\neg p \rightarrow p$	1	K1	CO1
2.	"If p, then q" is logically equivalent to (a) $p \vee q$ (b) $\neg p \vee q$ (c) $p \wedge q$ (d) $\neg p \vee q$	1	K1	CO1
3.	How many 3 different 3 digit numbers can be formed using the digits 2,3,4,5,6 without repeating any digit? (a) 10 (b) 60 (c) 120 (d) 20	1	K2	CO2
4.	In how many distinct ways can 6 people sit around a circular table? (a) 720 (b)120 (c) 360 (d) 24	1	K2	CO2
5.	A group must satisfy which of the following properties? (a) Closure, Associative, Identity, inverse. (b) Commutative, Associative, Identity, inverse. (c) Closure, Associative, Distributive, inverse. (d) Closure, Identity, Associative, Distributive.	1	K1	CO3
6.	Which of the following is a subgroup of (Z,+)? (a) Set of odd integers (b) Set of even integers (c) Set of positive integers (d) Set of prime numbers	1	K1	CO3
7.	In a simple graph with n vertices, the maximum number of edges is: (a) n^2 (b) $n(n-1)$ (c) $\frac{n(n-1)}{2}$ (d) $2n$	1	K1	CO4
8.	A graph is Eulerian if and only if: (a) It is connected and all vertices have even degree (b) It is complete (c) It has atleast one Hamiltonian cycle. (d) All vertices have odd degree	1	K1	CO4
9.	In a lattice, the meet($\wedge$) and join($\vee$) operations are: (a) Addition and subtraction (b) Union and intersection (c) Least upper bound and greatest lower bound (d) None of the above.	1	K1	CO5
10.	Which of the following is the dual of the Boolean expression a+0=a? (a) a.1=1 (b) a+1=1 (c) a.0=a (d) a+a=0	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

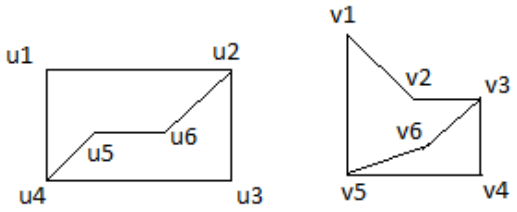
11.	Construct the truth table $p \vee \neg q$.	2	K2	CO1
12.	For the statement "if it rains then the ground is wet" Write the contra positive and inverse.	2	K2	CO1
13.	If seven colours are used to paint 50 bicycles, then show that an at least 8 bicycles will be the same colour.	2	K2	CO2
14.	Find the number of arrangements of the letters of the word "SUCCESS".	2	K2	CO2
15.	Prove that the identity element of a group is unique.	2	K2	CO3
16.	Define a monoid and give an example.	2	K1	CO3
17.	How many edges are there in a graph with ten vertices each of degree 5?	2	K2	CO4

18.	Define bipartite graph.	2	K1	CO4
19.	Show that the poset ({1,3,6,12,24},l) is a lattice.	2	K2	CO5
20.	Define a partial order relation.	2	K1	CO5
21.	Simplify (a.b)$(a.b)' + (a+b)'$ in a Boolean algebra.	2	K2	CO6
22.	In a Boolean algebra prove that $a(a+b)=a$.	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a) (i)	Derive $p \to (q \to s)$ using CP-rule (if necessary) from the the premises $p \to (q \to r)$ and $q \to (r \to s)$.	6	K3	CO1
	(ii)	Prove that that $(p \to q) \wedge (r \to q) \Leftrightarrow (p \vee r) \to q$ by truth table.	5	K3	CO1
		OR			
	b) (i)	Show that $r \wedge (p \vee q)$ follows logically from the the premises $p \vee q, q \to r, p \to s, \neg s$.	6	K3	CO1
	(ii)	Prove that $((p \vee q) \wedge \neg(\neg p \wedge (\neg q \vee \neg r))) \vee (\neg p \wedge \neg q) \vee (\neg p \wedge \neg q)$ is a tautology.	5	K3	CO1
24.	a)	Prove by mathematical induction that $3^{2n} + 4^{n+1}$ is divisible by 5,for $n \geq 0$.	11	K3	CO2
		OR			
	b)	Find the number of integers between 1 and 250 both inclusive that are divisible by any of the integers 2,3 ,5 and7.	11	K3	CO2
25.	a)	State and prove Lagrange's Theorem for finite groups.	11	K3	CO3
		OR			
	b)	If $*$ is the binary operation on the set R of real numbers defined by $a * b = a + b + 2ab$. (i)Find if $\{R,*\}$ is a semigroup. Is it commutative? (ii)Find the identity element, if exits. (iii)Which elements have inverse and what are they?	11	K3	CO3
26.	a) (i)	Examine whether the following pair of graphs are isomorphic. If not isomorphic, give the reasons.	5	K3	CO4



G1 G2

	(ii)	Prove that the maximum number of edges in a simple disconnected graph G with n vertices and k components is $\frac{(n-k)(n-k+1)}{2}$.	6	K3	CO4
		OR			
	b) (i)	Let G be a simple indirected graph with a vertices. Let u and v be two non – adjacent vertices in G such that deg(u) + deg(v) ≥ n in G. Show that G is Hamiltonian iff G+uv is Hamiltonian.	5	K3	CO4

(ii) Give an example of a connected graph which is *6 K3 CO4*
(1) Eulerian but not Hamilton.
(2) Hamiltonian but Eulerian.
(3) Neither Eulerian nor Hamiltoniaan.

27. a) Let $(L, \leq)$ be a lattice with the binary operations meet and join denoted by $*$ and $\oplus$. Then prove that for any a,b,c ∈ L the following are true. *11 K3 CO5*
(i) $a * a = a$ and $a \oplus a = a$ (ii) $a * b = b * a$ and $a \oplus b = b \oplus a$
(iii) $a * (b * c) = (a * b) * c$

OR

b) Let D_{100}={1,2,4,5,10,20,25,50,100} be the divisors of 100 and let the relation ≤ be the relation $a \leq b$ if a/b, then prove that $(D_{100}, /)$ is a poset. Determine *11 K3 CO5*
(i) GLB{10, 20} (ii) LUB{10, 20}
(iii) GLB{5, 10, 20, 25} (iv) LUB{5, 10, 20, 25}

28. a) In any Boolean algebra show that $ab' + a'b = 0$ *if and only if* $a = b$. *11 K3 CO6*

OR

b) State and prove Demorgan's law. *11 K3 CO6*