| Question Paper Code | 14235 |

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Second Semester
Computer Science and Business Systems
24BSMA204 - DISCRETE MATHEMATICS FOR COMPUTER SCIENCE
Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

### PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K – Level	CO

1. A compound proposition that is always true is called a -------   *1 K1 CO1*
   (a) Tautology   (b) Contradiction   (c) Satisfiable   (d) Contingency

2. Let P: We should be honest., Q: We should be dedicated., R: We should be overconfident.   *1 K1 CO1*
   Then 'We should be honest or dedicated but not overconfident.' is best represented by?
   (a) ~P V ~Q V R   (b) P ∧ ~Q ∧ R   (c) P V Q ∧ R   (d) P V Q ∧ ~R

3. If m pigeons are assigned to n pigeonholes, then there must be a pigeonhole containing   *1 K1 CO2*
   at least
   (a) $\left\lfloor \left(\frac{m-1}{n}\right)\right\rfloor + 1$ pigeons   (b) $\left\lfloor \left(\frac{m-1}{n}\right)\right\rfloor - 1$ pigeons
   (c) $\left\lfloor \left(\frac{m+1}{n}\right)\right\rfloor + 1$ pigeons   (d) $\left\lfloor \left(\frac{m-1}{n}\right)\right\rfloor$ pigeons

4. Determine the value of a_2 for the recurrence relation $a_n = 17a_{n-1} + 30n$ with $a_0=3$.   *1 K1 CO2*
   (a) 4387   (b) 5484   (c) 238   (d) 1437

5. The elements of the set $\{1, i, -i, -1\}$ forms a   *1 K1 CO3*
   (a) semigroup   (b) subgroup   (c) cyclic group   (d) abelian group

6. If H_1 and H_2 are subgroups of the group G, Then, which one of the following is also a   *1 K1 CO3*
   subgroup of G?
   (a) $H_1 \cup H_2$ (b) $H_1 \cap H_2$ (c) $H_1 \Delta H_2$ (d) none of these

7. In Boolean algebra, the complement of 1 is: *1 K1 CO4*
   (a) 1   (b) 0   (c) -1   (d) not defined

8. The absorption law in Boolean algebra is   *1 K1 CO4*
   (a) $A + (A \cdot B) = A$ (b) $A + A = A$ (c) $A \cdot (A + B) = A$ (d) Both A and C

9. A graph that has at least one path connecting any two vertices is called   *1 K1 CO5*
   (a) A cycle   (b) A connected graph   (c) A tree   (d) A digraph

10. What is the chromatic number of a bipartite graph $K_{m,n}$ *1 K1 CO6*
    (a) m-n   (b) mn   (c) m+n   (d) None of these

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. What is the contrapositive, the converse and the inverse of the conditional statement "the home team wins whenever it is raining".   *2 K2 CO1*

12. Prove that $\left(p \wedge \left(p \to q \right)\right) \to q \Rightarrow T$.   *2 K2 CO1*

13. Show that in any group of eight people, at least two have birthdays which fall on the same day of the week in any given year.   *2 K2 CO2*

14. Solve S(n)- 4S(n-1)- 11S(n-2) + 30 S(n-3) =0.   *2 K2 CO2*

15. Prove that the identity element of a group is unique.   *2 K2 CO3*

16. Let a and b be any two elements of a group (G,∗), then show that G is abelian. If and only if $(a * b)^2 = a^2 * b^2$.   *2 K2 CO3*

17. Show that in a Boolean algebra a.a =a, for all a∈ B.   *2 K2 CO4*

18. Simplify the Boolean expression a.c+c+[(b+b')+c].   *2 K2 CO4*

19. Define complete graph and give example.   *2 K1 CO5*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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20. Check whether the following graph is bipartite or not. If it is bipartite, check whether it is completely bipartite?   2   K2   CO5
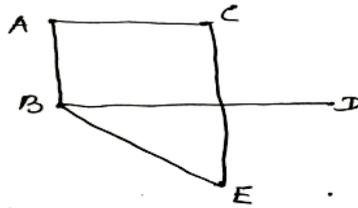
21. Define a spanning tree with an example.   2   K1   CO6

22. Define independence number.   2   K1   CO6

PART - C $(6 \times 11 = 66$ Marks)
Answer ALL Questions

23. a) Determine the Principal disjunctive normal form and hence find the principal conjunctive normal form of $(p \wedge \neg(q \wedge r)) \vee (p \rightarrow q)$.   11   K3   CO1

    OR

    b) Prove that $\left(\neg P \wedge (\neg Q \wedge R)\right) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ without using truth tables.   11   K3   CO1

24. a) Prove by using Mathematical induction $3^n + 7^n - 2$ is divisible by 8, for $n \geq 1$.   11   K3   CO2

    OR

    b) Solve the recurrence relation $a_{n+1} - a_n = 2n + 3 , n \geq 0, a_0=1$.   11   K3   CO2

25. a) If R is a relation defined on Z such that $a R b$ if and only if $a^2 - b^2$ is divisible by 3, show that R is an equivalence relation.   11   K3   CO3
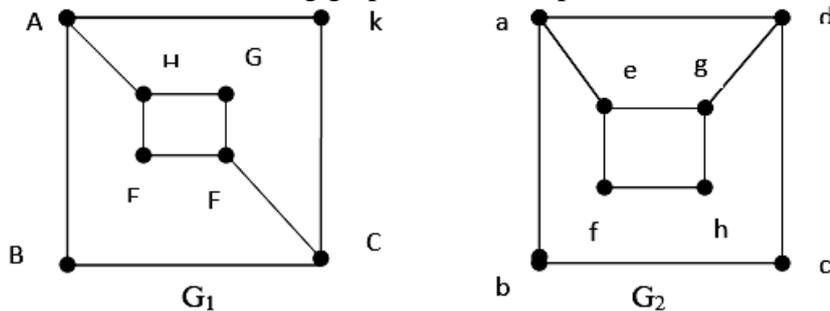
    OR

    b) State and prove Lagrange's theorem.   11   K3   CO3

26. a) Minimise the function f(a,b,c,d) $= \Sigma(0,2,6,7,8,9,13,15)$ using Karnaugh map method.   11   K3   CO4

    OR

    b) State and prove De Morgan's laws in Boolean algebra.   11   K3   CO4

27. a) Determine whether the following graphs are isomorphic or not.   11   K3   CO5

    OR

    b) Prove that the maximum number of edges in a simple disconnected group G with n vertices and k components is $\dfrac{(n-k)(n-k+1)}{2}$.   11   K3   CO5

28. a) Prove that a connected planar graph with n vertices and e edges has $e - n + 2$ regions.   11   K3   CO6

    OR

    b) Show that every tree with two or more vertices is 2 – Chromatic.   11   K3   CO6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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