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B.Tech. / M.Tech. (Integrated) DEGREE EXAMINATION, MAY 2025

Fourth and Fifth Semester

21MAB302T - DISCRETE MATHEMATICS

(For the candidates admitted during the academic year 2021 - 2022 to 2024 - 2025)

Note:

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 hours **Max. Marks: 75**

PART - A (20 × 1 = 20 Marks) — Answer **all** Questions

		Marks	BL	CO
1.	Power set of {a, {b}} is (A) {∅, {a} , {{b}} , {a, {b}}} (B) {∅, {a} , {b} , {a, {b}}} (C) {∅, {{b}} , {a, {b}}} (D) {∅, {a} , {{b}}}	1	1	1
2.	If P = {1, {2} , 4} and Q = {1, 2, 4}, then (A) P = Q (B) Q ⊆ P (C) $P \neq Q$ (D) P ⊆ Q	1	2	1
3.	If A = {3, 4, 5} and R is a relation on A given by R = {(x, y) | x + y > 10}, then R is (A) R = {(3, 4), (4, 5)(3, 5) (B) A (C) ∅ (D) {(3, 4), (4, 5)}	1	2	1
4.	Let $f(x) = 2x + 3$ and $g(x) = 3x + 2$ be functions on R then f∘g is (A) $3x + 7$ (B) $6x + 7$ (C) $6x + 11$ (D) $3x + 11$	1	2	1
5.	There are 10 points in a plane, no three of which are in the same straight line, excepting 4 points, which are collinear. The number of lines obtained from the pairs of these points is (A) 20 (B) 30 (C) 40 (D) 50	1	2	2
6.	If n pigeonholes are occupied by n + 1 pigeons, then any one of the pigeonhole is occupied by (A) One pigeon (B) Two pigeons (C) Three pigeons (D) Four pigeons	1	1	2
7.	If a and b be any two non zero integers, then gcd (a, b) is (A) $mn + ab$ (B) $ma + nb$ (C) $abmn$ (D) ab divides mn	1	1	2
8.	If $a = qb + r$, then (A) gcd (a, r) = gcd (b, r) (B) gcd (a, b) = gcd (a, r) (C) gcd (a, r) = gcd (q, r) (D) gcd (a, b) = gcd (b, r)	1	1	2
9.	A premise may be introduced at any point in the derivation is called (A) Rule P (B) Rule P and rule T (C) Rule T (D) Rule CP	1	1	3
10.	The dual of $(P \wedge Q) \vee T$ is (A) $(P \wedge Q) \wedge T$ (B) $(P \wedge Q) \wedge T$ (C) (P ∨ Q)∧ F (D) $(P \wedge Q) \vee F$	1	2	3
11.	Which one is the inverse of $q \rightarrow p$?			

(A) $p \rightarrow q$ (B) $7p \rightarrow 7q$

(C) $7q \rightarrow p$ (D) $7p \rightarrow q$

1 1 3

12. Which of the following proposition is a tautology?

(A) $(p \vee q) \rightarrow p$ (B) $p \vee (q \rightarrow p)$

(C) $p \vee (p \rightarrow q)$ (D) $p \rightarrow (p \rightarrow q)$

1 2 3

13. In a group $G = \{1, -1, i, -i\}$ under multiplication order of the element i is

(A) 1 (B) 2

(C) 3 (D) 4

1 2 4

14. In a permutation group S_3, if $p = \begin{pmatrix} a & b & c \\ b & c & a \end{pmatrix}$, then inverse of p is

(A) $\begin{pmatrix} a & b & c \\ c & a & b \end{pmatrix}$ (B) $\begin{pmatrix} a & b & c \\ a & c & b \end{pmatrix}$

(C) $\begin{pmatrix} a & b & c \\ b & c & a \end{pmatrix}$ (D) $\begin{pmatrix} a & b & c \\ b & a & c \end{pmatrix}$

1 2 4

15. Subgroup of $(R, +)$ is

(A) $(R, -)$ (B) $(Q, \bullet)$

(C) $(Z^+, +)$ (D) $(Z, +)$

1 1 4

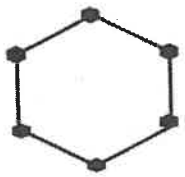
16. The inverse element in a group $(G, *)$ with binary operation a*b=a+b+2

(A) $-a$ (B) $-(a+4)$

(C) -2 (D) -4

1 2 4

17. The chromatic number for the following graph is



(A) 1 (B) 2

(C) 3 (D) 4

1 2 5

18. _____ graphs satisfy invariant property

(A) Homomorphic (B) Eulerian

(C) Isomorphic (D) Hamiltonian

1 1 5

19. A connected graph without any circuit is called _____

(A) Loop (B) Tree

(C) Leaf (D) Forest

1 1 5

20. A vertex which is not adjacent to every other vertex is called _____ vertex

(A) Isolated (B) Pendant

(C) Incident (D) Simple

1 1 5

PART - B (5 × 8 = 40 Marks)

Answer **all** Questions

Marks BL CO

21. (a) If A, B and C are sets, prove that both analytically and graphically $A \cap (B-C) = (A \cap B) - (A \cap C)$.

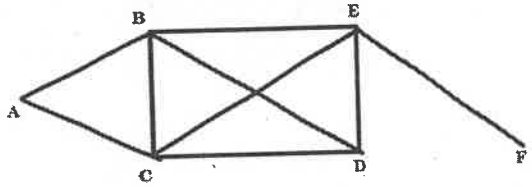
8 3 1

(OR)

(b) Draw the Hasse diagram representing the partial ordering $\{(A, B)/A \leq B\}$ the power set P(S) where S = {a, b, c}.

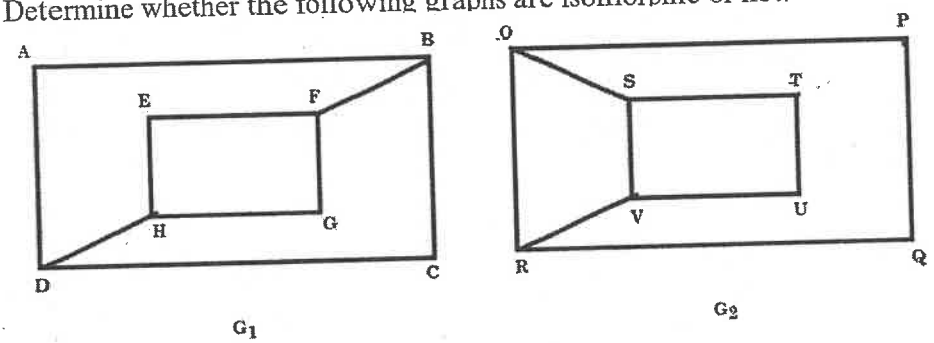
22.

	(a) There are 250 students in an Engineering college. Of these 188 have taken a course in Fortan, 100 have taken a course in C and 35 have taken a course in Java. Further 88 have taken courses in both Fortran and C, 23 have taken courses in both C and Java and 29 have taken courses in both Fortran and Java. If 19 of these students have taken all the three courses, how many of these 250 students have not taken a course in any of these 3 programming languages?	8	4	2
	(OR)			
	(b) Use the Euclidean division algorithm to find the gcd of (18, 19, 35, 87). Also express the gcd as a linear combination of the given numbers.			
23.	(a) Show that the following set of premises are inconsistent. If Rama gets his degree, he will go for a job. If he gets a job he will get married soon. If he goes for higher study he will not get married. Rama gets his degree and goes for higher study.$n \geq 1$.	8	4	3
	(OR)			
	(b) Prove by mathematical induction $n^3 + 2n$ is divisible by 3, for $n \geq 1$.			
24.	(a) If * is defined on R such that a*b=a+b–ab for a,b∈R then show that {R,*} is an abelian group.	8	3	4
	(OR)			
	(b) If the permutation of the elements of {1, 2, 3, 4, 5} are given by $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 1 & 4 & 5 \end{pmatrix}, \beta = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 3 & 5 & 4 \end{pmatrix}, \gamma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 4 & 3 & 1 & 2 \end{pmatrix}$, $\delta = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 2 & 1 & 5 & 4 \end{pmatrix}$ find $\alpha\beta, \beta\alpha, \alpha^2, \alpha\beta\gamma$.			
25.	(a) Find the number of vertices, the number of edges and the degree of each vertices from the following graph. Also verify the handshaking theorem.	8	3	5



(OR)

(b) Determine whether the following graphs are isomorphic or not.

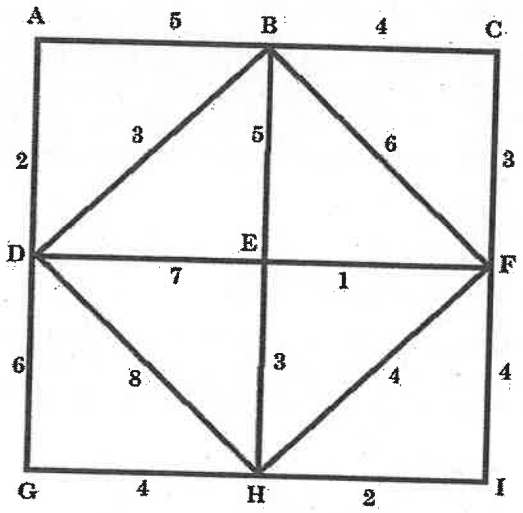


G_1 G_2

PART - C (1 × 15 = 15 Marks)

Answer **any 1** Questions

		Marks	BL	CO
26.	Let R = {(1, 1), (1, 3), (2, 3), (3, 4), (4, 1), (4, 2)} be the relation on A = {1, 2, 3, 4}. Find the transitive closure of R using Warshall's algorithm.	15	3	1
27.	Use Kruskal's algorithm to find a minimum spanning tree for the following weighted graph.			



15 4 5

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