Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2024

Fourth, Fifth and Sixth Semester

18MAB302T – DISCRETE MATHEMATICS FOR ENGINEERS

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

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 40^{th} minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours | Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
1. $A-(B\cap C)$ is (A) ϕ (B) A (C) (A–B)∩(A–C) (D) (A–B)∪(A–C)	1	1	1	2
2. Let R={(1,1), (2,2), (3,3)} be a relation on A={1,2,3}. Then R is (A) Reflexive only (B) Symmetric only (C) Transitive only (D) An equivalence relation	1	2	1	1
3. Let f={(1,2),(2,1),(3,4),(4,5),(5,3)} be a function on {1,2,3,4,5}. Then f is (A) Injective only (B) Surjective only (C) Bijective (D) Neither injective nor surjective	1	2	1	2
4. Let f={(1,2),(2,1),(3,4),(4,5),(5,3)} be a function on {1,2,3,4,5}. Then the inverse of f is (A) Not exist (B) {(1,2),(2,1),(3,4),(4,5),(5,3)} (C) {(1,2),(2,1),(3,5),(4,3),(5,4)} (D) {(1,2),(2,1),(3,5),(4,4),(5,5)}	1	1	1	2
5. If a club consisting of 6 men and 7 women, the number of ways to select a committee of 3 men and 4 women is (A) C(6,3)+C(7,4) (B) C(6,3)×C(7,4) (C) C(5,2)+C(6,3) (D) C(5,2)×C(6,3)	1	2	2	1
6. The number of different circular arrangements of n objects is (A) (n–1)! (B) (n+1)! (C) 1/2(n–1)! (D) 1/2(n+1)!	1	1	2	2
7. If 36 pigeons are accommodated in 4 pigeonholes, the least number of pigeons accommodated in one pigeonhole is (A) 8 (B) 9 (C) 10 (D) 11	1	2	2	1
8. If x and y are two positive integers, then gcd(x,y).lcm(x,y) is (A) x (B) y (C) xy (D) x+y	1	1	2	2

9. The dual of $p \rightarrow q$ is 1 1 3 2
   (A) $\neg p \vee q$ (B) $\neg p \wedge q$
   (C) $\neg p$ (D) q

10. A premise may be introduced at any step in the derivation is known as 1 2 3 2
   (A) Rule T (B) Rule P
   (C) Rule C (D) Rule CP

11. The symbolic form of "good food is not cheap". P : food is good and q : food is cheap. 1 1 3 1
   (A) $p \rightarrow q$ (B) $p \rightarrow \neg q$
   (C) $p \vee \neg q$ (D) $p \wedge \neg q$

12. $p \leftrightarrow q$ is equivalent to 1 2 3 1
   (A) $(p \rightarrow q) \vee (q \rightarrow p)$ (B) $(p \rightarrow q) \wedge (q \rightarrow p)$
   (C) $p \rightarrow q$ (D) $q \rightarrow p$

13. Which of the following is a group? 1 1 4 1
   (A) $(\mathbb{N},+)$ (B) $(\mathbb{Z},-)$
   (C) $(\mathbb{Z},.)$ (D) $(\mathbb{Z},+)$

14. The cardinality of the permutation group of degree n is 1 1 4 1
   (A) n (B) 2n
   (C) n! (D) (n–1)!

15. Let $G=\{1,-1,i,-i\}$ be a group under multiplication. The order of $-i$ is 1 2 4 2
   (A) 1 (B) 2
   (C) 3 (D) 4

16. The Hamming distance between 11010 and 10101 is 1 2 4 2
   (A) 4 (B) 3
   (C) 2 (D) 1

17. The maximum number of edges in a simple disconnected graph with 8 vertices and 2 components is 1 2 5 2
   (A) 19 (B) 20
   (C) 21 (D) 22

18. Every connected graph has atleast 1 1 5 1
   (A) One spanning tree (B) Two spanning tree
   (C) Three spanning tree (D) Four spanning tree

19. A tree with 10 vertices has 1 1 5 1
   (A) 8 edges (B) 9 edges
   (C) 10 edges (D) 11 edges

20. The chromatic number of a complete graph K_n with n vertices is 1 2 5 2
   (A) n–1 (B) n
   (C) n+1 (D) n+2

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

	Question	Marks	BL	CO	PO
21.	Draw the Hasse diagram for the divisibility relation on {2,4,5,10,12,20,25}.	4	3	1	1
22.	In how many ways can 2 letters be selected from the set {a,b,c,d} when repetition of the letters is allowed, if (i) The order of the letters matters (ii) The order does not matter?	4	4	2	2
23.	Construct a truth table for the compound proposition $(p \to q) \wedge (q \to r) \to (p \to r)$.	4	3	3	2
24.	Prove that the intersection of two subgroups of a group G is also a subgroup of G. Give an example to show that the union of two subgroups of G need not be a subgroup of G.	4	4	4	1
25.	Prove that the number of edges in a bipartite graph with n vertices is at most $n^2/4$.	4	3	5	1
26.	If R and S be relations on a set A represented by the matrices $M_R = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ *and* $M_s = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ find the matrix that represent R⊕S.	4	3	1	2
27.	Without constructing the truth table, prove that $\neg p \to (q \to r) \equiv q \to (p \vee r)$.	4	3	3	2

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

	Question	Marks	BL	CO	PO
28. a.i.	If R is the relation on the set of positive integers such that $(a,b) \in R$ if and only if a^2+b is even, prove that R is an equivalence relation.	6	4	1	1
ii.	Verify that fo(goh)=(fog)oh, when f,g,h:R→R are defined by $f(x) = x^2, g(x) = x+5$ *and* $h(x) = \sqrt{x^2+2}$.	6	4	1	1
	(OR)				
b.	By using Warshall's algorithm, find the transitive closure of the relation R={(1,1),(1,3),(2,1),(2,4),(3,3),(4,2),(5,4)} on the set A={1,2,3,4,5}.	12	3	1	2
29. a.	Find the number of integers between 1 and 250 both inclusive that are not divisible by any of the integers 2,3,5 and 7.	12	4	2	2
	(OR)				
b.	Use the Euclidean algorithm to find gcd(28844,15712) and express the gcd as a linear combination of the given number.	12	3	2	2
30. a.i.	Derive $p \to (q \to s)$ using the CP-rule from the premises $p \to (q \to r)$ and $q \to (r \to s)$.	6	3	3	1

ii. Use mathematical induction to prove that $\left(3^n + 7^n - 2\right)$ is divisible by 8, for $n \geq 1$. 6 3 3 1

(OR)

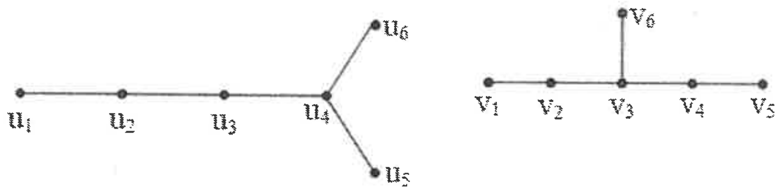
b. Construct an argument to show that the following premises imply the conclusion. If A works hard, then B or C will enjoy themselves. If B enjoys himself, then A will not work hard. If D enjoys himself, then C will not. Therefore, if A works hard, D will not enjoy himself. 12 4 3 1

31. a. State and prove the necessary and sufficient condition for a non empty subset to be a sub group. 12 3 4 1

(OR)

b. Find the code words generated by the parity check matrix $H = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ when the encoding function is $e: B^3 \to B^6$. 12 4 42

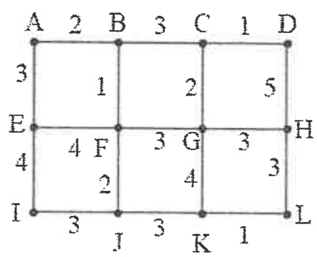
32. a.i. Determine whether the following graphs are isomorphic 6 3 5 2



ii. Show that the number of vertices of odd degree in a undirected graph is even. 6 3 5 2

(OR)

b. Find the minimum spanning tree for the following weighted graph using Kruskal's algorithm. 12 3 5 2



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