

## B.Tech. DEGREE EXAMINATION, DECEMBER 2022

Fourth and Fifth 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<sup>th</sup> minute.
- (ii) Part - B should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

Marks BL CO PO

## PART – A (25 × 1 = 25 Marks)

Answer ALL Questions

- Power set of empty set has exactly \_\_\_\_\_ subset.
 

(A) Two	(B) One	1	1	1	1.2
(C) Zero	(D) Three				
- A relation R on set A is said to be partial order relation if
 

(A) R is reflexive, transitive but not symmetric	(B) R is symmetric, transitive but not reflexive	1	1	1	1.2
(C) R is irreflexive and antisymmetric	(D) R is reflexive, antisymmetric and transitive				
- If R and S be relation on a set A represented by the matrices
 
$$M_R = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix} \text{ \& } M_S = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$
 then  $M_{R \circ S}$  is
 

(A) $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$	(B) $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix}$	1	2	1	1.2
(C) $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{pmatrix}$	(D) $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}$				
- If f and g are onto then the function g of f is
 

(A) One-one	(B) Many one	1	1	1	1.2
(C) Onto	(D) Into				
- Which of the following is not a function?
 

(A) $\{(1,2), (1,4), (2,5), (3,8)\}$	(B) $\{(1,2), (2,4), (3,6)\}$	1	2	1	1.2
(C) $\{(-1,1), (-2,4), (2,4)\}$	(D) $\{(1,1), (2,2), (3,3)\}$				
- In how many ways the letters of the word "STRESS" can be arranged?
 

(A) 360	(B) 720	1	2	2	1.2
(C) 240	(D) 120				
- How many 3 digit numbers can be formed from the digits 2,3,5,6,7 and 9 which are divisible by 5 and none of the digits is repeated.
 

(A) 5	(B) 10	1	2	2	1.2
(C) 20	(D) 15				
- In how many number of ways of arranging 7 persons around a circle?
 

(A) 6!	(B) 5!	1	1	2	1.2
(C) 7!	(D) 4!				



9. If  $\gcd(a,b)=1$ , then integers  $a$  and  $b$  are  
 (A) Prime (B) Relatively prime  
 (C) Composite (D) Even
10. If  $a = -23$  and  $b = 7$  then  
 (A)  $q = 4, r = 5$  (B)  $q = -4, r = 5$   
 (C)  $q = 4, r = -5$  (D)  $q = -4, r = -5$
11. The converse of the conditional statement "if it is raining, then I get wet" is  
 (A) If I get wet then it is raining (B) If I don't get wet then it is not raining  
 (C) If it is not raining then I don't get wet (D) If it is raining, then I may not get wet
12.  $P \rightarrow (P \vee Q)$  is equivalent to  
 (A) F (B) T  
 (C) P (D)  $\neg Q$
13. Dual of  $(P \wedge Q) \vee R$   
 (A)  $(P \wedge Q) \vee R$  (B)  $(P \wedge Q) \wedge R$   
 (C)  $(P \vee Q) \wedge R$  (D)  $(P \vee Q) \vee R$
14. The logically equivalent proportion of  $P \Leftrightarrow Q$  is  
 (A)  $(P \wedge Q) \vee (P \wedge \neg Q)$  (B)  $(P \Rightarrow Q) \wedge (Q \Rightarrow P)$   
 (C)  $(P \wedge Q) \vee (Q \Rightarrow P)$  (D)  $(P \wedge Q) \Rightarrow (Q \vee P)$
15. A premise may be introduced at any point in the derivation is called \_\_\_\_\_  
 (A) Rule P (B) Rule P and T  
 (C) Rule T (D) Rule CP
16. If  $a, b$  are the elements of a group  $G$ . then  $(a*b)^{-1}$   
 (A)  $b^{-1} * a^{-1}$  (B)  $b*a$   
 (C)  $a^{-1} * b^{-1}$  (D)  $a*b$
17. If  $\alpha, \beta$  are elements of the symmetric group  $S_4$  given by  $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 2 & 1 \end{pmatrix}$  and  $\beta = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 3 & 1 \end{pmatrix}$  then  $\alpha\beta$   
 (A)  $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{pmatrix}$  (B)  $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 1 & 4 & 2 \end{pmatrix}$   
 (C)  $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \end{pmatrix}$  (D)  $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 2 \end{pmatrix}$
18. A ring  $(R, +, \cdot)$  with identity is said to be a  
 (A) Field (B) Ring  
 (C) Division ring (D) Semi group
19. Minimum distance between the code words  $x=1001, y=0100, z=1000$   
 (A) 1 (B) 2  
 (C) 3 (D) 4
20. If the minimum distance between any two code words is atleast 5, then maximum number of errors that can be detected is  
 (A) 2 (B) 3  
 (C) 4 (D) 5



21. The degree of pendant vertex. 1 1 5 1,2  
 (A) 0 (B) 1  
 (C) 2 (D) 3
22. Graphs that include loops and possibly multiple edges connecting the same pair of vertices is called 1 1 5 1,2  
 (A) Pseudo graph (B) Bipartite graph  
 (C) Complete graph (D) Directed graph
23. The maximum number of edges in a simple disconnected graph with  $n$  vertices and  $k$  components is 1 1 5 1,2  
 (A)  $\frac{(n+k)(n+k+1)}{2}$  (B)  $\frac{(n+k)(n-k+1)}{2}$   
 (C)  $\frac{(n-k)(n-k+1)}{2}$  (D)  $\frac{(n-k)(n+k+1)}{2}$
24. A path in a graph  $G$  that includes each vertex exactly once is 1 2 5 1,2  
 (A) Euler path (B) Simple path  
 (C) Hamiltonian path (D) Cyclic path
25. The chromatic number of the complete bipartite graph  $K_{4,3}$  1 2 5 1,2  
 (A) 2 (B) 3  
 (C) 6 (D) 5

**PART - B (5 × 10 = 50 Marks)**

Answer ALL Questions

Marks BL CO PO

26. a. If two functions  $f: \mathbb{R} \rightarrow \mathbb{R}$  and  $g: \mathbb{R} \rightarrow \mathbb{R}$  are defined as  $f(x) = x^2 - 2$  and  $g(x) = x + 4$ , analyze whether  $f$  and  $g$  are injective, surjective and bijective. Also find  $\text{gof}$ ,  $\text{fog}$ . 10 4 1 1,2
- (OR)
- b. Applying Warshall's algorithm, find the transitive closure of a relation  $R$  10 3 1 1,2  
 $R = \{(1,1), (1,3), (1,4), (2,2), (3,4), (4,1)\}$ .
27. a.i. In a class of 50 students, 20 students play football and 16 students play hockey. It is found that 10 students play both the games. Compute the number of students who play neither. 5 3 2 1,2
- ii. Prove that if 10 points are placed in a 3 cm by 3 cm square then distance between two points must be less than or equal to  $\sqrt{2}$  cm apart. 5 3 2 1,2
- (OR)
- b. Apply Euclidean algorithm, to find  $\text{gcd}(1819, 3587)$  and also express the gcd as a linear combination of the given number. 10 4 2 1,2
28. a.i. If it rains heavily then travelling will be difficult. If students arrive on time then travelling was not difficult. If they arrive on time, then it did not rain heavily. Check the validity of the conclusion. 5 3 3 1,2
- ii. Apply mathematical induction to show that  $n! \geq 2^{n-1}$  for  $n = 1, 2, \dots$  5 3 3 1,2

(OR)



- b. Using indirect method of proof, derive  $p \rightarrow \neg s$  from the premises  $p \rightarrow (q \vee r)$ ,  $q \rightarrow \neg p$ ,  $s \rightarrow \neg r, p$ . 10 4 3 1,2

29. a. Show that the set  $Q^+$  of all positive rational numbers forms an abelian group under the operation  $*$  defined by  $a * b = \frac{1}{2}ab; a, b, \in Q^+$ . 10 3 4 1,2

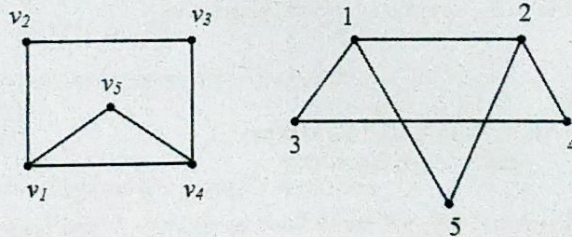
**(OR)**

- b. Compute the code words generated by the parity check matrix. 10 4 4 1,2

$$H = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

When the encoding function is  $e: B^3 \rightarrow B^6$ .

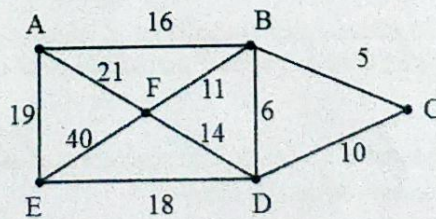
30. a.i. Check whether, the following two graphs are isomorphic. If not give reasons. 5 3 5 1,2



- ii. Prove that the number of edges in a bipartite graph with  $n$  vertices is at most  $n^2/4$ . 5 3 5 1,2

**(OR)**

- b. Applying Kruskal's algorithm, to find the minimum spanning tree for the weighted graphs. Also, draw the minimum spanning tree. 10 4 5 1,2



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