

Total No. of Questions : 8]

SEAT No. :

P652

[Total No. of Pages : 4

[5869] - 281

**S.E. (Information Technology)**  
**DISCRETE MATHEMATICS**  
**(2019 Pattern) (Semester - III)**

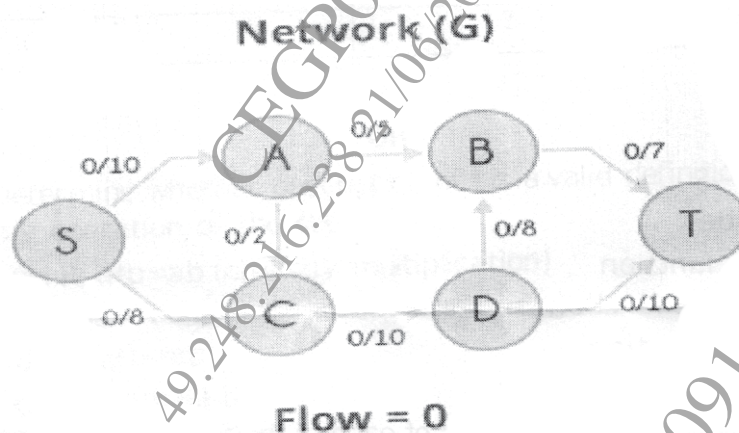
Time : 2½ Hours]

[Max. Marks : 70

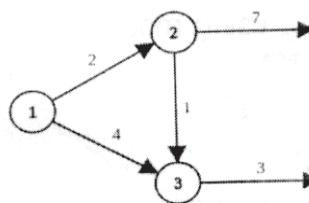
Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Draw neat diagrams wherever necessary.
- 4) Use of scientific calculators is allowed.
- 5) Assume suitable data if necessary.

- Q1) a) What are various operations on Graph? Explain it in detail? [4]
- b) Find the maximum flow in the given network. [8]



- c) Find the shortest path using Dijkstra's algorithm. [6]



OR

P.T.O.

- Q2) a)** Let 'G' be a connected planar graph with 20 vertices and the degree of each vertex is 3. Find the number of edges and regions in the graph. [6]
- b)** Explain the following types of graphs with the help of examples : [6]
- Bipartite Graph
  - Complete Graph
  - Regular Graph
  - Spanning Subgraph
- c)** Find under what conditions  $K_m, n$  the complete bipartite graph will have an Eulerian circuit. [6]

- Q3) a)** Suppose that the relation R on a set is represented by the matrix  $M_R$ . Is R reflexive, symmetric, and/or anti-symmetric? [6]

$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

- b)** Find the homogeneous solution for the recurrence relation [6]
- $$A_n - 6a_{n-1} - 11a_{n-2} + 6a_{n-3} \text{ with } a_0 = 2, a_1 = 5, a_2 = 15$$
- c)** Let  $f(x) = x + 2$ ,  $g(x) = x - 2$ ,  $h(x) = 3x$ , for  $x \in \mathbb{R}$  where  $\mathbb{R}$  is the set of real numbers Find i)  $\text{gof}$  ii)  $\text{fog}$  iii)  $\text{fof}$  iv)  $\text{hog}$  v)  $\text{gog}$ . [5]

OR

- Q4) a)** Find Relation Matrix, [6]
- If  $A = \{1, 2, 3, 4, 5, 6\}$  and  $a R b$  iff  $a$  divides  $b$  for  $a, b \in A$ .
  - $R = \{(a, b) / a < b\}$  for  $a, b \in A$ .
- b)** Let  $A = \{1, 2, 3, 4\}$ ,  $B = \{a, b\}$ , and  $R = \{(1, a), (2, a), (3, a), (4, a)\}$ ,  $S = \{(4, a), (4, b), (3, a), (3, b)\}$  [6]

Find

- $A \times B$
  - $\sim R$
  - $\sim S$
  - $\sim R \cup \sim S$
- c)** Describe : [5]
- Identity function
  - Composite function
  - Inverse function

- Q5) a)** Find the prime factorization of each of the following integer. [6]  
 i) 6647 ii) 45500  
 iii) 10!
- b) Find integers p and q such that  $51p + 36q = 3$  using [6]  
 Extended Euclidian algorithm. Also find GCD.
- c) Find the values of the following using modular arithmetic. [6]  
 i)  $77 \bmod 9$   
 ii)  $3110 \bmod 13$

OR

- Q6) a)** Solve the following using Fermat's Little theorem. [6]  
 i)  $769 \bmod 23$   
 ii)  $3101 \bmod 13$
- b) Find Euler Totient Function of the following numbers. [6]  
 i) 75 ii) 5488  
 iii) 77
- c) Compute GCD of the following using Euclidean algorithm. [6]  
 i) GCD (831, 366)  
 ii) GCD (2222, 1234)

- Q7) a)** Consider the (2, 6) encoding function e.  $e(00) = 100000$ , [7]  
 $e(10) = 101010$   
 $e(01) = 001110$ ,  $e(11) = 101001$   
 Find minimum distance of e.  
 How many errors will e detect?
- b) Let  $R = \{0^\circ, 60^\circ, 120^\circ, 180^\circ, 240^\circ, 300^\circ\}$  and  $*$  = binary operation, so [6]  
 that  $a * b$  is overall angular rotation corresponding to successive rotations  
 by a and then by b. Show that  $(R, *)$  is a Group.
- c) Prove that the following table on relation of elements of set [4]  
 $G = \{0, 1, 2, 3, 4, 5\}$  multiplication mod 6 is not a group.

	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	0
2	2	3	4	5	0	1
3	3	4	5	0	1	2
4	4	5	0	1	2	0
5	5	0	1	2	3	4

OR

Q8) a) Determine whether description of  $*$  is a valid definition of a binary operation on the set. [6]

i) On  $R$ ,  $a*b = ab$  (ordinary multiplication)

ii) On  $Z$ ,  $a*b = a/b$

iii) On  $Z$ ,  $a*b = ab$

iv) On  $Z$ ,  $a*b = a-b$

v) On  $Z$ ,  $a*b = 2a+b$

vi) On  $R$ ,  $a*b = ab/3$

b)  $S = \{1, 2, 3, 6, 12\}$ , where  $a*b$  is defined as LCM  $(a, b)$ . [7]

Determine whether it is an Abelian Group or not.

c) Define Ring. [4]

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