



BRAINWARE UNIVERSITY

Course – MCA

Discrete Mathematics (MCA104)

(Semester – 1)

Time allotted: 3 Hours

Full Marks: 70

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question)

10 x 1 = 10

1. Choose the correct alternative from the following
 - (i) If a relation R defined on a set $A = \{1, 2, 3\}$ such that $R = \{(1, 1), (1, 2), (2, 1)\}$, then R is

a. Symmetric only	b. Transitive only
c. both a and b	d. None of these.
 - (ii) Let $P(n): 5^n + 4^n$ is divisible by 9 for any positive integer n. The truth value of $P(2) \rightarrow P(3)$ is

a. True	b. False
c. Inadequate information	d. None of these
 - (iii) A circuit less connected graph is called

a. Multi graph	b. Tree
c. Pseudo graph	d. None of these
 - (iv) Cardinality of the power set of a non-empty set A is

a. $2^{ A }$	b. $2 A $
c. $ A ^2$	d. None of these.
 - (v) A pendant vertex has degree

a. 2	b. 1
c. 3	d. 4
 - (vi) If $f(x) = \cos x$ and $g(x) = x^x$ what will be $f \circ g$

a. $(\cos x)^{\cos x}$	b. $\cos x^{\cos x}$
c. $\cos x^x$	d. $(\cos x)^x$

- (vii) $[\sim p \vee (p \rightarrow q)] \rightarrow \sim p$ is
- Tautology
 - Contingency
 - Contradiction
 - None of these.
- (viii) Out of the following the singleton set (whose cardinality is one) is
- $A = \{ x : 3x^2 - 27 = 0, x \in \mathbb{Q} \}$
 - $B = \{ x : x^2 - 1 = 0, x \in \mathbb{R} \}$
 - $C = \{ x : 30x - 59 = 0, x \in \mathbb{N} \}$
 - $D = \{ x : x^2 - 1 = 0, x \in \mathbb{N} \}$
- (ix) The solution of the recurrence $a_r - 7a_{r-1} + 10a_{r-2} = 0$, given $a_0 = 0$, $a_1 = 3$ is
- $5^{-r} - 2^r$
 - $5^r + 2^r$
 - $5^r - 2^r$
 - None of these.
- (x) If a binary tree has 20 pendant vertices then the number of internal vertices of the tree is
- 20
 - 21
 - 23
 - 19

Group – B

(Short Answer Type Question)

(Answer any *three* from the following)

3 x 5 = 15

- In a survey of university students, 64 had taken mathematics course, 94 had taken chemistry course, 58 had taken physics course, 28 had taken mathematics and physics, 26 had taken mathematics and chemistry, 22 had taken chemistry and physics course, and 14 had taken all the three courses. Find how many had taken one course only. [5]
- Prove that $A \times (B \cup C) = (A \times B) \cup (A \times C)$ where A, B, C are three non empty sets. [5]
- Determine whether the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^3$ is bijective function or not. [5]
- Show that $(p \rightarrow r) \wedge (q \rightarrow r)$ and $(p \vee q) \rightarrow r$ are logically equivalent [5]
- Prove that product of three consecutive positive integers is always divisible by three. [5]

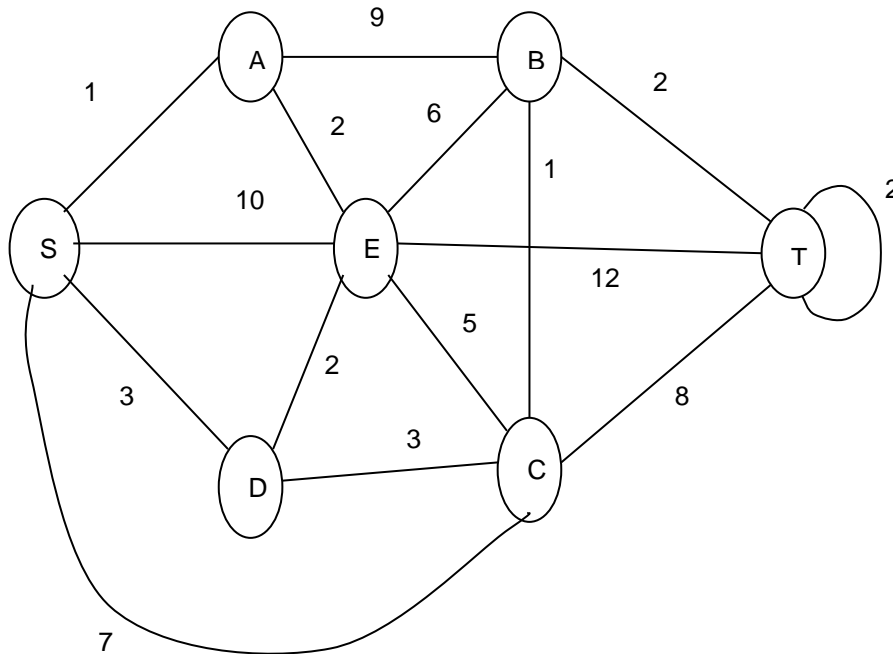
Group – C

(Long Answer Type Question)

(Answer any *three* from the following)

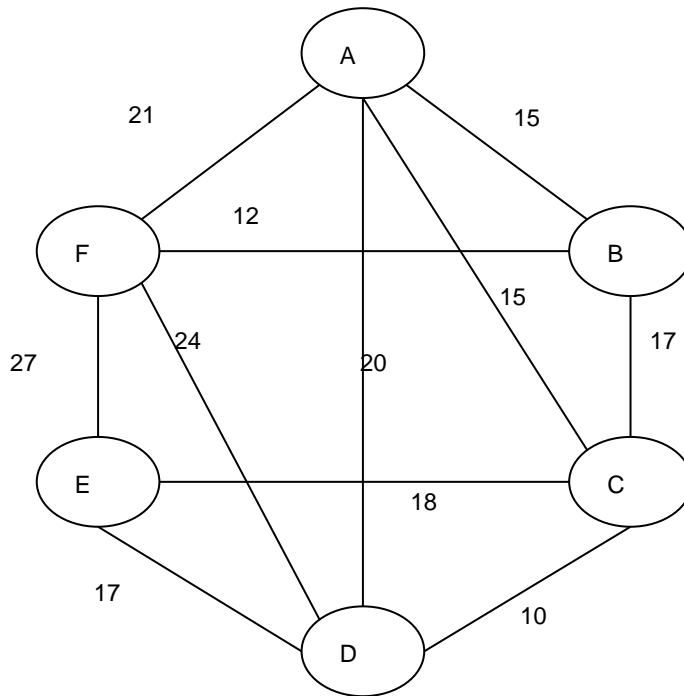
3 x 15 = 45

7. (a) Solve the following recurrence relation by using generating function
 $f_n - 6f_{n-1} + 8f_{n-2} = 0, f_0 = 1, f_1 = 3$ [9]
- (b) A relation ρ defined on a set Z such that “ $a \rho b$ iff $6a + 8b$ is divisible by 14” show that ρ is equivalent. [6]
8. (a) Prove that $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$ is a tautology [7]
- (b) Using Dijkstra's algorithm find the shortest path between S and T from the following graph.



9. (a) Prove that $(1 - 1/2^2) \cdot (1 - 1/3^2) \cdot \dots \cdot (1 - 1/n^2) = (n+1)/2n$, for all natural number $n \geq 2$ [8]
- [7]

- (b) Using Prim's algorithm draw the minimum spanning tree from the following graph.



[8]

- 10 (a) Prove that the number of odd degree vertices of a graph is even. [6]

- (b) Define Minimal spanning tree , Connected graph and Complete graph [9]