

M.C.A. - I (2 Years) New CBCS Pattern Semester-I  
**PSMCAT104.2 - Paper-IV : Elective-II : Discrete Mathematics**

P. Pages : 2

Time : Three Hours



**GUG/W/23/13639**

Max. Marks : 80

- Notes :
1. All questions are compulsory and carry equal marks.
  2. Draw neat and labelled diagram wherever necessary.
  3. Avoid vague answers and write answers relevant and specific to question only.

**Either:**

1. a) What do you mean by normal form? Explain Disjunction & Conjunctive normal form with suitable example. 8  
b) Verify the equivalence, 8  
 $\neg A \Leftrightarrow A^* (\neg P_i)$  where, A (P, Q, R) is  $\neg P \wedge \neg(Q \wedge R)$

**OR**

- c) Show that  $R \rightarrow S$  can be derived from the premises  $P \rightarrow (Q \rightarrow S), \neg R \vee P$  and Q. 8  
d) Suppose A, B, C are matrices then prove that 8  
i)  $A(B + C) = AB + AC$   
ii)  $(AB)C = A(BC)$

**Either:**

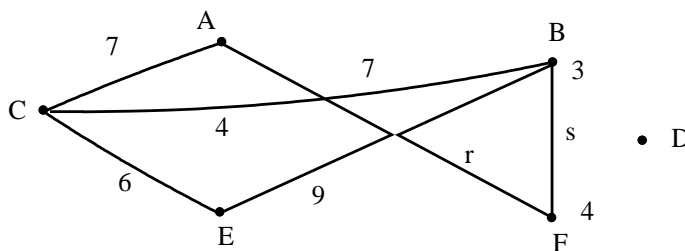
2. a) Let  $A = \mathbb{Z}^*$ , the set of positive integer and let  $R = \{(a, b) \in A \times A \mid a \text{ divides } b\}$  is R 8  
symmetric, asymmetric or antisymmetric?  
b) Determine the value of 'n' if- 8  
i)  $6 \times {}^n P_3 = 3 \times {}^{n+1} P_3$   
ii)  $3 \times {}^n P_4 = 7 \times {}^{n-1} P_3$

**OR**

- c) State and prove pigeonhole principle with example. 8  
d) Let  $A = \{a, b, c, d, e\}$  & 8  
 $R = \{(a, a), (a, b), (b, c), (c, e), (c, d), (d, e)\}$   
compute (a) $R^2$  (b) $R^\infty$ .

**Either:**

3. a) Find a minimum spanning tree of following weighted connected graph. 8



- b) What do you mean by Hasse Diagram? Determine the Hasse diagram of the relation R on set A.  
 $A = \{1, 2, 3, 4\}$  and  $R = \{(1, 1), (1, 2), (2, 2), (2, 4), (1, 3), (3, 3), (3, 4), (1, 4), (4, 4)\}$

**OR**

- c) Show that, in a lattice, if  $a \leq b \leq c$  then 8
- i)  $(a \oplus b) = (b * c)$
- ii)  $(a * b) \oplus (b * c) = b = (a \oplus b) * (a \oplus c)$
- d) Prove that: 8  
 $a \cdot (b + c) = a \cdot b + a \cdot c$

**Either:**

4. a) Let  $V = \{V_0, w, a, b, c\}$ ,  $S = \{a, b, c\}$  & Let  $\mapsto$  be the relation on  $V^*$  given by 8
- i)  $V_0 \mapsto aW$  ii)  $U_0 \mapsto bbW$
- iii)  $W \mapsto C$
- Find  $L(G)$  & derivation tree for it.

- b) Let T be set of all even integers. Show that the semigroup  $(Z, +)$  and  $(T, +)$  are isomorphic. 8

**OR**

- c) Consider the binary operation  $*$  on  $Q$ , the set of rational number defined by 8  
 $a * b = a + b - ab \quad \forall a, b \in Q$ . Determine whether  $*$  is associated.
- d) Explain the following terms: 8
- i) Idempotent ii) Distributivity
- iii) Inverse iv) Identity

5. Attempt all the questions.

- a) Write a short note on Principle Conjunctive Normal form. 4
- b) Prove that  $(P \rightarrow Q) \leftrightarrow (\neg P \rightarrow \neg Q)$  is a tautology. 4
- c) Write a short note on Boolean Polynomial with example. 4
- d) Let  $S = \{a, b, c\}$ . Draw the Hasse diagram of  $(P(S), \subseteq)$ . 4

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