Exam. Code : 105701
Subject Code : 1537

B.Sc. IT 1ˢᵗ Semester

APPLIED AND DISCRETE MATHEMATICS

Paper–III

Time Allowed—3 Hours]   [Maximum Marks—75

Note:– Eight questions are given. Candidates are required to attempt any **five** questions.

1. (a) If A = {1, 2, 3}, B = {4, 5, 6}, C = {7, 8, 9}, then verify that :

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

    (b) In a school there are 20 teachers who teach mathematics or physics of these 12 teach mathematics and 4 teach physics and mathematics. How many teach physics ?

    (c) Let U = {1, 2, 3, 4, 5, 6}, A = {2, 3} and B = {3, 4, 5}. Find A^C, B^C, $A^C \cap B^C$, $A \cup B$ and hence show that $(A \cup B)^C = A^C \cap B^C$.

    (d) If A = {1, 3, 5, 7, 9}, B = {2, 4, 6, 8, 10}, C = {1, 2, 3, 4}, then find :

      (i) A – C

      (ii) A ∩ (B – C)

      (iii) A – (B ∪ C)   3+4+3+5=15

2. (a) Find $A \Delta B$, if $A = \{2, 3, 5, 7\}$, $B = \{3, 4, 6, 8, 10\}$

   (b) Let $A = \left\{\dfrac{1}{2}, 2\right\}$, $B = \{2, 3, 5\}$, $C = \{-1, -2\}$,

   then verify that $A \times (B - C) = (A \times B) - (A \times C)$.

   (c) Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{2, 4, 6, 8, 10\}$.
   Let $R = \{(a, b) : a \in A, b \in B, a$ divides $b\}$ be
   a relation from A into B. Find R. Show that domain
   of R is A and range of R is B.   5+5+5=15

3. (a) Determine whether the relation represented by zero-

   one matrix $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$ is an equivalence relation.

   (b) Let $x = \{1, 2, 3, 4\}$, $R = \{< x, y > | x > y\}$. Draw
   the graph of R and also give its matrix.

   (c) Prove that $(p \wedge q) \rightarrow (p \wedge q)$ is a tautology but
   $(p \vee q) \rightarrow (p \wedge q)$ is not.

   (d) Prove the validity of following arguments :

   If man is a bachelor, he is unhappy

   If a man is unhappy, he dies young

   Therefore, bachelors die young   3+4+3+5=15

4. (a) Define two different types of quantifier with example.

   (b) Define :

   (i) Conjunction

   (ii) Disjunction

   (iii) Negation

   all with truth table.

   (c) Write the truth table of following statement :

   $[p \rightarrow (q \vee r)]' \vee [p \leftrightarrow \sim r]$ 5+5+5=15

5. (a) Prove that $\{[(p \rightarrow q) \vee p] \wedge q\} \rightarrow q$ is a tautology.

   (b) Let R be a relation on a set A = {1, 2, 3} defined by :

   R = {(1, 1), (1, 2), (2, 3)}. Find the reflexive closure of R and symmetric closure of R.

   (c) Define different type of closure with example.

                                        5+5+5=15

6. (a) Show that $(A + B)(\overline{A} + C) = AC + \overline{A}B$

   (b) Minimize the function :

   $f(A, B, C) = \Sigma m(0, 3, 5, 6, 7) + d(2, 4)$

   (c) Prove De-morgan law with the help of truth table.

                                        5+5+5=15

7. (a) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, then show that

$$A^3 - 6A^2 + 7A + 2I = 0$$

(b) Given that $A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$.

Find AB. Use this to solve the following system of linear equations :

$$x - y + z = 4, \quad x - 2y - 2z = 9, \quad 2x + y + 3z = 1$$

7.5+7.5=15

8. (a) Solve the following system of linear equations by matrix method :

$$x + y + z = 6, \quad x + 2z = 7, \quad 3x + y + z = 12$$

(b) Find the rank of the matrix $\begin{bmatrix} 1 & -1 & 3 & 6 \\ 1 & 3 & -3 & -4 \\ 5 & 3 & 3 & 11 \end{bmatrix}$

7.5+7.5=15