Time Allowed—3 Hours]   [Maximum Marks—75

Note :— Attempt any **FIVE** questions in all, selecting at least **ONE** question from each Section. The **fifth** question may be attempted from any Section. All questions carry equal marks.

SECTION—A

1. (a) Let A = [1, 2, 3] B = [3, 4] and C = [4, 5, 6]. Find $(A \times B) \cup (A \times C)$.

    (b) In a class of 35 students 24 like to play Cricket and 16 like to play Football. Also each student likes to play at least one of two games. How many students like to play both Cricket and Football ?

2. (a) List all subsets and all proper subsets of set [−1, 0, 1].

    (b) Let A = [1, 2, 3, 4] B = [1, 4, 6, 7] C = [4, 5, 7, 9]. Verify that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

SECTION—B

3. (a) Prove distributive law with the help of truth table:
        $p \wedge (q \vee r) = (p \wedge q) \vee (p \wedge r)$

    (b) Prove with the help of truth table
        $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ is tautology.

4. (a) Prove the validity of following argument with the help of truth table

        "if a man is bachelor, he is unhappy

        if a man is unhappy, he dies young

        therefore bachelor die young"   6

    (b) (i) conditional connector

        (ii) bi-conditional connector

        (iii) NAND connector.   2+2+2

    (c) Define intersection of set with example.   2+1

SECTION—C

5. (a) Reduce to sop form :
        $f(x, y, z) = (x + y) (x^c + y) (y + z)$.

    (b) Prove S = [1, 2, 35.70] which is subset of divisor of 70 :
        a + b = L.C.M. (a, b)
        a.b = G.C.D. (a, b)
        $A^c = 70/a$
        Is S is sub-algebra.

6. (a) Prove De Morgan's law with the help of Boolean Algebra.

   (b) State and prove representation theorem.

SECTION—D

7. (a) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ prove that $A^3 - 6A^2 + 7A + 2I = 0$

   (b) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -1 & -4 & 5 \end{bmatrix}$ find inverse of matrix A.

8. (a) Find rank of given matrix if

   $A = \begin{bmatrix} 3 & 4 & 12 \\ 9 & 12 & 15 \\ -6 & -8 & -10 \end{bmatrix}$.

   (b) Express the following matrix as Sum of Symmetric and skew Symmetric matrix

   $A = \begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$.