**Bachelor of Science (B.Sc.I.T.) Semester—I (C.B.S) Examination**

**APPLIED MATHEMATICS—I**

**Paper—VI**

Time : Three Hours] [Maximum Marks : 50

**N.B. :—** (1) All questions are compulsory and carry equal marks.

(2) Draw neat and labelled diagrams wherever necessary.

**EITHER**

1. (A) Show that :

$$P \to (Q \to R) \Leftrightarrow (P \wedge Q) \to R.$$ 5

(B) Given the truth values of P and Q as T and those of R and S as F, find the truth value of :

$$(P \vee (Q \to (R \wedge \neg P))) \rightleftarrows (Q \vee \neg S).$$ 5

**OR**

(C) Show that the truth value of

$$(P \wedge (P \to Q)) \to Q$$

is independent of its components. 5

(D) Show that :

$$\neg(P \wedge Q) \to (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$$

without using truth table. 5

**EITHER**

2. (A) Find the conjunctive normal form of :

$$(Q \vee (P \wedge Q)) \wedge \neg((P \vee R) \wedge Q).$$ 5

(B) Obtain the principal disjunctive normal form of :

$$(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R).$$ 5

**OR**

(C) Find the disjunctive normal form of :

$$\neg(P \vee Q) \rightleftarrows (P \wedge Q).$$ 5

(D) Obtain the principal conjunctive normal form of :

$$Q \wedge (P \vee \neg Q).$$ 5

**EITHER**

3. (A) Show that $R \to S$ can be derived from the premises $P \to (Q \to S)$, $\neg R \vee P$ and Q. 5

(B) Show that the conclusion C follows from the premises $H_1$ and $H_2$ :

$H_1 : P \to Q \quad H_2 : P \quad C : Q.$ 5

**OR**

(C) Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \to R) \wedge (Q \to S)$. 5

(D) Show that $\neg(P \wedge Q)$ follows from $\neg P \wedge \neg Q$. 5

**EITHER**

4. (A) Let P(x) : x is a person

F(x, y) : x is the father of y

M(x, y) : x is the mother of y

Write the predicate "x is the father of the mother of y." 5

(B) Show that $(\exists x)\ M(x)$ follows logically from the premises $(x)\ (H(x) \rightarrow M(x))$ and $(\exists x)\ H(x)$. 5

**OR**

(C) Show that $(x)\ (P(x) \vee Q(x)) \Rightarrow (x)\ P(x) \vee (\exists x)\ Q(x)$. 5

(D) Show that $\grave{u}\, P(a, b)$ follows logically from $(x)\ (y)\ (P(x, y) \rightarrow W(x, y)$ and $\grave{u}\, W(a, b)$. 5

5. Attempt **all** :

(A) Write the duals of :

(i) $(P \vee Q) \wedge R$

(ii) $(P \wedge Q) \vee T$. 2½

(B) Explain principal conjunctive normal form. 2½

(C) What are the rules of Inference ? 2½

(D) Explain free and bound variables. 2½