NRT/KS/19/2261

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

APPLIED MATHEMATICS—I

Paper—VI

Time : Three Hours] [Maximum Marks : 50

N.B. :— All questions are compulsory and carry equal marks.

EITHER

1. (a) Given the truth values of P and Q as T and those of R and S as F, find the truth values of the following :

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

 (ii) $(\neg(P \wedge Q) \vee \neg R) \vee (((\neg P \wedge Q) \vee \neg R) \wedge S)$ 5

 (b) Explain conditional and biconditional connectives using truth table. Also construct the truth table for $(P \to Q) \wedge (Q \to P)$. 5

OR

 (c) Show that :

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

 (d) What do you mean by "functionally complete set of connectives" ? Write an equivalent formula for $P \wedge (Q \rightleftharpoons R)$ which contains neither the biconditional nor the conditional. 5

EITHER

2. (a) Explain the terms :

 (i) Conjunctive Normal Form

 (ii) Disjunctive Normal Form. 5

 (b) Obtain the Principal Disjunctive Normal Form of :

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

OR

 (c) Explain Principal Conjunctive Normal Form. Obtain the Principal Conjunctive Normal Form of $Q \wedge (P \vee \neg Q)$. 5

 (d) Obtain the Principal Dinjunctive Normal Form of $P \wedge (P \to Q)$. 5

EITHER

3. (a) Determine whether the conclusion C follows logically from the premises H_1 and H_2 :

 (i) $H_1 : P \to Q$ $H_2 : \neg(P \wedge Q)$ $C : \neg P$

 (ii) $H_1 : \neg P$ $H_2 : P \rightleftharpoons Q$ $C : \neg(P \wedge Q)$ 5

 (b) Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q$, $Q \to R$, $P \to M$ and $\neg M$. 5

OR

 (c) Explain the rule of inference. Demonstrate that, R is a valid inference from the premise $P \to Q$, $Q \to R$ and P. 5

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

EITHER

4. (a) Explain the rules of specification and generalization with suitable example. 5

(b) Prove that :

$$(\exists x)\ (P(x) \wedge Q(x)) \Rightarrow (\exists x)\ (P(x) \wedge (\exists x)\ Q(x)). \quad 5$$

OR

(c) Show that :

$$(x)\ (P(x) \rightarrow Q(x)) \wedge (x)\ (Q(x) \rightarrow R(x)) \Rightarrow (x)\ (P(x) \rightarrow R(x)). \quad 5$$

(d) Socrates argument is given by :

All men are mortal

Socrates is a man

Therefore Socrates is a mortal

If we denote H(x) : x is a man,

M(x) : x is mortal and

S : Socrates, then

show that :

$$(x)\ (H(x) \rightarrow M(x)) \wedge H(s) \Rightarrow M(s). \quad 5$$

5. (a) Write the following statements in symbolic form :

(i) Mark is poor but happy

(ii) Mark is neither rich nor happy

given : R : Mark is rich

H : Mark is happy. 2½

(b) Show that the formula :

$$Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q) \text{ is a tautology.} \quad 2½$$

(c) Symbolize the statement, "All men are giants". 2½

(d) Show that $(\neg P\ (a, b)$ follows logically from $(x)\ (y)\ (P(x, y) \rightarrow W(x, y))$ and $\neg W(a, b)$. 2½