NRT/KS/19/2209

Bachelor of Computer Application (B.C.A.) Semester—I Examination

DISCRETE MATHEMATICS—I

Paper—IV

Time : Three Hours] [Maximum Marks : 50

Note :— All questions are compulsory and carry equal marks.

EITHER

1. (a) Construct the truth table for the following :

   (i) $(P \rightarrow Q) \wedge (Q \rightarrow P)$

   (ii) $\neg(P \wedge Q) \rightleftharpoons (\neg P \vee \neg Q)$ 5

   (b) Show that the truth values of the following formula is independent of its components :

   $(P \rightarrow Q) \rightleftharpoons (\neg P \vee Q)$ 5

OR

(c) What is well-formed formula ? What are the rules for well-formed formulas ? 5

(d) Show that :

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

EITHER

2. (a) What is Disjunctive Normal Form and Conjunctive Normal Form ? Explain the procedure to obtain Conjunctive Normal Form. 5

   (b) Obtain the Disjunctive Normal Form of $\neg(P \vee Q) \rightleftharpoons (P \wedge Q)$. 5

OR

(c) Show that the formula $Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ is a tautology. 5

(d) Obtain the Principal Conjunctive Normal Form of the formula, given by $(\neg P \rightarrow R) \wedge (Q \rightleftharpoons P)$. 5

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

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

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

   (b) Demonstrate the R is a valid inference from the premises $P \rightarrow Q$, $Q \rightarrow R$ and P. 5

OR

(c) What is meant by consistency of Premises ? Show that $\neg(P \wedge Q)$ follows logically from $(\neg P \wedge \neg Q)$. 5

(d) Explain the following Rules of Inference Theory :

(i) Rule P

(ii) Rule T

(iii) Rule CP. 5

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4. (a) Explain the following with the help of examples :

   (i) Predicate

   (ii) Quantifiers. 5

   (b) Show that $(x)\ (H(x) \rightarrow M(x)) \wedge H(x) \Rightarrow M(x)$. 5

   OR

   (c) What is free and bound variables ? Also determine the scope of variables, free and bound occurrences of variables in the following formulas :

   (i) $(x)\ (P(x) \rightarrow Q(x))$

   (ii) $(\exists x)\ (P(x) \wedge Q(x))$. 5

   (d) Show that :

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

5. (a) What is duality law ? Explain with examples. 2½

   (b) What is Minterms and Maxterms ? Write Minterms for 2 variables, P and Q. 2½

   (c) Show I_{12} : $\neg Q,\ P \rightarrow Q \Rightarrow \neg P$. 2½

   (d) Symbolize the expression “All the world loves a lover.” 2½

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