2049 **MCA–10/ PGDCA–08**

M.C.A./P.G.D.C.A. EXAMINATION–JANUARY, 2006.

Second Semester

THEORY OF COMPUTER SCIENCE

Time : 3 hours Maximum marks : 75

PART A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Define equivalence relation. Give an example.

2. For any two sets A and B, prove that

   (a) $A \cap B \subseteq A$, $A \cap B \subseteq B$

   (b) $A \subseteq B \Leftrightarrow A \cap B = A$

   (c) $A \cap B \subseteq A \cup B$.

3. Explain conjunctive normal form with an example.

4. Prove that $P \to (Q \cup R) \Leftrightarrow (P \to Q) \cup (P \to R)$.

5. Construct the grammar for the Ranguage $L(G) = \{a^n\ b\ a^m / n, m \geq 1\}$.

6. Define ambigous grammar. Give an example.

7. Prove that, "if a graph G has exactly two vertices of odd degree, there must be a path joining these two vertices.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

8. Define bijection. Show that the function $f : R \to R$ defined by $f(x) = 3x - 1$, $x \in R$ is a bijection.

9. Prove that the equivalence relation R defined on a set gives rise to partition of the set into equivalence classes.

10. Obtain the product of sums canonical forms for

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

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

11. Show that

$(\forall x)(P(x) \vee Q(x)) \Rightarrow (\forall x) P(x) \vee (\exists x) Q(x)$.

12. For the grammar G defined by $S \to AB$, $B \to a$, $A \to Aa$, $A \to bB$, $B \to Sb$, give derivation trees for the following sentential forms :

(a) $baSb$ (b) $baabaab$

(c) $bBABb$.

13. (a) Discuss the Konigsberg bridge problem.

(b) Show that "A given connected graph G is an Euler graph iff all vertices of G are of even degree.

14. Explain the tree traversal methods with suitable algorithms.