MCA 1st Semester Examination, 2010

FOUNDATION IN MATHEMATICS AND LOGIC

PAPER—CS/MCA/1104

Full Marks : 100

Time : 3 hours

Answer **Q.No.1** and any **five** from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. Answer any *five* questions :   2 x 5

   (a) What is isolated vertex adjacent vertices ?

   (b) What is connected and disconnected graph ?

   (c) What is transitive relation give example ?

(d) Give a relation which is reflexive, transitive but not symmetric.

(e) What is tautology and contradiction?

(f) What is power set?

(g) Define Bipartite graph.

2. (a) For three sets A, B and C are subsets of a universal set S.

(i) Prove that

$$A \times (B \cup C) = (A \times B) \cup (A \times C)$$

(ii) If $A \cap B = A \cup C$ and $A \cup B = A \cap C$, prove that $B = C$.   4 + 4

(b) Let R be a relation on set $A = \{ k, l, m, n \}$ defined by
$R = \{ (k, l), (m, l), (n, l), (l, l), (k, k), (m, k), (l, k), (n, k) \}$

Find domain and range of relation R. Also write the relation as a table and find its arrow diagram.   4

3. (a) Among the first 1000 positive integers :

   (i) Determine the integers which are not divisible by 5, nor by 7, nor by 9. Using set theory.

   (ii) Determine the integers divisible by 5, but not by 7, not by 9. $4 + 4$

   (b) Prove the following by Mathematical Induction : 4

$$1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 + \ldots + n(n+1)(n+2)$$
$$= \frac{1}{4} n(n+1)(n+2)(n+3).$$

4. (a) Consider the function $f, g : R \to R$ defined by
   $$f(x) = x^2 + 3x + 1$$
   $$g(x) = 2x - 3$$
   Find the composition functions

   (i) $f \circ f$

   (ii) $g \circ f$. 3

   (b) Define Injective, Surjective and Bijective function with suitable example. $3 + 3 + 3$

5. (a) Show that the sum of degree of all the vertices in a graph G is even.

   (b) Prove that in any graph, there are an even number of vertices of odd degree.

   (c) Define Euler path and Hamilton path with suitable example. 3 +

6. (a) Construct the truth table for the following statement :

   $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$.

   (b) Given the value of $p \rightarrow q$ is true. Determine the value of $\sim p \vee (p \leftrightarrow q)$.

   (c) Prove that the negation of biconditional statement $\sim (p \leftrightarrow q)$ is equivalent to $p \leftrightarrow \sim q$ or $\sim p \leftrightarrow q$.

7. (a) How many choice are there if the student must answer

   (i) 8 questions out of 10 questions ?

   (ii) 8 questions out of 10, but the first 3 are compulsory questions ? 2 +

(*Continu*

(b) Show that if there are 30 students in a class, at least the name of 2 students must start with the same letter. 4

(c) How many 7-digits numbers can be formed using digits 1, 7, 2, 7, 6, 7, 6 ? 3

8. Write short notes on (any *three*) : 4 × 3

(i) Spanning tree

(ii) Inverse of matrix

(iii) Recursive function

(iv) Boolean matrix.

[*Internal Assessment* : 30 Marks]

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