04017

MCA (Revised)

Term-End Examination

December, 2010

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

Note : Question number 1 is ***compulsory****. Attempt* ***any three*** *questions from the rest.*

1. (a) Use the principal of Mathematical Induction to show that 3

$$a + ar + ar^2 + \dots\dots\dots + ar^{n-1} = \frac{a\left(r^n - 1\right)}{(r-1)}.$$

(b) How many permutations are there of the letters taken all at time of the word "PATTIVEERANPATTI". 3

(c) In how many ways can two integers be selected from the integers 1, 2, ..., 100. So that their difference is exactly seven ? 3

(d) Draw a Venn diagram to represent $A \cup (B \cap C)$. 3

(e) Show that $\{[p \to q] \wedge \sim q\} \to \sim p$ is tautology. 3

(f) If $f(x) = \log x$ and $g(x) = e^x$ show that $(fog)(x) = (gof)(x)$. 3

(g) Let A be the set of all people on earth. A relation R is defined on the set A by ${}_aR_b$. If and only if 'a loves b' for a, b ϵ A. Examine if R is (i) Reflexive (ii) Symmetric. Justify Answer. 2

2. (a) Among 100 students, 32 study mathematics, 20 study physics, 45 study biology, 15 study mathematics and biology, 7 study mathematics and physics, 10 study physics and biology and 30 do not study any of three subjects. 6

(i) Find the number of students studying all three subjects.

(ii) Find the number of students studying exactly one of three subjects.

(b) Let P be the set of all people. Let R be a binary relation on P such that (a, b) is in R if 'a is brother of b'. (Disregard step-brothers and fraternity brothers). Is R 4

(i) Antisymmetric

(ii) Equivalence relation

3. (a) Use Truth Table to show $\sim(\sim p \wedge q) \wedge (p \vee q) \equiv p$. 3

(b) Five boys and five girls are to be seated in a row. In how many ways can they be seated if all boys must be seated in five left most seats ? 3

(c) Construct the logic circuit for the expression $(x_1' \wedge x_2) \vee (x_1 \vee x_3)$. 4

4. (a) How many "words" can be formed using letters of 'IGNOU' (each at most once). 3

   (i) If all the letters must be used.

   (ii) If some (or all) of the letters may be omitted.

   (b) An island has two tribes of natives. Any native from the first tribe always tells the truth, while any native from the other tribe tells lies always. You arrive at the island and ask a native if these is a gold on the island. He answers, "There is gold on island if and only if I always tell the truth". 7
   Is there gold on island. Prove/Disprove.

5. (a) Show that

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots\dots + \frac{1}{n\,(n+1)} = \frac{n}{n+1}$$ 4

   (b) Suppose n different games are to be distributed among n children. In how many ways can this be done so that exactly one child gets no game. 3

   (c) If $f = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ $g = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \end{bmatrix}$

   Check either (fog) is equal to (gof) or not. 3