MCA (Revised)

Term-End Examination

June, 2008

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) The chairs of an auditorium are to be labelled with a letter from the English alphabet {A, B, ..., Z} and a positive integer not exceeding 100. What is the largest number of chairs that can be labelled differently ? *3*

   (b) If R = {(1, 1), (2, 1), (3, 2), (4, 3)}, find R^2, R^4. *2*

   (c) How many bit strings of length 10 contain at least four 1's ? *3*

   (d) Show that $\neg(q \rightarrow r) \wedge r \wedge (p \rightarrow q)$ is a contradiction. *3*

   (e) Draw the logic circuit for the boolean function
   $$Y = AB' + (A + B)' + (A' B)'$$ *3*

(f) Write down all the partitions of 6. Also find P_6^3 and P_6^4. 3

(g) Let Q (x, y) denote "x + y = 0". What are the truth values of the quantification $\exists y \, \forall x \, Q(x, y)$? 3

2. (a) Find the number of integers between 1 and 250 both inclusive that are not divisible by any of the integers 2, 3, 5 and 7. 6

(b) From a club consisting of 6 men and 7 women, in how many ways can we select a committee of 4 persons that has at most one man ? 4

3. (a) Show that $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent. 3

(b) Prove, by mathematical induction, that

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

(c) How many permutations are there of the letters, taken all at a time, of the word ALLAHABAD ? 3

4. (a) Let A = {0, 1, 2, 3 ...} and R = {(x, y) : x − y = 3k, k is an integer} i.e., x R y iff x − y is divisible by 3, then prove that R is an equivalence relation. 3

(b) A car manufacturer has 5 service centres in a city. 10 identical cars were served in these centres for a particular mechanical defect. In how many ways could the cars have been distributed at various centres ? 4

(c) Write the CNF of the function 3

$$(xy' + xz)' + x'$$

5. (a) Prove that $\sqrt{7}$ is irrational. 4

(b) Check whether the following argument is valid : 3

$$((p \to q) \wedge (q \to r)) \Rightarrow (p \to r)$$

(c) Suppose A and B are mutually exclusive events such that $P(A) = 0{\cdot}3$ and $P(B) = 0{\cdot}4$. What is the probability that 3

(i) A does not occur ?

(ii) A or B occurs ?