

# PC-124/AK

**O-1/2041**

MATHEMATICAL FOUNDATION OF  
COMPUTER SCIENCE

Paper – MS(A)-114

Ist Year (Annual)

Time : Three Hours]

[Maximum Marks : 80

**Note :** Attempt *five* questions in all, selecting *two* questions each from Section A and Section B and Section C is compulsory.

## SECTION – A

- I. (a) Prove that the distinct equivalence classes of an equivalence relation on a set form a partition of that set.
- (b) Find how many integers between 1 and 60 are not divisible by 2 nor by 3 and nor by 5.
- II. (a) Prove that for any positive integer  $n$ , then number  $2^{3n} - 1$  is divisible by 7.
- (b) Show that  $p \vee (q \wedge r) = (p \vee q) \wedge (p \vee r)$ .

- III. (a) Explain all the functions along with an example used in the study of algorithms and their analysis.
- (b) Let  $X = Y = Z = R$  and let  $f: X \rightarrow Y$  and  $g: Y \rightarrow Z$  and such that  $f(x) = 2x + 1$  and  $g(y) = y/3$ . Verify that  $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$ .
- IV. (a) State and prove De-Morgan's law.
- (b) Use Quantifier :
- (i) to state that  $\sqrt{5}$  is not a rational number.
- (ii) to state that the sum of two rational number is rational.
- (iii) to state that the sum of any two real numbers is real. (2×16=32)

### SECTION – B

- V. (a) Solve :  $S(n) - 5S(n - 1) + 6S(n - 2) = 5^n$ .
- (b) Find the generating function of the relation
- $$S(n) + 3S(n - 1) - 4S(n - 2) = 0, n \geq 2$$
- with  $S(0) = 3, S(1) = -2$ .
- VI. (a) State and prove Euler Formula.
- (b) Explain the matrix representation of graphs.

- VII. (a) Solve :  $S(n) - 4S(n - 1) + 4S(n - 2) = (n + 1)2^n$ .
- (b) Define the Fibonacci Sequence and find its generating function.
- VIII. (a) Show that the maximum number of edges in a simple graph with  $n$  vertices is  $n(n - 1)/2$ .
- (b) If  $G$  is a connected graph and every vertex of  $G$  has even degree, then prove that  $G$  has Euler Circuit.  
(2×16=32)

### SECTION – C

- IX. (a) Define Power set. Write the power set of  $\{1, 2\}$ .
- (b) Give an example of the map which is one-one but not onto.
- (c) In how many ways can 3 people be seated in a row containing 7 seats?
- (d) Define Big-Theta Notation.
- (e) Find  $n$ , if a complete graph having  $n$  vertices has 15 edges.
- (f) Define shortest path problem.
- (g) Define closure of relation.
- (h) Define Recursion.