(i) **Printed Pages : 3** **Roll No. .....**

(ii) **Questions : 9** **Sub. Code : 0948**

Exam. Code : 0031

Bachelor of Computer Applications 5th Semester

(2123)

DISCRETE MATHEMATICAL STRUCTURE

Paper : BCA-16-502

Time Allowed : Three Hours] **[Maximum Marks : 65**

Note :—Attempt **FIVE** questions in all, including Q. No. **9** in Section–E, which is compulsory and taking **ONE** question each from Sections A–D. Each question carries **13** marks.

SECTION—A

1. (a) What do you mean by composition of functions ? Let $f : \Re \rightarrow \Re$ defined as $f(x) = 4x + 3$ and $g : \Re \rightarrow \Re$ defined as $g(x) = x/3$. Find $f \circ g(x)$.

   (b) Let $X = \{1, 2, 3\}$ and R is a relation on X defined as $xRy \Leftrightarrow x \neq y$ for all $x, y \in X$. Find the elements of the relation R and R^{-1}. Also check whether R is transitive ?

6,7

2. Explain the laws of set theory and prove the following set identities :

(a) $A - (B \cup C) = (A - B) \cap (A - C)$

(b) $\overline{(A \cup B)} = \overline{A} \cap \overline{B}$. 6,7

SECTION—B

3. Solve the following recurrence relation :

$F_n = 3F_{n-1} + 10F_{n-2} + 7.5^n$ where $F_0 = 4$ and $F_1 = 3$.

13

4. What are the generating functions for the sequences $\{a_k\}$ with $a_k = 2$ and $a_k = 3k$? 13

SECTION—C

5. Define a graph. Prove that the sum of degrees of all vertices in a graph is twice the number of edges. Verify it through one example. 13

6. Define a weighted graph. Prove that a connected graph has an Euler path but not an Euler circuit if and only if it has exactly two vertices of odd degree. 13

SECTION—D

7. What is an algorithm ? What is meant by time complexity of an algorithm ? Define O, Θ and Ω notations used in analyzing algorithms. 13

8. What is a finite state machine (FSM) ? How do Finite State Machines act as Language Recognizers ? Build a Finite State Machine to recognize the sequence '101'. 13

SECTION—E

(Compulsory Question)

9. (a) Define injective and bijective functions with an example.

   (b) Suppose a graph has vertices of degree 0, 2, 2, 3 and 9. How many edges does the graph have ?

   (c) What is travelling salesman problem ?

   (d) Define automata theory. 3,3,3,4