

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

(ii) Questions : 9 Sub. Code : 

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Exam. Code : 

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Bachelor of Computer Applications 5<sup>th</sup> 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  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined as  $f(x) = 4x + 3$  and

$g : \mathbb{R} \rightarrow \mathbb{R}$  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)  $\overline{(A \cup B)} = \bar{A} \cap \bar{B}$ . 6,7

### SECTION—B

3. Solve the following recurrence relation :

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

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  $O$ ,  $\Theta$  and  $\Omega$  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