

(i) Printed Pages: 3 Roll No.

(ii) Questions : 9 Sub. Code :

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Bachelor of Computer Applications 5th Semester

(2124)

DISCRETE MATHEMATICAL STRUCTURE

Paper : BCA-16-502

Time Allowed : Three Hours] [Maximum Marks : 65

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

SECTION—A

1. (a) Define one-one and onto functions with examples. If f is a function defined on the set of real numbers $\mathbb{R}$ by $f(x) = x^3$, then show that f is both one-one and onto function.
- (b) Let A , B and C be subsets of set U . Show that :
$$(A \cup B) - (C - A) = (A \cup B) \cap (C' \cup A). \quad 6,7$$
2. (a) Show that the relation R in the set $\mathbb{R}$ of real numbers, defined as $R = \{(a, b) : a \leq b^3\}$ is neither reflexive nor symmetric nor transitive.
- (b) If X and Y are two sets such that $X \cup Y$ has 50 elements, X has 28 elements and Y has 32 elements, how many elements does $X \cap Y$ have ? 6,7

SECTION—B

3. Using the method of generating functions, solve the following recurrence relation :

$$F_n = 5F_{n-1} - 6F_{n-2}, \text{ for } n \geq 2 \text{ where } F_0 = 1 \text{ and } F_1 = 4. \quad 13$$

4. Find the solution to the following recurrence relation :

$$a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3} \text{ with the initial conditions } a_0 = 2, a_1 = 5 \text{ and } a_2 = 15. \quad 13$$

SECTION—C

5. (a) Prove that the number of vertices of odd degree in a graph is always even.
- (b) Show that a simple graph G with n vertices is connected if it has more than $(n-1)(n-2)/2$ edges. 6,7
6. State and prove Euler's formula. What conditions should a graph satisfy to have Euler circuit ? Explain. 13

SECTION—D

7. Give the difference between a Deterministic Finite Automation (DFA) and Non-Deterministic Finite Automation (NDFA) with examples. Build a Finite State Machine to recognize the sequence '101'. 13
8. What is meant by space and time complexity of an algorithm ? How do you analyze algorithms ? Explain by taking appropriate examples. 13

SECTION—E

(Compulsory Question)

9. (a) Draw the graph of the function :

$$f(x) = |x| + 5 \text{ for } x \in [-5, 5].$$

- (b) What is Recursion ? Give an example of a recursive algorithm.
- (c) Let G be a graph with 10 vertices. If four vertices have degree four and six vertices have degree five, then find the number of edges of G .
- (d) What is the major objective of automata theory in Computer Science ?

3,3,3,4