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

(ii) Questions : 9 **Sub. Code : 1 7 9 4 8**

Exam. Code : 0 0 3 1

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 $\Re$ 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 :

   $(A \cup B) - (C - A) = (A \cup B) \cap (C' \cup A)$. 6,7

2. (a) Show that the relation R in the set $\Re$ 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 :

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

4. Find the solution to the following recurrence relation :

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