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

(ii) **Questions   : 9**   **Sub. Code :** | 0 | 9 | 4 | 8 |
                               Exam. Code : | 0 | 0 | 3 | 1 |

Bachelor of Computer Applications 5th Semester

(1129)

DISCRETE MATHEMATICAL STRUCTURE

Paper : BCA-16-502

Time Allowed : Three Hours]   [Maximum Marks : 65

Note :— Attempt **FIVE** questions in all, including Q. **9** in Unit-V
which is compulsory and taking **ONE** each from
Unit-I to Unit-IV.

UNIT—I

1. (a) Find f o g, g o f, f o f and g o g compositions for the
following functions :

$$f(x) = x^2 + 2, \quad g(x) = 1 - \frac{1}{1-x}, x \neq 1.$$

   (b) Draw the graph of the function y = [x] – 2, where [x]
is the greatest integer < = x.   7,6

2. (a) Prove that f : R → R defined by $f(x) = x^2 + 3$ is neither
one-one nor onto function.

   (b) Let A = {1, 2, 3}, B = {4, 5} and C = {1, 4} be three
sets. Find A × B, B × A, A × (B ∪ C) and (A ∩ C) × B.
                                                          7,6

3. (a) A sequence is defined by the recurrence relation $t_{n+1} = a\, t_n + b$ with $t_1 = 4$, $t_2 = 3.2$ and $t_3 = 2.04$. Find the values of a and b.

   (b) Find the sequence (t_n) satisfying the recurrence relation $t_n = 2t_{n-1} + t_{n-2} - 2t_{n-3}$, $n > = 3$, and the initial conditions $t_0 = 1$, $t_1 = 2$ and $t_2 = 0$. 7,6

4. (a) A sequence is defined by the recurrence relation $t_{n+1} = 0.6\, t_n + 4$ with $t_0 = 7$.

   Calculate the value of t_3 and the smallest value of n for which $t_n > 9.7$.

   (b) Determine the generating function of the sequence :

   $$0,\ 1,\ 2^2,\ 3^2,\ ....,\ n^2,\ ....$$ 7,6

UNIT—III

5. (a) For each of the following, either give an example, or prove there are none :

   (i) A simple graph with 6 vertices, whose degrees are 2, 2, 2, 3, 4, 4.

   (ii) A simple graph with 8 vertices, whose degrees are 0, 1, 2, 3, 4, 5, 6, 7.

   (iii) A simple graph with degrees 1, 2, 2, 3.

   (b) State Euler's formula for connected planar graphs. If a connected planar graph had 6 vertices and 9 edges then how many faces would it have ? 7,6

6. Calculate the single-source shortest paths from A to every other vertex in the following undirected, weighted graph :
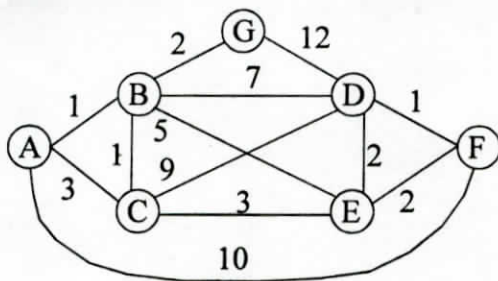
13

UNIT—IV

7. What is a finite state machine ? Why is it required ? What are the elements of FSM ? Design an NFA which does not accept set of all strings with two consecutive zeros.   13

8. What is an algorithm ? What are its features ? How do you determine the time as well as space complexity of an algorithm ? Explain with examples.   13

UNIT—V
(Compulsory Question)

9. (a) Given that A = {2, 4} and B = {x : x is a solution of $x^2 + 6x + 8 = 0$}. Are A and B disjoint sets ?

   (b) Write the power set of the set A = {y : y ∈ N and 1 ≤ y ≤ 3}.

   (c) A Moore state machine usually has power states than the equivalent Mealy machine.   (True/False)

   (d) Define Travelling Salesman Problem.

   (e) Define Recursive algorithm.

   (f) What is regular expression in Automata theory ?

   $3,5×2=13$