Register No.: ................................... Name: ....................................................................

# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIRST SEMESTER M.C.A DEGREE EXAMINATION (S), FEBRUARY 2023**

**(2021 SCHEME)**

**Course Code:** **21CA101**

**Course Name:** **Mathematical Foundations for Computing**

**Max. Marks:** **60** **Duration: 3 Hours**

## PART A

***(Answer all questions. Each question carries 3 marks)***

1. If f and g are functions such that $f(x) = 2x,\ g(x) = x + 1$ for all $x \in R$ find (i) $fog$ $(ii)\ gof$
2. Define a partial order relation.
3. Find $gcd\ (306, 657)$
4. Determine which of the following congruences are true and which are false $(i)\ 12 \equiv 7(mod\ 5)$ $(ii)\ 6 \equiv -8(mod\ 4)$ $(iii)\ 3 \equiv 3(mod\ 7)$
5. Does there exist a 4-regular graph on 6 vertices? If so construct a graph.
6. Draw an undirected graph represented by the adjacency matrix
$$\begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$
7. Find the eigen values of the matrix
$$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$$
8. Check whether the vectors (1,-1,1), (0,1,2) and (3,0,-1) are independent or not.
9. Explain any one method of studying correlation.
10. What are the normal equations for fitting of a straight line y = a + bx.

## PART B

***(Answer one full question from each module, each question carries 6 marks)***

### MODULE I

11. If R is a relation in the set Z defined by $R = \{(x, y)\ |x \in Z, y \in Z, x - y\ is\ divisible\ by\ 3\}$. Prove that R is an equivalence relation. Describe the distinct equivalence classes of R. (6)

**OR**

12. If the function $f: R \to R$ defined by
$$f(x) = \begin{cases} 3x - 4, & x > 0 \\ -3x + 2, & x \leq 0 \end{cases}$$
Determine (i) $f(0), f(2/3), f(-2)$ (ii) $f^{-1}(0),\ f^{-1}(2)\ , f^{-1}(-7)$. (6)

## MODULE II

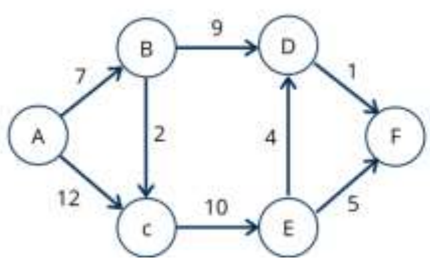
13. Solve the recurrence relation $a_{n+2} + 4a_{n+1} + 4a_n = 7, n \geq 0, a_0 = 1, a_1 = 2$ (6)

**OR**

14. Solve the recurrence relation $a_{n+2} + 3a_{n+1} + 2a_n = (3)^n;\ a_0 = 0,\ a_1 = 1.$ (6)

## MODULE III

15. Use Dijkstra's algorithm to find the shortest path from A to all other vertices. (6)




**OR**

16. a) Define complete graph and bipartite graph. (2)
    b) Draw the graphs $K_7$ and $K_{2,6}$. (4)

## MODULE IV

17. Deduce the matrix A = $\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$ to the diagonal form. (6)

**OR**

18. Show that the equations
$x + 2y - z = 0$
$3x + y - z = 0$ and
$2x - y = 0$ have non-trivial solution and find them. (6)

## MODULE V

19. Fit a linear equation $y =$ a + bx to the following data. (6)

| x | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| y | 0 | 5 | 7 | 9 | 11 | 13 |

**OR**

20. Calculate Karl Pearson's coefficient of correlation between the following data. (6)

| x | 39 | 65 | 62 | 90 | 82 | 75 | 25 | 98 | 36 | 78 |
|---|---|---|---|---|---|---|---|---|---|---|
| y | 47 | 53 | 58 | 86 | 62 | 68 | 60 | 91 | 51 | 84 |

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