

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER MCA DEGREE EXAMINATION (R), DECEMBER 2023**(2021 SCHEME)****Course Code: 21CA101****Course Name: Mathematical Foundations for Computing****Max. Marks: 60****Duration: 3 Hours***Use of non-programmable calculator may be permitted***PART A****(Answer all questions. Each question carries 3 marks)**

1. If $A = \{4,5,7,8,10\}$, $B = \{4,5,9\}$ and $C = \{1,4,6,9\}$ then verify that
 $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
2. Write the symmetric closure of the relation $R = \{(a,b) \mid a > b\}$ on the set of positive integers.
3. Find the GCD of 1479 and 272 using the Euclidean Algorithm.
4. Solve the recurrence relation $a_n - 10a_{n-1} + 25a_{n-2} = 0$; $a_0 = 0$, $a_1 = 4$, $n \geq 2$
5. Define planar graph and give one example
6. Construct an undirected graph from the following adjacency matrix

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$
7. Show that the vectors $(1,1,1)$, $(1,2,3)$, $(2,-1,1)$ are linearly independent.
8. If 3 is the eigen value of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ without using characteristic equation find the other two eigen values.
9. Write the normal equations for fitting a second-degree parabola.
10. Explain any one method of correlation study.

PART B**(Answer one full question from each module, each question carries 6 marks)****MODULE I**

11. a) Consider the relation $R = \{(i,j) \mid |i-j| = 2\}$ on $\{1,2,3,4,5,6\}$.
Is R reflexive? Is R symmetric? Is R transitive? (3)
- b) Let $f: Z \rightarrow Z$ where $f(z) = 2z$ for all $x \in Z$
Is the function f a one-one function? (3)

OR

12. a) Consider the relation R defined on $A = \{1,2,3\}$ whose matrix representation is

$$M_R = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}. \quad \text{Determine its inverse } R^{-1} \text{ and compliment } R' \quad (4)$$

- b) If the function $f: R \rightarrow R$ defined by $f(x) = x^2$, find $f^{-1}(4)$ (2)

MODULE II

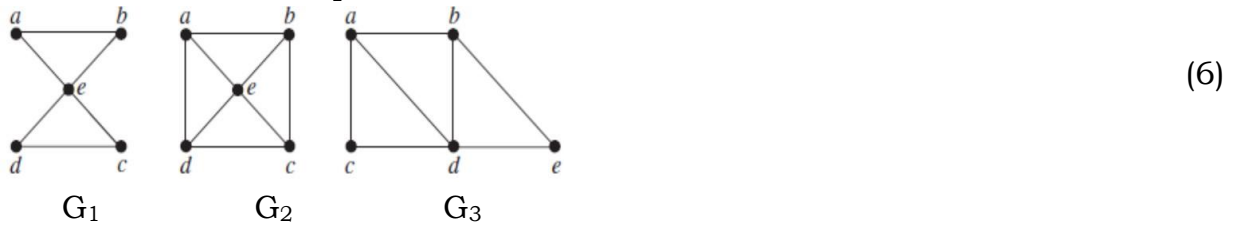
13. a) Find the integers x and y such that $423x + 198y = 9$ (4)
 b) Find the solution of the congruence relation $4x \equiv 1 \pmod{5}$ (2)

OR

14. Solve the recurrence relation $a_n - 3a_{n-1} = 5(7)^n$; $a_0 = 2, n \geq 1$ (6)

MODULE III

15. Which of the following graphs have an Euler circuit? Of those that do not, which have an Euler path



OR

16. Use Dijkstra's algorithm to find the shortest path from S to all other vertices.



MODULE IV

17. Determine the value of a and b for which the system
 $x + 2y + 3z = 6$
 $x + 3y + 5z = 9$ (6)
 $2x + 5y + az = b$ has (i) no solution (ii) unique solution (iii) infinite number of solutions

OR

18. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ (6)

MODULE V

19. Fit a straight line to the following data (6)
- | | | | | | | |
|-----|-----|-----|-----|-----|---|---|
| x : | 1 | 2 | 3 | 4 | 6 | 8 |
| y : | 2.4 | 3.1 | 3.5 | 4.2 | 5 | 6 |

OR

20. Calculate Karl Pearson correlation coefficient between expenditure on advertising and sales from the data given below (6)
- | | | | | | | | | | | |
|-----------------|----|----|----|----|----|----|----|----|----|----|
| Expenses ('000) | 90 | 65 | 62 | 39 | 82 | 75 | 25 | 98 | 78 | 36 |
| Sales (lakhs) | 86 | 53 | 58 | 47 | 62 | 68 | 60 | 91 | 84 | 51 |
