

Course Code: 20MCA101**Course Name: MATHEMATICAL FOUNDATIONS FOR COMPUTING**

Max. Marks: 60

Duration: 3 Hours

PART A*Answer all questions, each carries 3 marks.*

Marks

- 1 Verify De-Morgan's laws for the following sets. (3)

$$A = \{1, 2, 3\}, B = \{2, 3, 4\} \text{ and } U = \{1, 2, 3, 4, 5, 6\}$$

- 2 Define the following and give one example for each. (3)

i) one-one function ii) onto function

Using division algorithm, find the gcd of 86 and 58. (3)

If $a \equiv b \pmod{m}$ show that $ac \equiv bc \pmod{m}$ (3)

5 Define i) complete graph and ii) bipartite graph and give one example for each. (3)

6 Define Hamiltonian cycle and Euler circuit with examples. (3)

7 Find the rank of matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & -4 \\ 0 & 4 & 0 \end{bmatrix}$ (3)

8 Find the matrix C such that $Q = X^T C X$ (3)

$$\text{where } Q = -3x^2 + 4xy - y^2 + 2xz - 5z^2.$$

- 9 State the principle of least square. (3)

- 10 Explain the terms correlation and regression. (3)

PART B

Answer any one question from each module. Each question carries 6 marks.

Module I

- 11 a) Let $f, g: R \rightarrow R$ defined by $f(x) = x^2 - 2$, $g(x) = x + 4$. Find $f \circ g$ and $g \circ f$. Is $f \circ g = g \circ f$? (3)
- b) Let R be a relation on the set of integers defined by $R = \{(x, y) / x - y \text{ is divisible by } 6\}$. Check whether R is an equivalence relation. (3)

OR

- 12 a) Define a partial ordering relation. Show that the inclusion relation \subseteq is a partial ordering relation on the power set $P(S)$ of a given set S . (3)
- b) Using Warshall's algorithm, find the transitive closure of the relation $\{(1,3), (3,2), (2,4), (3,1), (4,1)\}$ on $\{1,2,3,4\}$. (3)

Module II

- 13 a) Solve the set of simultaneous congruences, $x \equiv 3 \pmod{5}$; $x \equiv 4 \pmod{7}$; $x \equiv 6 \pmod{9}$. (6)

OR

- 14 a) Solve the recurrence relation $a_n - 5a_{n-1} + 6a_{n-2} = 3^n + n$, given $a_0 = 0$ and $a_1 = 1$. (6)

Module III

- 15 a) Show that a connected graph G is Euler if and only if all the vertices of G are of even degree. (6)

OR

- 16 a) Show that the maximum number of edges in a simple graph with n vertices is nC_2 . (6)

Module IV

- 17 a) Solve the following system of equations using Guass - Elimination method:

(6)

$$\begin{aligned}x + 2y - z &= 3 \\3x - y + 2z &= 1\end{aligned}$$

$$2x - 2y + 3z = 2$$

$$x - y + z = -1$$

OR

- 18 a) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ -1 & 2 & 1 \\ 0 & 1 & 3 \end{bmatrix}$

(6)

Module V

- 19 a) Calculate the correlation coefficient for the following heights(in inches) of father (x) and their son (y).

(6)

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

OR

- 20 a) Fit a straight line to the following set of data

(6)

x	5	10	15	20	25
y	16	19	23	26	30
