

Reg No.: IVEMCA-2041

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

First Semester MCA (2 Year) Degree Examination December 2021

**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)  
 $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 4\}$  and  $U = \{1, 2, 3, 4, 5, 6\}$
- 2 ✓ Define the following and give one example for each. (3)
  - i) one- one function
  - ii) on to function
- 3 ✓ Using division algorithm, find the gcd of 86 and 58. (3)
- 4 ✓ 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  $f, g: \mathbb{R} \rightarrow \mathbb{R}$  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  $R = \{(x, y) / x - y \text{ is divisible by } 6\}$ . (3)  
Check whether  $R$  is an equivalence relation.

## 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 Gauss - Elimination method:

(6)

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

$$3x - y + 2z = 1$$

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

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

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

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