M.A. COLLEGE OF ENGINEERING, KOTHAMANGALAM-686666
(GOVERMENT AIDED AUTONOMOUS ENGINEERING COLLEGE)
DEPARTMENT OF MATHEMATICS
FIRST SESSIONAL EXAMINATION, OCTOBER 2026
B24MA1T01 - LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS
FIRST SEMESTER (Common to all Branches)

**Time: 1.5 Hours** **Maximum Marks: 40**

*Answer all questions.*

## PART A

1. Find the sum and product of eigenvalues of $A = \begin{bmatrix} 3 & 1 & -1 \\ 0 & 2 & 6 \\ 0 & 0 & 6 \end{bmatrix}$. **3 Marks(CO1)**

2. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$. **3 Marks(CO1)**

3. If $U = \dfrac{x^3 + y^3}{x - y}$, find $U_x + U_y$. **3 Marks(CO2)**

4. Find the slope of $f(x, y) = \sqrt{3x + 2y}$ in the $y$- direction at the point $(4, 2)$. **3 Marks(CO2)**

## PART B

5. (a) Solve the system of equations using Gauss elimination method

$$x + y - z = 9, \quad 8y + 6z = -6, \quad -2x + 4y - 6z = 40.$$

**7 Marks(CO1)**

(b) Find the matrix of transformation that diagonalizes the matrix $\begin{bmatrix} 2 & 4 \\ 4 & 2 \end{bmatrix}$. Also write the diagonal matrix. **7 Marks(CO1)**

6. (a) For what value of $k$ system has no solutions

$$x + y + z = 2, \quad x + 2y + z = -2, \quad x + y + (k - 5)z = k.$$

**7 Marks(CO1)**

(b) If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$. Prove that $\dfrac{1}{2}\dfrac{\partial u}{\partial x} + \dfrac{1}{3}\dfrac{\partial u}{\partial y} + \dfrac{1}{4}\dfrac{\partial u}{\partial z} = 0$. **7 Marks(CO2)**

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The institution is committed to transform itself into a centre of excellence in Technical Education upholding the motto "Knowledge is Power". This is to be achieved by imparting quality education to mould technically competent professionals with moral integrity, ethical values and social commitment, and by promoting innovative activities in the thrust areas emerging from time to time.

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