



Mid Term (Odd) Semester Examination October 2024

Roll no.....

Name of the Course and semester: **B.Tech., Semester I**

Name of the Paper: **Engineering Mathematics-I**

Paper Code: **TMA 101**

Time: 1.5 hour

Maximum Marks: 50

Note:

- (i) Answer all the questions by choosing any one of the sub questions
- (ii) Each question carries 10 marks.

Q1.

(10 Marks)

a. Determine for what values of λ and μ the following equations have

(i) no solution (ii) a unique solution (iii) infinite many solution

$$x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu.$$

(CO1)

OR

b. Reduce the matrix $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ to normal form and hence find its rank.

(CO1)

Q2.

(10 Marks)

a. Find the inverse of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ by applying elementary operations. (CO1)

OR

b. State the Cayley-Hamilton theorem and verify it for $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. (CO1)

Q3.

(10 Marks)

a. Check the linear dependency and linear independency of the vectors $(1, -1, 1)$; $(2, 1, 1)$ and $(3, 0, 2)$. If linearly dependent, find the relation between them. (CO1)

OR

b. Find the eigen values and eigen vector of matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & 6 \\ -1 & -2 & 0 \end{bmatrix}$. (CO1)



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Q4.

(10 Marks)

- a. For each of the following functions, verify that the function satisfies the criteria stated in Rolle's theorem and find all values c in the given interval where $f'(c) = 0$.

(i). $f(x) = x^2 + 2x$ over $[-2, 0]$

(ii). $f(x) = x^3 - 4x$ over $[-2, 2]$.

(CO2)

OR

- b. Verify Lagrange's mean value theorem for the function $f(x) = \sqrt{x^2 - 4}$ in $[2, 4]$. (CO2)

Q5.

(10 Marks)

a. Find $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{1/x^2}$.

(CO2)

OR

- b. Find the maximum value of the function $f(x) = x^2 e^{-x}$, $x > 0$. (CO2)