Graphic Era

Mid Term (Odd) Semester Examination 2025

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. Check the consistency of the following linear system and solve them completely if consistent: $x+y+z=6; x+2y+5z=10$ and $2x+3y+2z=8$. (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 $\begin{bmatrix} 0 & 2 & 1 & 3 \\ 1 & 1 & -1 & -2 \\ 1 & 2 & 0 & 1 \\ -1 & 1 & 2 & 6 \end{bmatrix}$ 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. Using State the Leibnitz theorem. If $y = e^{a \sin^{-1} x}$, prove that
$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2+a^2)y_n = 0$. (CO2)

Q5. (10 Marks)

a. Find $\lim\limits_{x \to 0} \left(\dfrac{\tan x}{x} \right)^{1/x^2}$. (CO2)

OR

b. Expand $\log x$ in powers of $(x - 1)$ by Taylor's theorem and hence compute $\log(1.1)$ approximately. (CO2)