Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

Mid Term (Odd) Semester Examination October 2024

Roll no... 2401392 .....

Name of the Course and semester: **B.Tech., Semester 1**
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 $\lim_{x \to 0} \left(\frac{\tan x}{x} \right)^{1/x^2}$. (CO2)

OR

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