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

GEHU/04M/9.1.3

Term Evaluation (Odd) Semester Examination September 2025

Roll No. 2594038

Name of the Course: 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, CO1)

a. Find the rank of the matrix A, by reducing it to Normal form

$$A = \begin{bmatrix} 1 & 3 & 4 & 2 \\ 2 & -1 & 3 & 2 \\ 3 & -5 & 2 & 2 \\ 6 & -3 & 8 & 6 \end{bmatrix}.$$

OR

b. Find for what values of λ and μ, the system of linear equations:

$$x+y+z=6,$$
$$x+2y+5z=10,$$
$$2x+3y+\lambda z=\mu,$$

has (i) a unique solution (ii) no solution (iii) infinite solutions.

Q2. (10 Marks, CO1)

a. Using Cayley-Hamilton theorem, find the inverse of the matrix $A = \begin{bmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix}$.

OR

b. Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.

Q3. (10 Marks, CO1&CO2)

a. Show that the following matrix is Skew-Hermitian matrix

$$A = \begin{bmatrix} -i & 3+3i & -2-i \\ -3+3i & 0 & 3-4i \\ 2-i & -3-4i & -2i \end{bmatrix}.$$

OR

b. Evaluate $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x}$.

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(10 Marks, CO2)

Q4.

a. Prove that $\dfrac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \dfrac{b-a}{1+a^2}, 0 < a < b$. Hence, show that $\dfrac{\pi}{4} + \dfrac{3}{25} < \tan^{-1}\dfrac{4}{5} < \dfrac{\pi}{4} + \dfrac{1}{6}$.

OR

b. Find the maximum and minimum value of the function
$y = \sin x(1+\cos x)$ in $(0, \pi)$.

(10 Marks, CO2)

Q5.

a. If $y = (\sin^{-1} x)^2$, prove that

$y_n(0) = 0,$ for n odd and

$y_n(0) = 2.2^2.4^2.6^2..........(n-2)^2,\quad n \neq 2$ for n even.

OR

b. Find the Maclaurin's series for the function $f(x) = (1+x)^m$ where m is not necessarily an integer and hence, use your answer to find the expansion of $\dfrac{1}{\sqrt{1-x^2}}$ up to the term in x^6.