

Term Evaluation (Odd) Semester Examination September 2025

Roll No. 2594036

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:

Answer all the questions by choosing any one of the sub-questions. (i)

(ii) Each question carries 10 marks.

Q1.

(10 Marks, CO1)

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

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

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)

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

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

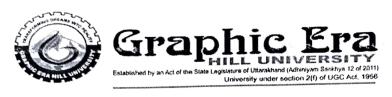
(10 Marks, CO1&CO2)

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

OR

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

Q5.

(10 Marks, CO2)

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

$$y_n(0) = 0,$$

for n odd and

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

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 $\frac{1}{\sqrt{1-x^2}}$ up to the term in x^6 .