Seat No.

OCT-NOV 2025 WINTER EXAMINATION

12609 Bachelor of Technology (NEP-2.1)
Sub. Name: Engineering Mathematics-I
Sub. Code: 114842

Day and Date: Friday ,06-02-2026 **Total Marks: 60**
Time: 10:30 AM To 12:30 PM

Instructions:

Special Inst.: **1) Question No. 1 is Compulsory.**
2) Candidate has to attempt Any Three Questions from Question No. 2 to 5.
3) Figures to the right indicate full marks.

Q1) Choose the correct alternative and rewrite the sentence **[6]**

a. For any real number n, the value of $(\cos\theta + i\sin\theta)^n$ is **[1]**

A) $(\cos n\theta - i\sin n\theta)$ B) $(\sin n\theta + i\cos n\theta)$

C) $(\cos n\theta + i\sin n\theta)$ D) $(\sin n\theta - i\cos n\theta)$

b. The coefficient of x^3 in the Maclaurin series of e^x is **[1]**

A) 1 B) 1/3

C) 1/4 D) 1/6

c. If $u = x^y$ then $\frac{\partial u}{\partial x}$ is **[1]**

A) x^{y-1} B) $y\,x^{y-1}$

C) $x^y logx$ D) $y\,x^{x-1}$

d. If the rank of matrix $\begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & \mu \end{bmatrix}$ is 2 then μ = **[1]**

A) 1 B) 2

C) −1 D) 0

e. For a square matrix A, the sum of eigenvalues is equal to **[1]**

A) Determinant of A B) Trace of A

C) Rank of A D) Inverse of A

f.

The numerical method which transforms the augmented matrix directly to diagonal form is [1]

A) Gauss elimination method B) Gauss–Jordan method

C) Jacobi method D) Gauss–Seidel method

Q2) Answer the following questions **[18]**

a. Find all the values of $\left(\frac{1}{2}+i\frac{\sqrt{3}}{2}\right)^{\frac{3}{4}}$ and show that their product is 1. **[6]**

b. Using De Moivre's theorem, prove that **[6]**

$$\frac{\sin 5\theta}{\sin\theta} = 16\cos^4\theta - 12\cos^2\theta + 1$$

c. Evaluate $\lim_{x\to 0}\frac{e^{2x}-(1+x)^2}{x\log(1+x)}$ **[6]**

Q3) Answer the following questions **[18]**

a. If $u = \log\left(\frac{x^2+y^2}{xy}\right)$ then prove that $\frac{\partial^2 u}{\partial x\partial y} = \frac{\partial^2 u}{\partial y\partial x}$ **[6]**

b. Determine the extreme values of **[6]**

$f(x,y) = x^3 + y^3 - 3axy$, a > 0

c. Reduce the following matrix to normal form and find the rank **[6]**

$$\begin{bmatrix} 1 & 3 & 4 & 5 \\ 1 & 2 & 6 & 7 \\ 1 & 5 & 0 & 10 \end{bmatrix}$$

Q4) Answer the following questions **[18]**

a. Verify Cayley Hamilton Theorem for the matrix **[6]**

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

b.

[6]

Find the eigen values and eigen vector for largest eigen value of the matrix

$$A=\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$$

c. [6]

Solve the following equations by using Gauss-Jordan method.

$x - y + 2z = 5, \quad 3x + 2y + z = 10, \quad 2x - 3y - 2z = -10$

Q5) Answer the following questions **[18]**

a. [6]

Expand $f(x) = x^4 - 3x^3 + 2x^2 - x + 1$ in powers of $(x - 3)$

b. [6]

Solve the equations

$x + y - z + w = 0, \quad x - y + 2z - w = 0, \quad 3x + y + w = 0$

c. [6]

Solve by Gauss-Seidel method. (Carry out Three iterations only)

$10x + 2y + z = 9, \; 2x + 20y - 2z = -44, \; -2x + 3y + 10z = 22$

End Of Question Paper

Important Note for Chief Exam Officer / SRPD Coordinator / Sr Supervisor/ Student -
This Question Paper may be distributed for following Subjects as common code.
सदरची प्रश्नपत्रिका खालील विषयांकरिता वितरित करता येईल.

1] (12609) Bachelor of Technology (NEP-2.1) (114842) Engineering Mathematics-I Part 1 SEM 1