

Seat No. **MAR-APR 2025 SUMMER EXAMINATION****11731 Bachelor of Technology (NEP-2.0)****Sub. Name: Engineering Mathematics-I****Sub. Code: 108717****Day and Date: SEPTEMBER, 15-09-2025****Total Marks: 60****Time: 10:30 AM To 01:00 PM****Instructions:**

- Special Inst.:**
- 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Use of non-programmable calculator is allowed.

Q1) Attempt any Three of the following. (5 Marks Each) [15]

a. Solve $x^6 - i = 0$. [5]

b. Expand $e^{\sin x}$ by Maclaurin's series up to the term containing x^4 . [5]

c. If $z = x^3 + y^3 - 3axy$, prove that $\frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y}$. [5]

d. Evaluate $\lim_{x \rightarrow 1} \left(\frac{1}{\log x} - \frac{x}{x-1} \right)$ [5]

Q2) Attempt any Three of the following. (5 Marks Each) [15]

a. Reduce the following matrix to its normal form and hence find rank. [5]

$$\begin{bmatrix} -1 & 2 & -1 & -2 \\ -2 & 5 & 3 & 0 \\ 1 & 0 & 1 & 10 \end{bmatrix}$$

b. Test for consistency the following equations, and if possible, solve the equations. [5]

$$x + y + z = 6, \quad x + 2y + 3z = 14, \quad 2x + 4y + 7z = 30$$

c. Solve the following system of equations. [5]

$$4x + 3y - z = 0, \quad 3x + 4y + z = 0, \quad x - y - 2z = 0, \quad 5x + y - 4z = 0$$

d.

Determine the values of k , for which the equations

$$x + y + z = 1, \quad 2x + y + 4z = k, \quad 4x + y + 10z = k^2$$

Have infinite number of solutions.

Q3) Attempt any Three of the following. (5 Marks Each)

[15]

a. Find the characteristic equation of the matrix A and hence find A^{-1} where

[5]

$$A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$$

b. Find the eigen values of matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$ and hence find eigen vector for largest eigen value.

[5]

c. Find the eigen values of matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$

[5]

and hence find eigen values of (i) A^{-1} (ii) $\text{adj } A$

d. Verify Cayley-Hamilton Theorem for the matrix A where $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$

[5]

Q4) Attempt any Three of the following. (5 Marks Each)

[15]

a. Apply Gauss Elimination method to solve

[5]

$$x + y + z = 9, \quad 2x - 3y + 4z = 13, \quad 3x + 4y + 5z = 40$$

b. Solve by Jacobi's iteration method (Four iterations only)

[5]

$$10x + y - z = 11.19, \quad x + 10y + z = 28.08, \quad -x + y + 10z = 35.61$$

c. Solve by Gauss-Seidel method the equations (Three iterations only)

[5]

$$83x + 11y - 4z = 95, \quad 7x + 52y + 13z = 104, \quad 3x + 8y + 29z = 71$$

d. Apply Gauss Jordan method to solve the equations

[5]

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

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] (11731) Bachelor of Technology (NEP-2.0) (108717) Engineering Mathematics-I Part 1 SEM 1

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