

Code No: **R231101**

R23

SET - 1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM
I B. Tech I Semester Supplementary Examinations June 2025

LINEAR ALGEBRA & CALCULUS

(Common to all branches)

Time: 3 hours

Max. Marks: 70

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.

PART-A

(20 Marks)

- 1 a) Find the Rank of the Diagonal matrix of order 4. [2]
- b) If the $\rho(A) = \rho(A:B) = 3$ and the number of unknowns is 4 the how many solutions exist for the system of equations. [2]
- c) If the eigen values of A are 3,4 -2 the find the Eigen values of A^{-1} . [2]
- d) Find the nature of the quadratic form if the eigen values are 1, 0, -2. [2]
- e) What is the interpretation of Rolle's mean value theorem. [2]
- f) Check whether $f(x) = \tan x$ is continuities on $[0, \pi]$. [2]
- g) Find $\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}$ for $z = \tan xy$. [2]
- h) Find the $\frac{dy}{dt}$ for $y = \cos 4x, x = e^t$. [2]
- i) Evaluate $\int_1^2 \int_3^4 xy \, dx \, dy$. [2]
- j) What is change of order of integration? [2]

PART-B

(50 Marks)

Unit-1

- 2 a) Find the rank of A using Normal form where $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$. [5]
- b) Solve the system of equations $x + y + z = 3, 2x - y + 3z = 16, 3x + y - z = -3$ using Gauss-Elimination method. [5]

(OR)

- 3 a) Find the rank of A using Echelon form where [5]

$$A = \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}$$

- b) Test the consistency, hence solve the $5x + 3y + 7z = 4, 3x + 26y + 2z = 9, 7x + 2y + 10z = 5$ system of equations [5]

Unit-2

- 4 a) Find the eigen values and eigen vector of $A = \begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$ [5]

- b) Reduce the quadratic form $10x^2 + 2y^2 + 5z^2 - 4xy - 10xz + 6yz$ to canonical form using diagonalization method hence find rank, index of the quadratic form. [5]

(OR)

- 5 a) Using Cayley-Hamilton theorem find A^{-1} where [5]

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

- b) Find the nature of the quadratic form $3x^2 + 2y^2 + 3z^2 - 2xy - 2yz$ [5]

Unit-3

- 6 a) Verify Cauchy's mean value theorem for $f(x) = \frac{1}{x}$, [5]
 $g(x) = \log x_e$ on $[2, 4]$.

- b) Verify Lagrange's mean value theorem $f(x) = \sin x$ on $[0, \pi/2]$ [5]

(OR)

- 7 a) Verify Rolle's mean value theorem for $f(x) = |x|$ on $[-1, 1]$ [5]
 b) Expand $f(x) = \sin x$ about $x = \pi/4$ using Taylor's theorem. [5]

Unit-4

- 8 a) Find the $J\left(\frac{u,v}{x,y}\right)$ where if $u = x^2 - y^2$, $v = 2xy$ [5]

- b) Expand $f(x, y) = \tan^{-1}(xy)$ about $x=1$, $y=-1$ [5]

(OR)

- 9 a) Find the extreme values of $f(x, y) = x^2y^2 - 5x^2 - 8xy - 5y^2$ [5]
 b) Find $\frac{du}{dx}$ If $u = x \log(xy)$, where $x^3 + y^3 + 3xy = 1$. [5]

Unit-5

- 10 a) Evaluate $\int_0^{\pi/4} \int_0^{a \sin \theta} \frac{r}{\sqrt{a^2 - r^2}} dr d\theta$ [5]

- b) Evaluate $\iiint \frac{dx dy dz}{x^2 + y^2 + z^2}$, taken over the volume bounded by the sphere $x^2 + y^2 + z^2 = a^2$ [5]

(OR)

- 11 a) Find the area bounded by the curves $y = x^3$ and $y = x$. [5]

- b) Find the volume of ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ [5]
