PC

I Int

SNPSU

SAPTHAGIRI NPS UNIVERSITY

BE 1st Semester 2024-25

First Internal Assessment Test

Course Code: 24BEPHY102 **Semester: I**

Course: Linear Algebra and Calculus **SRN:**

Duration: 1.5 hours **Max Marks: 50**

PART –A

Answer any Ten of the following **2x10=20**

1. Define Echelon form of a matrix.
2. Find the Rank of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 6 \end{bmatrix}$
3. Find the Rank of the matrix A $=\begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 1 \\ 4 & 1 & 3 \end{bmatrix}$.
4. Solve the following system of linear equations using Gauss elimination method $\begin{matrix} x - y = 2 \\ 2x + y = 5 \end{matrix}$.
5. Using Gauss-Seidel iteration method find 1st iteration $5x - y = 9;\ x - 5y + 2 = -4;\ y - 5z = 6$
6. Use the Rayleigh power method to find the eigenvalue & eigen vector of the matrix: $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$.
7. Write the n^{th} derivative of $y = \log(ax + b)$
8. Find the nth order derivative of $y = x^2 e^x$
9. Find the nth order derivative of $y = a^{5x}$
10. If $y = \tan^{-1}x$, find the second order derivative.
11. Write the condition for orthogonal intersection of two curves?
12. Find the angle between the radius vector and tangent to the curve $r = a\theta$ at any point.

PART –B

5 x 4 =20

Answer any Four of the following

1. Find the rank of a matrix $A = \begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$
2. Solve the following system of equation by Gauss Jordon Method

   $2x + y + 4z = 12; 4x + 11y - z = 33; 8x - 3y + 2z = 20.$
3. Solve the following system of equation by Gauss Siedel Iterative Method

   $20x + y - 2z = 17;\ 3x + 20y - z = -18;\ 2x - 3y + 20z = 25.$
4. Find the angle between the radius vector and tangent to the curve

   $r^m = a^m(\cos m\theta + \sin m\theta)$
5. Show that the following pairs of curves intersect each other orthogonally:

   $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$

PART – C

Answer any One of the following **10 x 1 =10**

1. Find the largest eigenvalues and the corresponding eigenvectors for the following matrices by Rayleigh's Power Method: $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ by taking the initial eigen vector as $[1, 0.8, -0.8]^T$ perform 5 iterations
2. If $\tan y = x$, prove that $(1 + x^2)y_2 + 2xy_1 = 0$ and hence show that

   $(1 + x^2)y_{n+2} + 2(n + 1)xy_{n+1} + n(n + 1)y_n = 0$