

**CMR ENGINEERING COLLEGE: : HYDERABAD**  
**UGC AUTONOMOUS**

**I–B.TECH–I–Semester End Examinations (Supply) -June- 2025**

**LINEAR ALGEBRA AND CALCULUS**

**(Common for all)**

**[Time: 3 Hours]**

**[Max. Marks: 70]**

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 20 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART-A**

**(20 Marks)**

1. a) Define Symmetric Matrix and Hermitian matrix? [2M]
- b) Find the rank of the matrix  $\begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & -8 \end{bmatrix}$  [2M]
- c) Define Characteristic equation? [2M]
- d) Find Nature of the Matrix? [2M]
- e) Explain P –test with example? [2M]
- f) Show that  $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1}$  is conditionally convergent [2M]
- g) Explain Taylor s series? [2M]
- h) Define Gamma function? [2M]
- i) State Euler s theorem? [2M]
- j) Find the Stationary points of the function  $x^3 + y^3 - 3axy$  for maxima and minima. [2M]

**PART-B**

**(50 Marks)**

2. For what values of  $\lambda, \mu$  the simultaneous equations  $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ , have (i) no solution (ii) unique solution and (iii) infinite number of solutions. [10M]

**OR**

3. Solve the following by Gauss-Seidel method [10M]  
 $20x + y - 2z = 317, 3x + 20y - z = -18, 2x - 3y + 20z = 25$
4. State and prove Cayley-Hamilton theorem and find the inverse of the matrix  $\begin{bmatrix} 1 & 1 & 2 \\ 0 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$  [10M]

**OR**

5. Reduce the quadratic form  $3x^2 + 3y^2 + 3z^2 + 2yz + 2zx + 2xy$  into canonical form using orthogonal transformation and find the nature of quadratic form. [10M]

6. Test for Convergence of  $\sum \frac{x^n}{n(n-1)(n-2)}$  [10M]

OR

7. Discuss the convergence of [10M]

$$x + \frac{2^2 x^2}{2!} + \frac{3^2 x^3}{3!} + \frac{4^2 x^4}{4!} + \dots$$

8. State Cauchy's theorem and Discuss the applicability of Cauchy mean value theorem [10M]  
for the function  $f(x) = \frac{1}{x^2}$ ,  $g(x) = \frac{1}{x}$  on [a,b].

OR

9. State Rolle's theorem? Verify Rolle's theorem for  $f(x) = \frac{\sin x}{e^x}$  in  $[0, \pi]$ . [10M]

10. If [10M]

$$u = \frac{y}{z} + \frac{z}{x} \quad \text{find} \quad x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}.$$

OR

11. Explain Beta function and Express in terms of Beta function. [10M]

$$\int_0^3 \frac{dx}{\sqrt{9-x^2}}$$

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