

R18

Code No: 151AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, May/June - 2019

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, EIE, IT MCT, MMT, AE, MIE, PTM)

Time: 3 hours

Max. Marks: 75

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

Part A is compulsory which carries 25 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

(25 Marks)

- 1.a) If  $A$  is orthogonal matrix, prove that  $A^T$  and  $A^{-1}$  are also orthogonal. [2]
- b) Find the Eigen values of  $A^2$ , if  $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ . [2]
- c) State Cauchy's integral test. [2]
- d) State Rolle's theorem. [2]
- e) State Euler's theorem for homogeneous function in  $x$  and  $y$ . [2]
- f) State the conditions when the system of non homogenous equations  $AX=B$  will have  
i) unique solution ii) Infinite no of solutions iii) No solution. [3]
- g) Prove that the Eigen values of a skew-Hermitian matrix are purely imaginary or zero. [3]
- h) State Leibnitz test. [3]
- i) Evaluate  $\int_0^{\infty} e^{-x} x^7 dx$ . [3]
- j) Find  $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ , if  $u = x + y + z, v = x + y$  and  $z = z$ . [3]

PART-B

(50 Marks)

2. Using Gauss Seidel method solve  $25x + 2y + 2z = 69, 2x + 10y + z = 63, x + y + z = 43$ . [10]

3. OR  
Solve the system of equations  $x - y + 2z = 4, 3x + y + 4z = 6, x + y + z = 1$  using Gauss elimination method. [10]

4. Find Eigen values and Eigen vectors of  $\begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$ . [10]

OR

5. Find Eigen values and Eigen vectors of  $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ . [10]

- 6.a) Test the convergence of the series  $\sum_{n=0}^{\infty} \frac{n!(n+1)!}{(3n)!}$ .
- b) Find the radius of convergence of the series  $\sum_{n=0}^{\infty} \frac{n^3 x^{3n}}{n^4 + 1}$ . [5+5]

OR

7. Does the series  $\sum_{n=0}^{\infty} \frac{(-1)^n}{\sqrt{n^2 + 1}}$  converge absolutely, conditionally or diverge? [10]

- 8.a) Expand  $\tan^{-1}x$  in powers of  $(x-1)$  using Maclaurin's theorem.  
 b) Find the volume of the solid that results when the region enclosed by the curves  $xy = 1$ ,  $x$  - axis and  $x = 1$  rotated about  $x$  - axis. [5+5]

OR

- 9.a) Verify Cauchy mean value theorem for the functions  $e^x$  and  $e^{-x}$  in the interval  $(a, b)$ .  
 b) Evaluate  $\int_0^{\infty} x^4 e^{-x^2} dx$  Beta and Gamma. [5+5]

- 10.a) If  $u = \log\left(\frac{x^2 + y^2}{x + y}\right)$  prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 1$ .

- b) If  $x + y + z = u$ ,  $y + z = uv$ ,  $z = uvw$ , then evaluate  $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ . [5+5]

OR

- 11.a) Show that  $U = x^2 e^{-y} \cosh z$ ,  $V = x^2 e^{-y} \sinh z$ ,  $w = x^2 + y^2 + z^2 - xy - yz - zx$  are functionally dependent. If dependent find the relationship between them.  
 b) Find the maximum of  $x^2 + y^2 + z^2$  such that  $2x + 3y + z = 14$  using Lagrange's multiplier method. [5+5]

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