

Code No: 131AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, June - 2022

MATHEMATICS - I

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

Time: 3 Hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

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- 1.a) A body is originally at  $80^{\circ}\text{C}$  and cools down to  $60^{\circ}\text{C}$  in 20 minutes. If the temperature of the air is  $40^{\circ}\text{C}$ , find the temperature of the body after 40 minutes.
- b) Solve the Differential Equation  $(D^2 + 1)y = \sin x \sin 2x + e^x x^2$ . [7+8]
- 2.a) Solve for the current  $i(t)$  in RL circuit if  $R = 2$  ohms,  $L = 25$  henries and  $E(t) = Ae^{-t}$  with  $A > 0$  and  $i(0) = 0$ .
- b) Solve the Differential Equation  $(D^2 + 4)y = 4 \tan 2x$  by the method of variation of parameters. [7+8]
- 3.a) Find the rank of  $\begin{bmatrix} 2 & -4 & 3 & -1 & 0 \\ 1 & -2 & -1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$  using Echelon form.
- b) Solve the following system of equations  
 $x + y - 2z + 3w = 0$ ,  $x - 2y + z - w = 0$ ,  $4x + y - 5z + 8w = 0$ ,  $5x - 7y + 2z - w = 0$ . [7+8]
- 4.a) Solve the following system of equations by Gauss-seidal method.  
 $5x + y + z + w = 4$ ,  $x + 7y + z + w = 12$ ,  $x + y + 6z + w = -5$ ,  $x + y + z + 4w = -6$ .
- b) Solve the following system of equations by LU decomposition method.  
 $x + y + z = 6$ ,  $x + 2y + 3z = 14$ ,  $x + 4y + 9z = 36$ . [8+7]
- 5.a) If  $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$  Verify Cayley Hamilton theorem. Hence find  $A^4$ .
- b) Prove that the matrix  $A$  and  $A^T$  have same Eigen values. [8+7]
6. Find Rank index and signature of quadratic  $7x^2 + 6y^2 + 5z^2 - 4xy - 4yz$  form by reduce into normal form by orthogonal reduction. [15]

7.a) Find  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$  using Euler's theorem for  $u = \log\left(\frac{x^2 + y^2}{xy}\right)$ .

b) Find the minimum values of the following function using Lagrange's multiplier method.

$$x + y + z \text{ subject to } \frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 1. \quad [7+8]$$

8.a) Solve the Partial Differential Equation  $p^3 + q^3 = pqz$ .

b) Solve the Partial Differential Equation  $yp - xq = -xe^{x^2+y^2}$ . [7+8]

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