

Code No: 131AA

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech I Year I Semester Examinations, September - 2023

MATHEMATICS - I

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

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

- 1.a) Solve $ydx - xdy = a(x^2 + y^2)dx$. [2]
- b) Find the complementary function for the equation $\frac{d^4y}{dx^4} + 4y = \cos 2x + \cos 4x$. [3]
- c) Find the LU decomposition of $A = \begin{bmatrix} 1 & 3 \\ 4 & -1 \end{bmatrix}$. [2]
- d) Reduce the following matrix to upper triangular form (Echelon form) by elementary row transformations $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ 3 & 1 & 2 \end{bmatrix}$. [3]
- e) Find the sum and product of the Eigen values of the matrix $A = \begin{bmatrix} 2 & 5 & 7 \\ 1 & 4 & 6 \\ 2 & -2 & 3 \end{bmatrix}$. [2]
- f) Find the nature, index and signature of the Quadratic form:
 $Q = 2x_1x_2 + 2x_1x_3 + 2x_2x_3$ [3]
- g) If $u = x^y$, show that $\frac{\partial^3 u}{\partial x^2 \partial y} = \frac{\partial^3 u}{\partial x \partial y^2}$. [2]
- h) If $u = \cos^{-1} \frac{x+y}{\sqrt{x+y}}$, then show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = -\frac{1}{2} \cot u$. [3]
- i) Form the partial differential equation by eliminating the arbitrary constants a and b from $z = ax^n + by^n$. [2]
- j) Solve $zp + yq = x$. [3]

PART - B

(50 Marks)

- 2.a) Solve $(D^2 + 2D^2 + 1)y = x^2 \cos x$.
- b) According to Newton's law of cooling, the rate at which a substance cools in moving air is proportional to the difference between the temperature of the substance and that of the air. If the temperature of the air is 30°C and the substance cools from 100°C to 70°C in 15 minutes, find when the temperature will be 40°C ? [5+5]
3. Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = \tan x$. [10]
- OR

