Code No: 121AB **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, August - 2018

MATHEMATICS-I

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

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) A body is heated to $110^0\ C$ and placed in air at 10^0C. After one hour its temperature is 60^0C. How much additional time is required for it to cool to 30^0C? [2]

b) Find the integrating factor for the following equation $(3xy - 2ay^2)dx + (x^2 - 2axy)dy = 0$ [3]

c) Find the rank of the matrix $\begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -1 & 2 & 2 \\ 3 & 1 & 2 & 3 \end{bmatrix}$. [2]

d) Find the value of x such that the Rank of the following matrix is 2 [3]

$$\begin{bmatrix} 4 & 2\sqrt{5} & 0 \\ 2\sqrt{5} & 4 & \sqrt{5} \\ 0 & \sqrt{5} & x \end{bmatrix}$$

e) Find the sum and product of Eigen values of $A = \begin{pmatrix} 8 & -1 \\ 2 & 2 \end{pmatrix}$. [2]

f) If 1, 3, -2 are eigen values of a matrix A, then find the eigen values of 2A+3I. [3]

g) Write the Taylor's series expansion for f(x,y) about the point (a,b). [2]

h) Find the value of $\frac{\partial^3 u}{\partial x \partial y \partial z}$, where $u = x^3y^3z^3$ [3]

i) Form the partial differential equation of $z = ax^2 + by^2$ where a and b are arbitrary constants. [2]

j) Find the order and degree of the partial differential equation

$$\frac{\partial^2 z}{\partial x \partial y} = 5\left(\frac{\partial^2 z}{dx^2}\right)^2 + 7\left(\frac{\partial z}{\partial y}\right)$$ [3]

PART-B

(50 Marks)

2.a) Solve the differential equation $(D^2 - 1)y = x^2e^x$.

b) Find the orthogonal trajectories of the lines y = m x, m is arbitrary constant. [5+5]

OR

3.a) Solve the differential equation $(D^2-5D+6)y = \text{Sin } 4x$.

b) In a culture of yeast, the active ferment doubles itself in 3 hours. Determine the number of times it multiplies itself in 15 hours. [5+5]

4.a) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & -13 \end{bmatrix}$.

b) Find by LU decomposition method solve the linear system. [5+5]

$$\begin{bmatrix} -3 & 12 & -6 \\ 1 & -2 & 2 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -33 \\ 7 \\ -1 \end{bmatrix}$$

OR

5.a) Find the value of k for which the system of equations
$(k+1)x + 8y = 4k$; $kx + (k-3)y = 3k - 1$ has infinitely many solutions.

b) Solve the system of equations by the Gauss Seidel method [5+5]

$$10x + y + z = 12$$
$$2x + 10y + z = 13$$
$$2x + 2y + 10z = 14$$

6.a) If a matrix $A = \begin{bmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$ then find the Eigen values of A^2?

b) If $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$ then find eigenvalues of $3A^3 + 5A^2 - 6A - 2I$. [5+5]

OR

7.a) Reduce the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_3x_2 + 4x_3x_1$ to canonical form.

b) If λ is an eigenvalue of A, then prove that λ^m is an eigenvalue of A^m, (m is any positive integer). [5+5]

8.a) If $u = x \log xy$ *where* $x^3 + y^3 + 3xy = 1$ find the value of $\frac{du}{dx}$

b) Find the Taylor's series expansion of $f(x, y) = \text{Sin}(xy)$ about the point $(0,\pi)$. [5+5]

OR

9.a) Find the maximum and minimum values of the function $f(x, y, z) = 2x + 3y + z$, under the conditions
$x^2 + y^2 = 5$ and $x + y = 1$

b) The sum of three positive numbers is constant. For what values of x, y *and* z is their product a maximum? [5+5]

10. If $p = \frac{\partial z}{\partial x}$ *and* $q = \frac{\partial z}{\partial y}$ Solve the following partial differential equations

a) $p - q = \log(x + y)$

b) $y^2p - xyq = x(z - 2y)$. [5+5]

OR

11. If $p = \frac{\partial z}{\partial x}$ *and* $q = \frac{\partial z}{\partial y}$ Solve the following partial differential equations

a) $p = \log(px - y)$

b) $p - x^2 = q + y^2$. [5+5]

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