Code No: 131AA

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, May - 2018

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, 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) Find an integrating factor for the following equation $\frac{dy}{dx} = e^{2x} + y - 1$. [2]

b) Find the solution of $\frac{dy}{dx} = -\frac{x}{y}$ at x=1 and y=$\sqrt{3}$. [3]

c) Find the value of α such that the vectors (1, 1, 0), (1, α, 0) and (1, 1, 1) are linearly dependent. [2]

d) Determine whether the system of equations is consistent $\begin{aligned} 2x - 3y + 5z &= 1 \\ 3x + y - z &= 2 \\ x + 4y - 6z &= 1 \end{aligned}$ [3]

e) If λ is the Eigen value of a matrix A then derive the Eigen value of (adjoint$A$). [2]

f) Taking A as a 2 ×2 matrix show that the Eigen values of A = the trace of A. [3]

g) If $u = x^y$ show that $\frac{\partial^3 u}{\partial x^2 \partial y} = \frac{\partial^3 u}{\partial x \partial y \partial x}$ [2]

h) Find the stationary values of $xy(a - x - y)$. [3]

i) Eliminate the arbitrary function f from the equation and form the partial differential equation $z = xy + f(x^2 + y^2)$. [2]

j) Eliminate the constants a and b from the equation: $z = (y + a)(x + b)$. [3]

PART-B

(50 Marks)

2.a) Solve the Following differential equations:
$y'' - 2y' + y = te^t + 4, \quad y(0) = 1, \quad y'(0) = 1$

b) Find the orthogonal trajectories for the family of curves $r^n \sin n\,\theta = a^n$. [5+5]

OR

3.a) In an L-R circuit an e.m.f. of 10 sin t volts is applied. If I(0)=0, find the current I(t) in the circuit at any time t.

b) Solve the Following differential equation $y'' + 2y' + 5y = 4e^{-t}\cos 2t, \quad y(0) = 1, \quad y'(0) = 0$. [5+5]

4.a) Find an LU factorization for the matrix $\begin{bmatrix} 1 & 2 \\ -3 & -1 \end{bmatrix}$

b) In the following equations determine, for what value of "k" if any will the systems have i) unique solution ii) no solution iii) Infinitely many solutions

$$k\,x + 2\,y = 3$$
$$2x - 4y = -6$$

[5+5]

OR

5.a) Use either the Gaussian Elimination or the Gauss Jordan method to solve

$$x + 2y - 3z = 9$$
$$2x - y + z = 0$$
$$4x - y + z = 4$$

b) Using the theory of matrices, find the point such that the line of intersection of the planes $3x + 2y + z = -1$ and $2x - y + 4z = 5$ cuts the plane $x + y + z = 4$. [5+5]

6.a) Obtain the Eigen values of the following matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ and verify whether its Eigen vectors are orthogonal.

b) Show that 0 is an Eigen value of a matrix A if and only if it is singular. [5+5]

OR

7.a) If $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ then show that $A^n = A^{n-2} + A^2 - I \;\; for\; n \geq 3$. Hence find A^{50}.

b) Show that the matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$ is not similar to a diagonal matrix. [5+5]

8.a) If $\sin u = \frac{x^2y^2}{x+y}$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3\tan u$.

b) If $f(0) = 0$ *and* $f'(x) = \frac{1}{1+x^2}$ then using Jacobians show that $f(x) + f(y) = f\left(\frac{x+y}{1-xy}\right)$.

[5+5]

OR

9.a) Expand $e^x \cos y$ *in powers of x and* $\left(y - \frac{\pi}{2}\right)$ 0.

b) Show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube. [5+5]

10. Find the general integrals of the linear partial differential equations

a) $y^2p - xy\,q = x(z - 2y)$

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

OR

11. Find complete integrals of the following equations

a) p+q=pq

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

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