R16

Code No: 131AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, December - 2016

MATHEMATICS-I

(Common to all Branches)

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) Solve the following differential equation $n(2y - x^3)dx + x\,dy = 0$. [2]

b) Find the Particular Integral of the equation $(D^2 - 2D + 1)y = x\,e^x \sin x$. [3]

c) Examine whether the vectors are linearly dependent or not (3 1 1), (2 0 -1), (4 2 1). [2]

d) If $\alpha, \beta, and\ \gamma$ are the roots of the equation $x^3 + px + q = 0$ then the value of the determinant $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$ is [3]

e) Compute the Eigen values and Eigen vectors of $\begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$. [2]

f) Find the Eigen values of the following system $\begin{aligned} 8x - 4y &= \lambda x \\ 2x + 2y &= \lambda y \end{aligned}$ [3]

g) Find the value of $\frac{\partial x}{\partial y}\cdot\frac{\partial y}{\partial z}\cdot\frac{\partial z}{\partial x}$ if f(x, y, z) = 0. [2]

h) Find $\frac{dy}{dx}$ if $x^y = y^x$. [3]

i) Form the partial differential equation by eliminating the arbitrary function $z = f(x^2 + y^2)$ [2]

j) Solve the following partial differential equation $y\,q - x\,p = z$. [3]

PART-B

(50 Marks)

2.a) Find the value of the constant d such that the parabolas $y = c_1x^2 + d$ are the orthogonal trajectories of the family of ellipses $x^2 + 2\,y^2 - y = c_2$.

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]

OR

3.a) Solve $(D^2 + 5D + 6)y = e^x cos2x$.

b) Solve by the method of variation of parameters $y'' + y = \sec x$. [5+5]

4.a) Discuss the consistency of the system of equations $\begin{aligned} 2x + 3y + 4z &= 11 \\ x + 5y + 7z &= 15 \\ 3x + 11y + 13z &= 25 \end{aligned}$.

b) Find an LU decomposition of the Matrix A and solve the linear system AX=B

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

[5+5]

OR

5.a) Solve the system of equations by the Gauss Seidel method

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

b) Convert the matrix into echelon form $\begin{bmatrix} 3 & 2 & 1 \\ 2 & 1 & 1 \\ 6 & 2 & 4 \end{bmatrix}$. [5+5]

6.a) Find A^{39} if $A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$.

b) Compute the Modal matrix for $\begin{bmatrix} 5 & 4 \\ 12 & 7 \end{bmatrix}$. [5+5]

OR

7. Reduce the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_3x_2 + 4x_3x_1$ to the sum of squares and find the corresponding linear transformation. Find the index and signature.

[10]

8.a) Determine the functional dependence and find the relation between $u = \frac{x-y}{x+y}, v = \frac{xy}{(x-y)^2}$.

b) If $u = x^2 + y^2 + z^2, v = xyz$ find $J\left(\frac{x, y}{u, v}\right)$. [5+5]

OR

9.a) Expand $x^2y + 3y - 2$ in powers of $x - 1$ using Taylor's theorem.

b) Find the maximum and minimum distances of the point (3, 4, 12) from the sphere $x^2 + y^2 + z^2 = 1$. [5+5]

10 Solve the partial differential equations:

a) $px(z - 2y^2) = (z - qy)(z - y^2 - 2x^3)$

b) $xp - yq + x^2 - y^2 = 0$. [5+5]

OR

11. Solve the partial differential equations:

a) $p(1 + q) = qz$

b) $z^2(p^2x^2 + q^2) = 1$. [5+5]

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