

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 α, β , and γ 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 $\begin{bmatrix} 1 & 4 \\ 13 & 2 \end{bmatrix}$. [2]
- f) Find the Eigen values of the following system $\begin{cases} 8x - 4y = \lambda x \\ 2x + 2y = \lambda y \end{cases}$ [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 $y = c_1 x^2 + d$ are the orthogonal trajectories of the family of ellipses $x^2 + 2y^2 - y = c_2$.
 - 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 $(D^2 + 5D + 6)y = e^x \cos 2x$.
 - b) Solve by the method of variation of parameters $y'' + y = \sec x$. [5+5]

- $2x + 3y + 4z = 11$
 $x + 5y + 7z = 15$
 $3x + 11y + 13z = 25$
- 4.a) Discuss the consistency of the system of equations
- b) Find an LU decomposition of the Matrix A and solve the linear system $AX=B$
- $$\begin{bmatrix} -3 & 12 & -6 \\ 1 & -2 & 2 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -33 \\ 7 \\ -1 \end{bmatrix} \quad [5+5]$$
- OR**
- 5.a) Solve the system of equations by the Gauss Seidel method
- $$\begin{aligned} 10x + y + z &= 12 \\ 2x + 10y + z &= 13 \\ 2x + 2y + 10z &= 14 \end{aligned}$$
- 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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