R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year I Semester Examinations, May/June – 2019
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) Solve the following differential equation $x\frac{dy}{dx} - y = x^2$.   [2]

b) Find the complimentary function for the equation $\frac{d^4y}{dx^4} + 4y = \cos 2x + \cos 4x$.   [3]

c) Find the value of k such that the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & k & 7 \\ 3 & 6 & 10 \end{bmatrix}$ is 2.   [2]

d) Find the LU decomposition of $A = \begin{bmatrix} 1 & 3 \\ 4 & -1 \end{bmatrix}$.   [3]

e) If a square matrix A has an Eigen value λ then what is the Eigen value of the matrix kA^T where $k \neq 0$ is a scalar.   [2]

f) If a matrix $A = \begin{bmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$ then what are the Eigen values of A^2?   [3]

g) If $u = e^{xyz}$ find the value of $\frac{\partial^3 u}{\partial x \partial y \partial z}$.   [2]

h) If $v = \frac{x^3y}{x^3+y^3}$ find the value of $x\frac{\partial v}{\partial x} + y\frac{\partial u}{\partial y}$.   [3]

i) Form the partial differential equation by eliminating the arbitrary constants a, b $z = (x + a)(y + b)$.   [2]

j) Solve $zp + yq = x$.   [3]

PART-B
(50 Marks)

2.a) Solve $(D^2 - 4)y = x \sin x$

b) Find the current at any time $t > 0$ in a circuit having in series a constant electromotive force 40V, a resistor 10 Ω, and an inductor 0.2 H given that the initial current is zero. Find the current when emf is 150 cos200 t.   [5+5]

OR

3.a) Solve $(D^2 + 2D^2 + 1)y = x^2 \cos x$

b) Solve by the method of variation of parameters: $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$.   [5+5]

4. Factorize the matrix by the LU decomposition method $\begin{bmatrix} 2 & -3 & 1 \\ 3 & 4 & 2 \\ 2 & -3 & 4 \end{bmatrix}$ [10]

OR

5.a) For what values of λ and μ do the system of equations $x+y+z=6$, $x+2y+3z=10$, $x+2y+\lambda z = \mu$ have i) no solution, ii) unique solution iii) more than one solution?

b) 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. [5+5]

6 Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ -1 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$ and obtain A^{-1} and A^3. [10]

OR

7. Reduce the quadratic form $3x^2 + 3y^2 + 3z^2 - 2yz + 2zx + 2xy$ to its canonical form. [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 $y_1 = \frac{x_2 x_3}{x_1}$, $y_2 = \frac{x_3 x_1}{x_2}$, $y_3 = \frac{x_1 x_2}{x_3}$, Find the Jacobian of y_1, y_2, y_3 with respect to x_1, x_2, x_3. [5+5]

OR

9.a) Obtain the Taylor's expansion of $\tan^{-1}\frac{y}{x}$ about $(1,1)$ upto and including second degree terms.

b) Find a point within a triangle such that the sum of the squares of its distances from the three angular points is a minimum. [5+5]

10. Solve the partial differential equations:
a) $(x^2 - yz)p + (y^2 - zx)q = (z^2 - xy)$
b) $x^2 \frac{\partial z}{\partial x} + y^2 \frac{\partial z}{\partial y} = (x + y)z$. [5+5]

OR

11. Solve the partial differential equations
a) $p^2 + q^2 = z^2(x + y)$
b) $x^2 p^2 + y^2 q^2 = z$. [5+5]

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