

Code No: 131AA

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, December - 2017

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) Define exact differential equation. Give an example. [2]
- b) Find a particular integral of $y'' - 2y' + y = \frac{e^x}{x}$. [3]
- c) Show that the matrix $A = \begin{pmatrix} 3i & 2+i \\ -2+i & -i \end{pmatrix}$ is Skew-Hermitian. [2]
- d) Find the values of a and b such that the system $2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$, $2x + 3y + az = b$ has no solution. [3]
- e) Find the sum and product of the Eigen values of the matrix $A = \begin{pmatrix} 2 & 5 & 7 \\ 1 & 4 & 6 \\ 2 & -2 & 3 \end{pmatrix}$. [2]
- f) Write the quadratic form corresponding to the matrix $A = \begin{pmatrix} 1 & 5 & 7 \\ 5 & 4 & 6 \\ 7 & 6 & 3 \end{pmatrix}$. [3]
- g) If $u = f(x-y, y-z, z-x)$, find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$. [2]
- h) Expand $f(x, y) = e^{xy}$ about origin up to 2nd degree terms. [3]
- i) Form a partial differential equation by eliminating the arbitrary function f from $z = f(x^2 + y^2)$. [2]
- j) Solve $\sqrt{p} + \sqrt{q} = 1$. [3]

PART-B

(50 Marks)

- 2.a) Solve $(3xy^2 - y^3)dx - (2x^2y - xy^2)dy = 0$.
- b) Solve $y'' + y = x \sin x$. [5+5]

OR

- 3.a) Apply the method of variation of parameters to solve $y'' - y = x^2$.
- b) If the temperature of the air is 30°C and the substance cools from 100°C to 70°C in 15 minutes, find when the temperature will be 40°C . [5+5]

4.a) Find the rank of the matrix $A = \begin{pmatrix} 0 & 1 & -3 & -1 \\ 0 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$ by reducing to echelon form.

b) Show that the system of equations $5x+3y+7z=4$, $3x+26y+2z=9$, $7x+2y+10z=5$ is consistent and hence solve it. [5+5]

OR

5. Solve the system of equations $2x-2y-2z=-4$, $-y+z=-1$, $-x+5y+2z=6$ by LU - decomposition method. [10]

6.a) Find the Eigen values of $5A^5 - 2A^2 + 7A - 3A^{-1} + I$, if $A = \begin{pmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{pmatrix}$.

b) Using Cayley-Hamilton theorem, find A^{-1} and A^{-2} if $A = \begin{pmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{pmatrix}$. [5+5]

OR

7. Reduce the quadratic form $Q = 8x^2 + 7y^2 + 3z^2 + 12xy + 4xz - 8yz$ to canonical form and hence find its rank, nature, index and signature. [10]

8.a) If $f(x, y) = \ln\left(\frac{x^4 + y^4}{x + y}\right)$, show that $xf_x + yf_y = 3$.

b) Determine whether the functions $u = \frac{x+y}{x-y}$, $v = \frac{xy}{(x-y)^2}$ are dependent. If so, find the relation between them. [5+5]

OR

9.a) Find the Taylor series expansion of $f(x, y) = e^x \cos y$ in powers of $(x-1)$ and $\left(y - \frac{\pi}{4}\right)$.

b) Find the maximum and minimum values of the function $f(x, y) = x^4 + y^4 - x^2 - y^2 + 1$. [5+5]

10.a) Find all possible second order partial differential equations by eliminating the arbitrary constants a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

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

OR

11.a) Reduce the equation $p^2x^2 = z(z-xy)$ to $F(p, q, z) = 0$ form and hence solve it.

b) Solve $p^2y(1+x^2) = qx^2$. [5+5]