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 $y'' - 2y' + y = \dfrac{e^x}{x}$.   [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 $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z}$.   [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 $(3xy^2 - y^3)dx - (2x^2 y - xy^2)dy = 0$.

  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 30^0 C and the substance cools from 100^0 C to 70^0 C in 15 minutes, find when the temperature will be 40^0 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 $f(x, y) = \ln\left(\dfrac{x^4 + y^4}{x + y}\right)$, show that $x f_x + y f_y = 3$.

b) Determine whether the functions $u = \dfrac{x + y}{x - y}, v = \dfrac{xy}{(x - y)^2}$ 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 $\left(y - \dfrac{\pi}{4}\right)$.

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 $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1$.

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

OR

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

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

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