

Code No: 131AA

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, May/June - 2017

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, MIE, 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) Verify $y(2x^2 - xy + 1)dx + (x - y)dy = 0$ is an exact differential equation or not? [2]
- b) Solve $y'' + 6y' + 9y = 0$, $y(0) = 2$, $y'(0) = -3$ [3]
- c) Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$ [2]
- d) Find a non trivial solution of homogeneous system $3x + 2y + z = 0$, $2x + 3z = 0$, $y + 5z = 0$, if it exist. [3]
- e) Find all the Eigen values of $A^2 + 3A - 2I$, if $A = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$. [2]
- f) Find the nature, index and signature of the quadratic form $3x^2 + 5y^2 + 3z^2$. [3]
- g) State Euler's theorem for function of two variables. [2]
- h) Examine the function $f(x, y) = x^3 y^2$ for extrema. [3]
- i) Solve $(p - q)(z - px - qy) = 1$ [2]
- j) Solve $xp + yq = 3z$ [3]

Part-B (50 Marks)

- 2.a) Solve $(x^2 y - 2xy^2)dx - (x^3 - 3x^2 y)dy = 0$
- b) Find the orthogonal trajectories of the family of Cardioids $r = a(1 - \cos \theta)$, where a is the parameter. [5+5]

OR

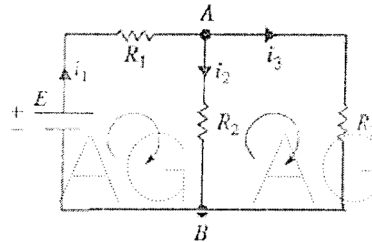
- 3.a) Solve $y'' - 2y' + y = xe^x \sin x$
- b) The number N of bacteria in a culture grew at a rate proportional to N . The value of N was initially 100 and increased to 332 in one hour. What would be the value of N after $1\frac{1}{2}$ hours? [5+5]

- 4.a) Determine the value of b such that the rank of $A = \begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ b & 2 & 2 & 2 \\ 9 & 9 & b & 3 \end{bmatrix}$ is 3.

- b) Discuss for what values of λ and μ , the simultaneous equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ have i) no solution ii) a unique solution iii) an infinite number of solutions. [5+5]

5.a) Find the rank of the matrix $A = \begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$.

- b) Use Gauss Jordan elimination method to solve the following network system, when $R_1=10$ ohms, $R_2=20$ ohms, $R_3=10$ ohms and $E=12$ volts. [5+5]



- 6.a) Find the Eigen values and the corresponding Eigen vectors of the matrix

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

- b) Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$. Express

$$B = A^8 - 11A^7 - 4A^6 + A^5 + A^4 - 11A^3 - 3A^2 + 2A + I \text{ as a quadratic polynomial in } A.$$

Find B .

[5+5]

OR

- 7.a) Diagonalize the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{bmatrix}$, hence find A^4 .

- b) Reduce the quadratic form $x^2 + y^2 + 2z^2 - 2xy + 4xz + 4yz$ to the canonical form. Hence find its nature. [5+5]

- 8.a) If $u = \log \left(\frac{x^2 + y^2}{x + y} \right)$, prove that $xu_x + yu_y = 1$

- b) If $u = x^2 - y^2$, $v = 2xy$ when $x = r \cos \theta$, $y = r \sin \theta$. Show that $\frac{\partial(u,v)}{\partial(r,\theta)} = 4r^3$. [5+5]

OR

- 9.a) Expand $f(x,y) = e^y \ln(1+x)$ in powers of x and y and verify the result by direct expansion.

- b) Find the extreme values of $\sqrt{x^2 + y^2}$ when $13x^2 + 13y^2 - 10xy = 72$. [5+5]

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10.a) Form the partial differential equation from $z = x^n f\left(\frac{y}{x}\right)$.

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b) Solve $(z - y)p + (x - z)q = y + x$.

OR

11.a) Solve $(y^2 + z^2)p - xyq + zx = 0$.

b) Solve $z^2(p^2x^2 + q^2) = 1$.

[5+5]

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