R16

Code No: 131AA

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 $y\left(2x^2-xy+1\right)dx+\left(x-y\right)dy=0$ 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 $f\left(x,y\right)=x^3y^2$ for extrema. [3]

i) Solve $\left(p-q\right)\left(z-px-qy\right)=1$ [2]

j) Solve $xp+yq=3z$ [3]

Part-B (50 Marks)

2.a) Solve $\left(x^2y-2xy^2\right)dx-\left(x^3-3x^2y\right)dy=0$

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 ½ hours? [5+5]

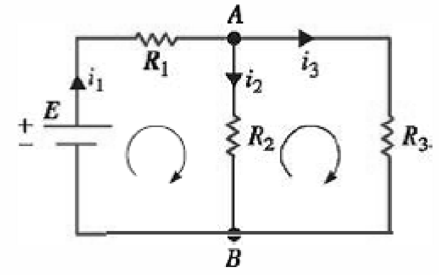
4.a) Determine the value of b such that the rank of $A=\begin{bmatrix}1 & 1 & -1 & 0\\ 4 & 4 & -3 & 1\\ b & 2 & 2 & 2\\ 9 & 9 & b & 3\end{bmatrix}$ is 3.

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]

OR

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 $B = A^8 - 11A^7 - 4A^6 + A^5 + A^4 - 11A^3 - 3A^2 + 2A + I$ 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 $u = \log\left(\dfrac{x^2+y^2}{x+y}\right)$, 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 $\dfrac{\partial(u,v)}{\partial(r,\theta)} = 4r^3$. [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]

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

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

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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