R18

Code No: 151AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year I Semester Examinations, January/February - 2025
MATHEMATICS - I
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, MIE, PTM, CSBS, CSIT, ITE, CE(SE), CSE(CS), CSE(AI&ML), CSE(DS), CSE(IOT), CSE(N), AI&DS, AI&ML, CSD)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Show that $A=\begin{bmatrix} 1/3 & -2/3 & 2/3 \\ -2/3 & 1/3 & 2/3 \\ -2/3 & -2/3 & -1/3 \end{bmatrix}$ is an orthogonal matrix. [2]

b) If $A=\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ choose α and β, so that $\left[(\alpha I)^2+(\beta A)^2\right]=A$. [3]

c) Find the characteristic equation of a matrix $A=\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. [2]

d) If $A=\begin{bmatrix} 1 & 0 \\ 2 & 4 \end{bmatrix}$ then, find the Eigen values of $4A^{-1}+3A+2I$. [3]

e) What is the condition for convergence of the series $\frac{1}{1^p}-\frac{1}{2^p}+\frac{1}{3^p}-\frac{1}{4^p}+....$ [2]

f) Find the radius of the convergence of the series $1+x+x^2+x^3+....$ [3]

g) State Lagrange's mean value theorem and write its geometrical interpretation. [2]

h) Verify whether Rolle's Theorem can be applied to the function $f(x)=\tan x$ in $[0,5]$. [3]

i) If $z=\log\left(x^3+y^3-x^2y-xy^2\right)$ then find the value of $\frac{\partial z}{\partial x}+\frac{\partial z}{\partial y}$. [2]

j) If $x=r\cos\theta$ and $y=r\sin\theta$, then find $\frac{\partial(r,\theta)}{\partial(x,y)}$. [3]

PART - B

(50 Marks)

2. Use Gauss Jordan method to compute the Inverse of the matrix $A=\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$. [10]

OR

3. Find all the solutions of the system of equations
$x_1+2x_2-x_3=1;\ 3x_1-2x_2+2x_3=2;\ 7x_1-2x_2+3x_3=5.$ [10]

4. Diagonalize the matrix $A=\begin{bmatrix} 1 & 2 \\ 5 & 4 \end{bmatrix}$, if possible. [10]

OR

5. Find the Eigen values and Eigen vectors of the matrix $A=\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$. [10]

6. Discuss the convergence of the series $1+\frac{2}{5}x+\frac{6}{9}x^2+\frac{14}{17}x^3+.....+\frac{2^n-2}{2^n+1}x^{n-1}+.....+\infty.$ [10]

OR

7. Test the convergence of the series $\sum\left(\frac{1}{\log n}\right)^n$. [10]

8. Verify Rolle's Theorem for $f(x)=\frac{\sin x}{e^x}$ in $[0,\pi]$. [10]

OR

9.a) Evaluate $\int_0^1 x^{m-1}\left[\log\left(\frac{1}{x}\right)\right]^{m-1} dx.$

b) Evaluate $\int_0^{\pi/2} \sin^6\theta\, d\theta$ using β and Γ functions. [5+5]

10. If $u=\sin\left(x^2+y^2\right)$ where $a^2x^2+b^2y^2=c^2$ find $\frac{du}{dx}$. [10]

OR

11. Examine the function for extreme values
$f(x,y)=x^4+y^4-2x^2+4xy-2y^2, x>0, y>0.$ [10]

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