

Code No: 151AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, July - 2021

MATHEMATICS-I

(Common to CE, ME, ECE, EIE, MCT, MMT, ECM, AE, MIE, PTM, CSBS, CSE(AIML), CSE(IOT))

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

1. Solve the equations $8x - 3y + 2z = 20$; $4x + 11y - z = 33$; $6x + 3y + 12z = 35$ using Gaussian-Seidel method. [15]

- 2.a) Find the rank of the matrix $\begin{pmatrix} -1 & -3 & 3 & -1 \\ 1 & 1 & -1 & 0 \\ 2 & -5 & 2 & -3 \\ -1 & 1 & 0 & 1 \end{pmatrix}$ by reducing it to Normal form.

- b) Solve the system of equations by Gauss elimination method $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$. [7+8]

- 3.a) Determine the Eigen values and Eigen vectors of $B = 2A^2 - \frac{1}{2}A + 3I$ where $A = \begin{pmatrix} 8 & -4 \\ 2 & 2 \end{pmatrix}$.

- b) Find the nature of the quadratic form $3x^2 + 3y^2 + 3z^2 + 2xy + 2xz - 2yz$. [7+8]

4. Verify Cayley-Hamilton theorem for $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$ and hence find A^{-1} and find the Eigen values of B, where $B = A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$. [15]

- 5.a) Test the series for convergence $\sum \frac{(n^3 + 1)^{\frac{1}{3}} - n}{\log n}$.

- b) Show that the series $\frac{\cos x}{1^3} - \frac{\cos 2x}{2^3} + \frac{\cos 3x}{3^3} - \dots$ converges absolutely. [7+8]

- 6.a) Show that the series $\sum (-1)^{n+1} \frac{n^3}{2^n}$ converges absolutely.

- b) Show that $\int_0^{\infty} \frac{x^a}{a^x} dx = \frac{\Gamma(a+1)}{(\log a)^{a+1}}$, if $a > 1$ [7+8]

7.a) Using Lagrange's mean value theorem, show that $\frac{\pi}{3} - \frac{1}{5\sqrt{3}} > \cos^{-1} \frac{3}{5} > \frac{\pi}{3} - \frac{1}{8}$.

b) Show that $\int_0^{\infty} e^{-ax} x^{n-1} dx = \frac{\Gamma(n)}{a^n}$. [8+7]

8.a) If $x = r \cos \theta, y = r \sin \theta$ show that $\frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2} = \frac{1}{r^2} \left[\left(\frac{\partial r}{\partial x} \right)^2 + \left(\frac{\partial r}{\partial y} \right)^2 \right]$.

b) If $x = c \cos u \cosh v$ and $y = c \sin u \sinh v$, show that $\frac{\partial(x, y)}{\partial(u, v)} = \frac{1}{2} c^2 (\cos 2u - \cosh 2v)$.

[7+8]

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