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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year I Semester Examinations, September/October - 2021
MATHEMATICS-I
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, ECM, AE, MIE, PTM,
CSBS, CSIT, ITE, CE(SE), CSE(CS), CSE(AI&ML), CSE(DS), CSE(IOT),
CSE(Networks))

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

Answer any five questions
All questions carry equal marks
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1.a)   Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -2 & 3 \\ 2 & 5 & -4 & 6 \\ -1 & -3 & 2 & -2 \\ 2 & 4 & -1 & 6 \end{bmatrix}$ by converting it into normal form.

b)   Solve the system of equations
   $10x + y + z = 12$, $2x + 10y + z = 13$, $2x + 2y + 10z = 14$ by Gauss-Seidel method.   [7+8]

2.   For what values of 'λ', the system of equations
   $x + y + z = 1$, $x + 2y + 4z = \lambda$, $x + 4y + 10z = \lambda^2$ will have a solution and solve them
   completely in each case.   [15]

3.   Determine the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.   [15]

4.a)   Using Cayley – Hamilton theorem, find A^8, if $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$

b)   Find the nature of the quadratic form $x^2 + 5y^2 + z^2 + 2xy + 2yz + 6zx$.   [7+8]

5.a)   Verify the convergence of the series $\sum \frac{(n!)^2}{(2n)!} x^{2n}$

b)   Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$ [7+8]

6.a)   Verify Rolle's theorem for the function $f(x) = \log\left\{ \frac{x^2 + ab}{x(a+b)} \right\}$ in (a, b).

b)   If f(x) and g(x) are respectively e^x and e^{-x}, prove that 'c' of Cauchy's mean value
   theorem is the arithmetic mean between a and b.   [7+8]

7.a) Find the area of the tangent cut off from the parabola $x^2 = 8y$ by the line $x - 2y + 8 = 0$.

b) Prove that $\displaystyle\int_0^1 \frac{x^2 dx}{\sqrt{(1-x^4)}} \times \int_0^1 \frac{dx}{\sqrt{(1+x^4)}} = \frac{\pi}{4\sqrt{2}}$. [7+8]

8.a) Verify whether $\dfrac{\partial^2 u}{\partial x \partial y} = \dfrac{\partial^2 u}{\partial y \partial x}$ where $u = \ln(y \sin x + x \sin y)$.

b) Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube. [7+8]

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