Code No: 121AL
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, July - 2021
MATHEMATICAL METHODS
(Common to EEE, ECE, CSE, EIE, IT, ETM)

Time: 3 hours   Max. Marks: 75

Answer any five questions
All questions carry equal marks

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1.a) Interpolate the value of y at $x = 2.5$ from the following data.

x:	0	1	2	3
y:	2	5	13	35

  b) Prove that $\Delta\nabla = \Delta - \nabla$ and $\nabla = E^{-1}\Delta$, where Δ, ∇ and E are the forward, backward and shifting operators respectively.   [7+8]

2. Fit a straight line of the form $y = a + bx$ and a quadratic curve of the form $y = a + bx + cx^2$ to the data given below.   [15]

x:	1	2	3	4
y:	10	5	2	1

3. Solve the equations $10x + y + z = 12, 2x + 10y + z = 13, 2x + 2y + 10z = 104$ by Gauss-Seidel iteration method.   [15]

4. Apply Runge-Kutta method of order 4, solve $\dfrac{dy}{dx} = \dfrac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ at $x = 0, 1, 0.2$.   [15]

5. Find the Fourier series expansion of $f(x) = \begin{cases} \pi + x, & -\pi < x \le 0 \\ 0, & 0 < x < \pi \end{cases}$, $f(x + 2\pi) = f(x)$

  and hence show that $1 + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \dots = \dfrac{\pi^2}{8}$.   [15]

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

  b) Find a partial differential equation by eliminating the arbitrary functions f and g from $z = f(x) \, g(y)$.   [7+8]

7.a) If $\overline{F} = (x + y + 1)\hat{i} - \hat{j} - (x + y)\hat{k}$, show that $\overline{F} \cdot Curl \, \overline{F} = 0$.

  b) Show that $\nabla^2\left(r^n\right) = n(n + 1)r^{n-2}$.   [7+8]

8. Verify Gauss's divergence theorem for $\overline{F} = x^2\hat{i} + z\hat{j} + yz\hat{k}$ taken over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.   [15]

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