

R15

Code No: 121AL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, May - 2016

MATHEMATICAL METHODS

(Common to EEE, ECE, CSE, EIE, IT, ETM)

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) Evaluate $\Delta x^{(2)}$. [2]
- b) Show that $\Delta f_i^2 = (f_i + f_{i+1})\Delta f_i$. [3]
- c) Find two values of x between which the root of $xe^x = \cos x$ lies. [2]
- d) Find $y(0.2)$ and $y(0.4)$ by Euler's method given that $y' = \frac{x^2}{(y^2+1)}$, $y(0) = 2$. [3]
- e) If $f(x) = \begin{cases} 1-x, & 0 < x < 3 \\ 0, & 3 < x < 6 \end{cases}$ then find a_0 in Fourier series in $(0, 6)$. [2]
- f) If the fourier transform of f is $\frac{s}{(s^2+1)}$ then find the fourier transform of $f(at)$. [3]
- g) A rod of length l has its ends A and B kept at 0°C and 60°C respectively, until steady state conditions prevail. Find $u(x)$. [2]
- h) Form the partial differential equation from $z = f\left(\frac{y}{x}\right)$. [3]
- i) If $\phi = xyz$ then find $(\nabla \phi)$. [2]
- j) If $\vec{F} = y(ax^2 + z)\vec{i} + x(y^2 - z^2)\vec{j} + 2xy(z - xy)\vec{k}$ is solenoidal then find a . [3]

PART-B

(50 Marks)

Fit a parabola of the form $y = a + bx + cx^2$

X	2	4	6	8	10
Y	3.7880	17.2460	41.4640	76.4420	122.1800

[10]

OR

3. Fit a natural cubic spline to the following data. Hence determine $y(0.5)$, $y'(0.4)$ and $y(1.5)$. [10]

x	0	1	2
y	4	1	2

4. Find $y(0.2)$ and $y(0.4)$ given that $y' = y - x$, $y(0) = 2$, $h = 0.2$, using fourth order Runge Kutta formula. [10]

OR

- 5.a) Find the first derivative of $f(x)$ at $x = 1.5$ from the following table.

X	1.5	2.0	2.5	3.0	3.5	4.0
Y	3.375	7.0	13.625	24	38.87	59

- b) The velocity V of a particle at a distance s from a point on its path is given by the following table.

$s(ft)$	0	10	20	30	40	50	60
$V(ft/s)$	47	58	64	65	61	52	38

- Estimate the time taken to travel 60 ft using Simpson's $\frac{3}{8}$ th rule. [5+5]

- 6.a) Obtain the Fourier series for the function $f(x) = \begin{cases} -1, & \text{if } -2 \leq x \leq -1 \\ x, & \text{if } -1 < x < 1 \\ 1, & \text{if } 1 \leq x \leq 2 \end{cases}$

- b) Find the finite Fourier cosine transforms $x(\pi - x)$ in $(0, \pi)$. [5+5]

OR

- 7.a) Obtain a cosine series for the function $f(x) = \begin{cases} x, & 0 \leq x \leq \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} \leq x \leq \pi \end{cases}$

- b) Obtain the Fourier cosine transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$. [5+5]

8. Solve the partial differential equation by Charpit's method $px + qy = pq$. [10]

OR

9. Find the general solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$. [10]

10. Prove that $\vec{F} = (y^2 \cos x + z^3)\mathbf{i} + ((2y \sin x - 4)j + 3xz^2)\mathbf{k}$ is irrotational and find its scalar potential. [10]

OR

11. Verify Green's theorem for $\int_c (xy + y^2)dx + x^2 dy$ where c is bounded by $y = x$ and $y = x^2$. [10]