

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 $0^\circ C$ and $60^\circ C$ 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)**

2. 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's 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 $\bar{F} = (y^2 \cos x + z^3)i + ((2y \sin x - 4)j + 3xz^2k)$ 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]