

**R15**

Code No: 121AL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, August - 2018

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) Construct the forward difference table for the following data. [2]

x :	1	2	3	4	5
y :	4	13	34	73	136

- b) Write the normal equations to fit a curve of the form
- $y = a + bx + cx^2$
- for the data
- $(x_i, y_i), i = 1, 2, \dots, n$
- . [3]

- c) Derive the Newton-Raphson iterative formula to find
- $\sqrt{N}$
- ,
- $N > 0$
- . [2]

- d) Evaluate
- $\int_0^1 x^3 dx$
- using Trapezoidal rule with
- $h = \frac{1}{4}$
- . [3]

- e) Determine the Fourier coefficient
- $a_0$
- in the Fourier series of
- $f(x) = |\sin x|$
- in
- $[-\pi, \pi]$
- . [2]

- f) Find the Fourier sine transform of
- $f(x) = e^{-x}$
- . [3]

- g) Obtain a partial differential equation by eliminating the arbitrary function
- $f$
- from
- $z = f(x^2 + y^2)$
- . [2]

- h) Solve
- $pq = z$
- . [3]

- i) Find the unit normal vector to the surface
- $2x^2 + y^2 + 2z = 3$
- at
- $(2, 1, -3)$
- . [2]

- j) State Stoke's theorem. [3]

**PART-B**

(50 Marks)

- 2.a) Find the cubic polynomial which takes the values
- $y(0) = 1, y(1) = 0, y(2) = 1$
- and
- $y(3) = 10$
- .

- b) Using Lagrange's formula to find
- $y(10)$
- from the data given below. [5+5]

x :	5	6	9	11
y :	12	13	14	16

OR

- 3.a) Using the method of least squares, fit a straight line of the form  $y = ax + b$  for the following data.

x:	1	2	3	4
y:	0	1	1	2

- b) Fit a curve of the form  $y = ab^x$  to the following data. [5+5]

x:	1	2	3	4
y:	4	11	35	100

4. Solve the following system of equations using L-U decomposition method. [10]

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

OR

- 5.a) Find  $\frac{dy}{dx}$  at  $x = 0.1$  from the following table.

x:	0.0	0.2	0.4	0.6	0.8	1.0
y:	0.0	0.12	0.48	1.10	2.0	3.20

- b) Find an approximate value of  $y(0.1)$  for  $y' = \frac{y-x}{y+x}$ ,  $y(0) = 1$  by Euler's method with [5+5]

$$h = 0.02.$$

- 6.a) Obtain the Fourier series for  $f(x) = x^2$  in  $[-\pi, \pi]$  and hence show that

$$1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}.$$

- b) Find the half range cosine series for the function  $f(x) = x$  in  $[0, \pi]$ . [5+5]

OR

7. Find the Fourier transform of  $f(x) = \begin{cases} 1-x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$  and hence evaluate:

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos\left(\frac{x}{2}\right) dx.$$

[10]

- 8.a) Solve  $p + 2q = \tan(y - 2x) + 5z$ .

- b) Solve  $z = px + qy + p^2 + q^2$  by Charpit's method. [5+5]

OR

9. A square plate is bounded by the lines  $x = 0$ ,  $y = 0$ ,  $x = 20$  and  $y = 20$  and its faces are insulated. The temperature along the upper horizontal edge is given by  $u(x, 20) = x(20 - x)$ ,  $0 < x < 20$  while other three edges are kept at  $0^\circ\text{C}$ . Find the steady state temperature in the plate. [10]

10.a) Find the directional derivative of  $f(x, y, z) = x^2yz + 4xz^2$  at  $(1, -2, 1)$  in the direction of the Vector  $2\hat{i} - \hat{j} - 2\hat{k}$ .

b) If  $\vec{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$ , find  $\nabla \cdot \vec{F}$  and  $\nabla \times \vec{F}$ . [5+5]

OR

11. Verify Green's theorem for  $\oint_C (x^2 - \cosh y) dx + (y + \sin x) dy$ , where  $C$  is the rectangle with vertices  $(0,0), (\pi,0), (\pi,1)$  and  $(0,1)$ . [10]

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