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 $(x_i, y_i), i = 1, 2, ...n$. [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 $h = 0.02$. [5+5]

6.a) Obtain the Fourier series for $f(x) = x^2$ in $[-\pi, \pi]$ and hence show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + ... = \frac{\pi^2}{12}$.

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 0^0C. 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 $\vec{F} = grad\ (x^3 + y^3 + z^3 - 3xyz)$, *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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