Code No: 111AL **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

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MATHEMATICAL METHODS

(Common to EEE, ECE, CSE, EIE, BME, IT, ETM, ECOMPE, ICE)

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

1.a) Write the method of least squares to fit a straight line from the given data (x_i, y_i) where i =1, 2, 3,………..n. [2m]

b) Solve the difference equation $y_{n+2} + 5y_{n+1} + 6y_n = 0$. [3m]

c) Explain graphically the root of an equation. [2m]

d) Explain Taylor's series method for solving an initial value problem. [3m]

e) Form the Partial differential equation from f(x+t)+g(x-t). [2m]

f) Write the boundary conditions for the following problem:
A rectangular plate is bounded by the line x=0, y=0, x=a and y=b. Its surfaces are insulated. The temperature along x=0 and y=0 are kept at 0^0 C and the others are kept at 100^0 C. [3m]

g) Define Fourier transform and Finite Fourier transform. [2m]

h) Find the sum of the Fourier series for $f(x) = \begin{cases} x, 0 \le x < 1 \\ 2, 1 < x < 2 \end{cases}$ at x=1, x=0.5 and 1.5. [3m]

i) Prove that $\vec{F} = yz\vec{i} + zx\vec{j} + yx\vec{k}$ is irrotational. [2m]

j) State Green's theorem. Write the line integral which gives the area of a plane region. [3m]

PART-B

2.a) Find Newton's interpolating polynomial of degree 3 in the way to approximate the specific value for x=4.3.

X	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
F(x)	0	2.3	4.2	2.7	3.2	3.7	3.0	4.3	4.5	4.7	3.9	4.1

b) Fit a curve of the form $y = ax^2 + bx + c$ from the following data:

X	1	2	3	4
y	6	11	18	27

OR

3.a) Find the curve of best fit of the type $y = ae^{bx}$ to the following data:

X	1	5	7	9	12
y	10	15	12	15	21

b) Find F(3) from the following data:

X	0	1	2	4	5	6
F	1	14	15	5	6	19

4. Given that $\frac{dy}{dx}=\frac{1}{2}\left(1+x^2\right)y^2$; y(0)=1; y(0.1)=1.06; y(0.2)=1.12 and y(0.3)=1.21. Evaluate y(0.4)and y(0.5) by a predictor corrector method.

OR

5. Using Gauss-Seidel iterative method solve $\begin{bmatrix} 5 & -2 & 3 \\ -3 & 9 & 1 \\ 2 & -1 & -7 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$.

6.a) Find the Fourier series of the function $f(x)=\begin{cases} 0, -\pi \le x \le 0 \\ Sin\,x, 0 \le x \le \pi \end{cases}$. Hence evaluate $\frac{1}{1\cdot 3}+\frac{1}{3\cdot 5}+\frac{1}{5\cdot 7}+.....$

b) Find the Fourier sine transform of $\frac{e^{-ax}}{x}$,where a>0.

OR

7. Find the Fourier transform of $f(x)=\begin{cases} a^2-x^2, -a \le x \le a \\ 0, \text{other wise} \end{cases}$. Hence deduce that $\int_0^\infty \frac{Sin\,t - t\,Cos\,t}{t^3}dt=\frac{\pi}{4}$.

8. A string is stretched and fastened to two points at x=0 and x=L .Motion is started by displacing the string into the form $y=k(lx-x^2)$ from which it is released at time t=0. Find the displacement of any point on the string at a distance of x from one end at time t.

OR

9.a) Solve $z^2(p^2+q^2)=x^2+y^2$.

b) Find the singular integral of $z = px+qy+pq+q^2$.

10.a) Verify Green's theorem for $\vec{F}=(x^2+y^2)\vec{i}-2yx\vec{j}$ taken around the rectangle bounded by the lines x=a, x=-a, y=0, y=b.

b) Evaluate $\int_C\left[\left(x^2+xy\right)dx+(x^2+y^2)dy\right]$, where C is the boundary of the region bounded by the lines x=0, x=1, y=0, y=1.

OR

11. Verify gauss divergence theorem for the vector point function. $\vec{F}=(x^3-yz)\vec{i}-2yx^2\vec{j}+2\vec{k}$ Over the cube bounded by x=0, y=0, z=0 and x=a, y=a, z=a.

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