Code No: 111AL **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, May - 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) If $\sum_{i=1}^{10} x = 15$, $\sum_{i=1}^{10} y = 23$, $\sum_{i=1}^{10} x^2 = 25$ and $\sum_{i=1}^{10} xy = 55$, find best fit of straight line $y = a + bx$. [2]

b) Find the missing value from the following data [3]

x	0	1	2	3
f(x)	2	-	5	10

c) Let $A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$, find L and U using LU decomposition method. [2]

d) Find the approximate value of $\sqrt[3]{30}$ using Newton's Raphson method. [3]

e) Define finite Fourier sine and cosine transforms. [2]

f) Find the half range sine series of $f(x) = x$ on $(0, l)$ [3]

g) Solve $z = px + qy + \sqrt{1 + p^2 + q^2}$ [2]

h) Form the partial differential equation from $z = (x^2 + a)(y^2 + b)$ by eliminating the arbitrary constants a, b. [3]

i) Define divergent of a vector point function and what does its geometrical meaning? [2]

j) Let $\bar{F} = (x^2 - yz)\bar{i} + (y^2 - xz)\bar{j} + (z^2 - xy)\bar{k}$ is an irrotational vector, find its scalar potential function. [3]

PART-B

(50 Marks)

2. Define interpolation, and Find the interpolate polynomial from the following data

x	0	1	2	3	4
y	3	6	11	18	27

and hence find the value of $y(0.1)$, $y(2.1)$ and $y(4.5)$. [10]

OR

3. Given points (1, -8), (2, -1) and (3, 18) satisfying the function $y = f(x)$, Determine the values of $y(2.5)$ and $y(2.0)$, using the Cubic spline approximation. [10]

4.a) Find the positive root of the equation $3x = \cos x + 1$ by iteration method.

b) Solve the following system by Gauss-Seidel method

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$

[5+5]

OR

5.a) Evaluate $\int_0^2 e^{-x^2} dx$ using Trapezoidal rule as well as Simpson's rule, taking step size h=0.2.

b) Use Adams-Bashforth Moulton method, find y(0.8) from $\frac{dy}{dx} = x + y$, y(0)=1. Find the initial values y(0.2), y(0.4) and y(0.6) from Taylors series method. [5+5]

6.a) Let $\bar{f}_s(p)$ and $\bar{f}_c(p)$ are Fourier sine and cosine transform of $f(x)$, Prove that $F_c\{xf(x)\} = \frac{d}{dp}\bar{f}_s(p)$ and $F_s\{xf(x)\} = -\frac{d}{dp}\bar{f}_c(p)$

b) Obtain the Fourier series expansion of f(x) = |x| in (- π, π) and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots\dots\dots\dots.$ [5+5]

OR

7.a) Find the Fourier transform of $f(x) = \begin{cases} 1 & \text{for } -1 < x < 1 \\ 0 & \text{for } x < \text{-}1, x > 1 \end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$.

b) Find the Fourier sine transform of xe^{-2x}, $x > 0$. [5+5]

8. Find the solution of the one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ under the boundary conditions $u(0,t) = 0$, $u(l,t) = 0$ and $u(x,0) = x(l - x)$, $0 < x < l$, l being the length of the rod. [10]

OR

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

b) Solve $z^2(p^2x^2 + q^2) = 1$ [5+5]

10.a) Applying Green's theorem, evaluate $\int_c (y - \sin x)dx + \cos x dy,$ where C is the plane triangle enclosed by the lines $y = 0, x = \frac{\pi}{2}$ and $y = \frac{2x}{\pi}$.

b) Use Divergence theorem to evaluate $\int_S \vec{F} \bullet \vec{n} ds$ over the surface of sphere $x^2 + y^2 + z^2 = a^2$ where $\overline{F} = 3x\bar{i} + 3y\bar{j} + 3z\bar{k}$. [5+5]

OR

11. Verify Gauss divergence theorem for $\overline{F} = (x^3 - yz)\bar{i} - 2x^2 y\bar{j} + z\bar{k}$ taken over the cube bounded by the planes $x = y = z = a$. [10]

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