R13

Code No: 111AL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, December - 2017
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) Prove that $h\Delta = \log(1+\Delta) = -\log(1-\Delta) = \sin^{-1}(\mu\delta)$. [2]

b) If $y = a_o + a_1 x, \sum x_i = 15, \sum y_i = 30, \sum x_i y_i = 110, \sum x_i^2 = 55$ then find a_1. [3]

c) Find square root of a number N by Newton-Raphson method. [2]

d) Find first approximation of $y' = x + y$ if $y(0) = 1$ by picards method. [3]

e) Express f(x) = x as a Fourier Series in $(-\Pi, \Pi)$. [2]

f) Prove that $F\{f(ax)\} = \frac{1}{a}\bar{F}\left(\frac{p}{a}\right)$, where $\bar{F}(p)$ = Fourier transform of f(x). [3]

g) Eliminate arbitrary function from $z = f(x^2 + y^2 + z^2)$. [2]

h) Find the general solution of $\sqrt{p} + \sqrt{q} = 1$. [3]

i) If $\phi = 3x^2 y - y^3 z^2$ find grad ϕ at (1, -2, -1). [2]

j) Find the curl of the vector $xyz\bar{i} + 3x^2 y\bar{j} + (xz^2 - y^2 z)\bar{k}$. [3]

PART-B

(50 Marks)

2.a) Find f(2.5) using Newton's forward formula from the following table.

x	0	1	2	3	4	5	6
y	0	1	16	81	256	625	1296

b) Using Lagranges interpolation formula, find y(10) from the following table.

x	5	6	9	11
y	12	13	14	16

[5+5]

OR

3.a) Fit a second degree polynomial to the following data by the method of least squares.

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

b) Find the parabola of the form $y = ax^2 + bx + c$ passing through the points (-1, 2), (0, 1) and (1, 4). [5+5]

4.a) Find a root of the equation $x - \cos x = 0$ using bisection method correct to two decimals places.

b) Find $f'(6)$ from the following data

x	0	2	3	4	7	9
$f(x)$	4	26	58	112	466	922

[5+5]

OR

5.a) Find y(0.1) and y(0.2) using R-K fourth order formula given that $y' = x^2 - y$ and y(0) = 1.

b) Use Milne's method to find y(0.8) and y(1.0) from $y' = 1 + y^2, y(0) = 0,$ if $y_1 = 0.2027, y_2 = 0.4228, y_3 = 0.6841.$ [5+5]

6. Find the Fourier series of $f(x) = x\sin x,\ -\Pi < x < \Pi.$ Hence deduce that $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + ... = \frac{1}{4}(\Pi - 2).$ [10]

OR

7.a) Using Fourier integral show that $e^{-ax} = \frac{2a}{\Pi}\int_0^\infty \frac{\cos\lambda x}{\lambda^2 + a^2} d\lambda, (a > 0).$

b) Find $F_s^{-1}\left\{\frac{s}{1+s^2}\right\}.$ [5+5]

8.a) Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where u(x, 0) = 6.e^{-3x}.

b) If a string of length l is initially at rest in equilibrium position and each of its points is given the velocity $V_o \text{Sin}^3 \frac{\Pi x}{l}$, find the displacement $y(x,t)$. [5+5]

OR

9. An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is π. This end is maintained at a temperature u_o at all points and the other edges are at zero temperature. Determine the temperature at any point of the plate in the steady state. [10]

10. Show that $\iint_s \bar{F}.\hat{n}ds = \frac{3}{2}$ where $\vec{F} = 4\times zi - y^2 j + yzk$ and S is the surface of the cube bounded by the planes x = 0, x = 1, y = 0, y = 1, z = 0, z = 1. [10]

OR

11. Verify Stoke's theorem for $\bar{F} = (x^2 + y - 4)i + 3xyj + (2xz + z^2)k$ over the surface of hemisphere $x^2 + y^2 + z^2 = 16$ above the xoy plane. [10]

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