R15

Code No: 121AL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, May - 2016
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) Evaluate $\Delta x^{(2)}$. [2]

b) Show that $\Delta f_i^2 = (f_i + f_{i+1})\Delta f_i$. [3]

c) Find two values of x between which the root of $xe^x = \cos x$ lies. [2]

d) Find y(0.2) and y(0.4) by Euler's method given that $y' = \dfrac{x^2}{\left(y^2+1\right)}$, y(0) = 2. [3]

e) If $f(x) = \begin{cases} 1-x, & 0 < x < 3 \\ 0, & 3 < x < 6 \end{cases}$ then find a_0 in Fourier series in (0, 6). [2]

f) If the fourier transform of f is $\dfrac{s}{(s^2+1)}$ then find the fourier transform of *f(at)*. [3]

g) A rod of length l has its ends A and B kept at 0^0C and 60^0C respectively, until steady state conditions prevail. Find u(x). [2]

h) Form the partial differential equation from $z = f\left(\dfrac{y}{x}\right)$. [3]

i) If $\phi = xyz$ then find $(\nabla\phi)$. [2]

j) If $\bar{F} = y\left(ax^2+z\right)i + x\left(y^2-z^2\right)j + 2xy\left(z-xy\right)k$ is solenoidal then find a. [3]

PART-B

(50 Marks)

2. Fit a parabola of the form $y = a + bx + cx^2$

X	2	4	6	8	10
Y	3.7880	17.2460	41.4640	76.4420	122.1800

[10]

OR

3. Fit a natural cubic spline to the following data. Hence determine y(0.5), y'(0.4) and y(1.5) [10]

x	0	1	2
y	4	1	2

4. Find y(0.2) and y(0.4) given that $y' = y - x$, y(0) = 2, h = 0.2, using fourth order Runge Kutta formula. [10]

OR

5.a) Find the first derivative of f(x) at x = 1.5 from the following table.

X	1.5	2.0	2.5	3.0	3.5	4.0
Y	3.375	7.0	13.625	24	38.87	59

b) The velocity *V* of a particle at a distance *s* from a point on its path is given by the following table.

$s(ft)$	0	10	20	30	40	50	60
$V_{(ft/s)}$	47	58	64	65	61	52	38

Estimate the time taken to travel 60 ft using Simpson's $\frac{3}{8}th$ s rule. [5+5]

6.a) Obtain the Fourier series for the function $f(x) = \begin{cases} -1, & if\ -2 \le x \le -1 \\ x, & if\ -1 < x < 1 \\ 1, & if\ 1 \le x \le 2 \end{cases}$

b) Find the finite Fourier cosine transforms $x(\pi - x)$ in $(0, \pi)$. [5+5]

OR

7.a) Obtain a cosine series for the function $f(x) = \begin{cases} x, & 0 \le x \le \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} \le x \le \pi \end{cases}$

b) Obtain the Fourier cosine transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$. [5+5]

8. Solve the partial differential equation by Charpit's method $px + qy = pq$. [10]

OR

9. Find the general solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$. [10]

10. Prove that $\bar{F} = \left(y^2 \cos x + z^3\right) i + \left(\left(2y \sin x - 4\right) j + 3xz^2 k\right)$ is irrotational and find its scalar potential. [10]

OR

11. Verify Green's theorem for $\int_c \left(xy + y^2\right) dx + x^2 dy$ where *c* is bounded by $y = x$ *and* $y = x^2$. [10]