FUNDAMENTALS OF LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS (MA211TA)

UNIT 5: NUMERICAL METHODS

TUTORIAL SHEETS – 1

Objective type Questions:

1. Construct the table of differences for the data below and evaluate $\Delta^3 f(1)$

x	0	1	2	3	4
$f(x)$	1	1.5	2.2	3.1	4.6

2. The value of $\Delta^3[(1+3x)(1-5x)(1-4x)]$ taking interval of differencing $h=1$ is _____.
3. Construct the difference table of the polynomial $f(x)=x^3+5x-7$ for $x=-1,0,1,2,3,4$ and hence find $\Delta y_0, \Delta y_3, \Delta^2 y_1$.
4. The $(n+1)^{th}$ order difference of the n^{th}degree polynomial is _____.

Descriptive Questions:

1. Find a polynomial $f(x)$ which takes the values given by the following table

x	0	1	2	3	4
$f(x)$	10	21	6	43	66

2. The following data defines the sea-level concentration of dissolved oxygen for fresh water as a function of temperature:

$T^o(C)$	0	8	16	24	32
O(mg/L)	14.621	11.843	9.870	8.418	7.305

   Using Newton-Gregory formula, calculate the amount of oxygen when temperature 10^oC and 35^oC.

3. From the following data, estimate the number of students who obtained marks between 40 and 45 using Newton's interpolation method

Marks:	30-40	40-50	50-60	60-70	70-80
Number of Students:	31	42	51	35	31

4. Estimate the values of $f(22)$ and $f(42)$ from the following data

x	20	25	30	35	40	45
$f(x)$	354	332	291	260	231	204

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TUTORIAL SHEETS – 2

Descriptive Questions:

1. Given that $f(0) = 7,\ f(1) = 18,\ f(3) = 18,\ f(5) = -230, f(6) = 18$ find $f(x)$ as a polynomial in x and hence find $f(2)$.

2. The following table gives the viscosity of an oil as a function of temperature. Use Lagrange's formula to find viscosity of oil at a temperature of 140^o.

Temp :	110	130	160	190
Viscosity:	10.8	8.1	5.5	4.8

3. Using Lagrange's interpolation, find the polynomial of lowest degree which agrees with the point (x, y) given in the following table. Hence find $y(2.5)$

x	3	2	1	-1	0
$y(x)$	8	26	32	-40	14

4. The following data was collected for the distance travelled versus time:

t(sec):	0	25	50	75	100	125
y(km):	0	32	59	78	92	100

   Use numerical differentiation to calculate velocity and acceleration at $t = 25$ and $t = 100$.

5. A rod is rotating in a plane. The following table gives the angle θ (radians) through which the rod has turned for various values of the time t second.

t:	0	0.2	0.4	0.6	0.8	1.0	1.2
θ:	0	0.12	0.49	1.12	2.02	3.20	4.67

   Calculate the angular velocity and the angular acceleration of the rod, when $t = 1.0$ second.

6. Find $f'(1), f''(1)$ and $f'(3)$ from the following data:

x	1	2	3	4	5	6
$f(x)$	3.614	4.604	5.857	7.451	9.467	11.985

7. The following table gives the temperature θ (in degree Celsius) of a cooling body at different instants of time t $(in\ sec)$.

t:	1	3	5	7	9
θ:	85.3	74.5	67	60.5	54.3

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Calculate θ at $t = 2$ and also find approximately the rate of cooling at $t = 9$ sec.

TUTORIAL SHEETS – 3

Objective type Questions:

1. While applying Simpson's three-eight rule, the number of sub intervals should be taken as _____.
2. $f(x)$ is given by

x	0	0.5	1	1.5	2
$f(x)$	0	0.25	1	2.25	4

   Then the value of $\int_0^2 f(x)\,dx$ by Simpson's three-eight rule.
3. Find $\int_0^{0.3} f(x)\,dx$ if $f(0) = 1, f(0.1) = 0.99, f(0.2) = 0.9608$ and $f(0.3) = 0.9139$ by Simpson's three-eight rule.

Descriptive Questions:

1. Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\cos(x)}\,dx$by dividing the interval into six equal parts using Simpson's one-three rule, Simpson's three-eight rule and Weddle's rule.
2. Find an approximate value of $\int_0^{\pi} e^{sin\theta}\,d\theta$, by considering seven ordinates of the interval (0, π) using Simpson's one-three rule, Simpson's three-eight rule and Weddle's rule.
3. Find $\int_2^5 y\,dx$ by (i) the Simpson's one-three rule (ii) Simpson's three-eight rule (iii) Weddle's rule if x and y are as given below

x	2	2.5	3	3.5	4	4.5	5
y	1.3863	1.4351	1.4816	1.5260	1.5686	1.6094	1.6486

4. A river is 80feet wide. The depth d in feet at a distance x feet from one bank is given by:

x	0	10	20	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

   Find approximately the area of across section of the river.
5. A curve is drawn to pass through the points given by the following table:

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x	1	1.5	2	2.5	3	3.5	4
y	2	2.4	2.7	2.8	3	2.6	2.1

Using Simpson's one-three rule, Simpson's three-eight rule and Weddle's rule, estimate the area bounded by the curve, the axis and the lines $x = 1$, $x = 4$.