NUMBER THEORY, VECTOR CALCULUS AND COMPUTATIONAL METHODS (MA221TC)

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 nth 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 $10^o C$ and $35^o C$.

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

TUTORIAL SHEETS – 2

Descriptive Questions:

1. Given that $f(0) = 0$, $f(1) = 18$, $f(3) = 18$, $f(5) = -230$, $f(6) = 18$ 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°.

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

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