3) By using the table given below find polynomial regression equation of order 2

X	3	4	5	6	7
Y	2.5	3.2	3.8	6.5	11.5

4) Fit a line through following set of points

X	1	2	4	8	6	5	8	9	7
y	2	3	4	7	6	5	8	8	6

5) Use trapezoidal rule and Simpson's 1/3 rd rule to evaluate $\int_1^2 (x^3 + 1)dx$ with h = 1

6) Compute $\int_0^6 \frac{1}{y} dx$ from the following data using Simpson's three-eight's rule

X	0	1	2	3	4	5	6
y	0.146	0.161	0.176	0.190	0.204	0.217	0.230

Q.4) Attempt any THREE questions from the following. **(15)**

1) Using 2nd order Runge-Kutta method, Solve $\frac{dy}{dx} = 1 + y^2$ with y(0) = 0 for x = 0.2 by taking h = 0.2
2) Use Euler's method to solve $\frac{dy}{dx} = 1 + y^2$, with y(0) = 0. Find y(0.1), y(0.2) , y(0.3)
3) Apply Runge-kutta 4th order method to find approximate value of y at x = 0.2, given that $\frac{dy}{dx} = x + y^2$ with y(0) = 1.
4) Use Euler's modified method to solve $\frac{dy}{dx} = 2y/x$ with y (1) = 2. Find y (2) with step size h=0.25
5) Given equation $\frac{dy}{dx} = 2y/x$ with y(1) = 2. Estimate y(2) using Adams-Bashforth Moulton method, with y(1.25) = 3.13, y(1.5) = 4.50, y(1.75) = 6.13
6) using Milne-Simpson's predictor-corrector method find y at x=0.8 , Given equation $\frac{dy}{dx} = x - y^2$ with y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762

Q.5) Attempt any THREE questions from the following. **(15)**

1) Find QR decomposition of a matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 0 \\ 0 & -1 & 1 \end{bmatrix}$
2) Using Householder's tridiagonalization method reduce the following matrix into tridiagonal form $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & 2 \\ -1 & 2 & 1 \end{bmatrix}$
3) Find largest eigen value of a matrix and corresponding eigen vector of a matrix using Power method where $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$
4) Using shooting Method, Solve $\frac{d^2y}{dx^2} = 2y + 8x(9 - x)$ with y(0)=0, y(9) = 0. Find y(3) and y(6).
5) Use Inverse Power method to compute smallest eigen value of A with initial vector $(1,1,)^T$ where $A = \begin{bmatrix} 2 & -12 \\ 1 & -5 \end{bmatrix}$
6) Using finite difference method, Solve $y'' - y = x$,with boundary condition $y(0) = y(1) = 0$, taking h = 0.25.

Note: (i) All questions are compulsory.
(ii) Figures to the right indicate marks for respective questions.

Q.1) Attempt any THREE questions from the following. **(15)**

1) Use Secant method to estimate the root of the equation $x^2 - 4x - 10 = 0$ with initial estimates of $x_1 = 4$ *and* $x_2 = 2$
2) Using Newton Raphson method, find estimate root of $x^3 - 4x - 9 = 0$ by taking initial root as 2.
3) Estimate the square root of 5 using the equation $x^2 - 5 = 0$ by applying Fixed point iteration method.
4) Using Regular falsi method, find the approximate root of $x^3 - x - 1 = 0$. Carry out only 3 iterations
5) Using Bisection method, Find the approximate root of equation $x^2 + x - 2 = 0$. Perform at-least 5 iterations
6) Write a short note on Absolute error, Relative error and Percentage error.

Q.2) Attempt any THREE questions from the following. **(15)**

1) Use Gauss Elimination method to show that the following system has unique solution.
$x - 2y + 6z = 4$
$2x + y - 3z = 8$
$3x - y + 5z = 15$
2) Define linear system of equations and explain algorithm to solve linear system of equation using Jacobi's iteration method.
3) Use Gauss seidel method to find the solution of
$2x + 5y = 16$
$3x + y = 11$
4) Find LU Decomposition for the matrix $A = \begin{bmatrix} 3 & -12 & 6 \\ 0 & 2 & 0 \\ 6 & -28 & 13 \end{bmatrix}$
5) Use Gauss Jordan method to solve,
$2x + 3y - 4z = 5$
$3x + 4y - 5z = -6$
$4x + 5y - 6z = 7$
6) Use LU decomposition method to solve the system of equations,
$-3x1 - 6x2 = 0$
$-2x1 + 5x2 = 1$

Q.3) Attempt any THREE questions from the following. **(15)**

1) Use following table and find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1 by using Newton's forward formula

X	1.5	2	2.5	3	3.5	4
Y	3.375	7	13.625	24	38.875	59

2) Use Newton's Backward formula to find f'(1.5) from the following table

X	0	0.5	1	1.5	2
y	0.3989	0.3521	0.2420	0.1295	0.0540