(3 Hours)   **Total Marks: 80**

Note :

    a)   **Solve any four questions.**
    b)   **Figures to the right indicates marks.**

Q.1. a. Solve $f(x)=x^3-5x^2+7x-3$ using Standard and Modified Newton Raphson's Methods **(10)** with an initial guess of $X_0 = 0$

    b. Explain in detail how the Finite Difference approximation method will be applied **(10)** to solve the Laplace eq^n

$$\frac{\partial^2 \emptyset}{\partial x^2} + \frac{\partial^2 \emptyset}{\partial y^2} = 0$$

Q.2. a. Define Coefficient of determination and correlation coefficient and briefly explain **(10)** their significance in 'Best curve Fit' analogy.
Fit a second order polynomial to the below mentioned data using polynomial regression.

x_i	0	1	2	3	4	5
y_i	2.1	7.7	13.6	27.2	40.9	61.1

    b. Solve $y''-2y'+2y = e^{2t} \sin t$ for $0 \le t \le 1$ using Runge-Kutta Method. Given that **(10)** $y(0) = -0.4$, $y'(0) = -0.6$ and $h = 0.1$

Q.3. a. Solve using Gauss Jordan method   **(10)**
$3x_1-0.1x_2-0.2x_3 = 7.85$
$0.1x_1+7x_2-0.3x_3 = -19.3$
$0.3x_1-0.2x_2+10x_3 = 71.4$

    b. Solve $I = \int_0^{1/2}(10e^{-t}\sin 2\pi t)^2 \, dt$ using Two point and Three point Gauss **(10)** quadrature integration formulae.

Q.4. a. Solve $f(x)=x^3+4x^2-10$ wing either Bisection method or False position method. Given **(10)** that it has root in (1,2)

    b. Compute the largest eigenvalue and the corresponding eigen vector of the **(10)** following coefficient matrix using Power method with a relative error of 0.1% or less on the eigenvalues.

$$\begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 4 & -1 & 0 \\ 0 & -1 & 4 & -1 \\ 0 & 0 & -1 & 2 \end{bmatrix}$$

Q. 5 a) Obtain the root of the following equation to an accuracy of 0.01% using Muller's **(10)** method starting with the points 0, 0.5 and 1 to start the iterations.
$x^3 -1.25x^2 - 1.562525\,x + 1.9530938 = 0$

b) Using Newton method solve the following set of nonlinear equations starting with **(10)** an initial guess of (2, 2) in not more than 5 iterations.
$$x_1^2 + x_2^2 - 4 = 0$$

$$x_1^2 - x_2^4 - 1 = 0$$

Q. 6 a) $\frac{dy}{dx} = (1 + x) \sqrt{y}$ **(10)**

Calculate y (0.5) using Fourth Order Runge Kutta method. Given that y (o) = 1

b) Using Gauss Elimination method solve the following set of simultaneous equations. **(10)**
$$7 x_1 + 2x_2 - 3x_3 = 12$$
$$2 x_1 + 5x_2 - 3x_3 = 20$$
$$x_1 - x_2 - 6x_3 = 26$$

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