UNIT 1

1. Explain conservation laws and engineering problems.
2. Explain the following with examples:-

   I. Blunders

   II. Formulation Error

   III. Data uncertainty

   IV. Total numerical error
3. What is a mathematical model? With the help of flowchart explain the solving of engineering problems.
4. Suppose that you have the task of measuring the lengths of a bridge and a rivet and come up with 9999 and 9 cm, respectively. If the true values are 10,000 and 10 cm respectively. Compute, i) True error and ii) Percentage relative error for each case.
5. Evaluate $y = x^3 - 7x^2 + 8x - 0.35$, At 1.37 use three digit and four digit arithmetic and find significant digits lost. Also find the relative error after rounding - off.
6. A resistor labeled as 240 ohm is actually 243.32753 ohm. What are the absolute and relative errors of labeled value?
7. Let p=0.896375 and q=0.896301 . Use decimal five-digit arithmetic to approximate p-q and determine the absolute and relative errors using i) rounding and ii) chopping.
8.

Determine the absolute and relative errors when approximating p by p^* when

i. $p = 0.3000 \times 10^1$ and $p^* = 0.3100 \times 10^1$

ii. $p = 0.3000 \times 10^{-3}$ and $p^* = 0.3100 \times 10^{-3}$

iii. $p = 0.3000 \times 10^4$ and $p^* = 0.3100 \times 10^4$

9. Convert the following base-2 numbers to base-10: (a) 101101, (b) 101.011, and c) 0.01101.
10. Convert the following base-8 numbers to base-10: 71,263 and 3.147.

11. Use zero- through third order Taylor series expansions to predict f(3) for

    $f(x) = x^3 - 10x^2 + 6$.

12.

Use zero- through third-order Taylor series expansions to predict $f(3)$ for
$$f(x) = 25x^3 - 6x^2 + 7x - 88$$
using a base point at $x = 1$.

13. Use zero- through fourth - order Taylor series expansions to approximate the function

$f(x) = -0.1x^4 - 0.15x^3 - 0.5x^2 - 0.25x + 1.2$ from $x_i = 0$ with $h = 1$ .That is to predict the function's value at $x_{i+1} = 1$.

14. Perform the operation:- a) 0.9998 E1 + 0.1000 E-99 b) 0.1000 E5 + 0.9999 E3 c) 0.9998 E1 / 0.1000 E-99 d) 0.5543 E12 x 0.4111 E-15

UNIT 2

1. Using the bisection method, find an approximate root of $x^3-x-4=0$. Perform 3 iterations.
2. Determine the real root of $f(x) = -26 + 85x - 91x^2 + 44x^3 - 91x^2 + x^5$ between 0.5 and 1.0 correct up to 3 decimal places using bisection method.
3. Determine the real roots of $f(x) = 4x^3 - 6x^2 + 7x - 2.3$ using the bisection method correct upto 3 decimal places.
4. Obtain the root correct to two decimal places of the equation $x^3-2x-5=0$ using the Regula falsi method.
5. Find the root of equation $f(x)=e^{-x}- x=0$ by regula falsi method (Take three iteration)
6. Find the roots of the equation $2x - 3\sin x - 5 = 0$. Using Regula - Falsi method correct upto 3 decimal places.
7. Find the root of the equation $x^4=20$ using Newton Raphson method. Take initial value 2. Find the answer correct upto 4 decimal places.

8.

Find $f(0.9)$ if $f(0.6) = -0.17694460$, $f(0.7) = 0.01375227$, $f(0.8) = 0.22363362$, $f(1.0) = 0.65809197$ using Lagrange's Interpolation formula.

Using appropriate interpolation formula find $f(4.25)$ from the table:

X	4.0	4.1	4.2	4.3	4.4	4.5
$f(x)$	27.21	30.18	33.35	36.06	40.73	54.01

9. Find the missing term in 2 ways from the table:-

x	5	10	15	20	25	30
y	32	78	–	144	257	377

10. Given f(0)=2, f(2)=5, f(4)=10, f(6)=17, f(18)=26, estimate f(7) using Lagrange's interpolation.

The following table gives the information about weight of packets and number of packets.

Wt. of packets	0-5	5-10	10-15	15-20	20-25
Number of packets	10	16	7	4	3

Find the number of packets whose weights are less than 18 gms.

UNIT 3

1. Solve the following system of equations by Gauss-Jordan method:
   x+y+z=90, 2x-3y+4z=370, 3x+4y+5z=-340
2. Solve the following system of equations by Gauss-Jordan method:
   x+y+z=9, 2x-3y+4z=13, 3x+4y+5z=40
3. Solve the following equations by using the Gauss-Seidel method.
   10x+2y+z=9 x+10y-z=-22 -2x+3y+10z=22
4.

For the set of points (0, 2), (2, -2), (3, -1), evaluate $\left(\frac{dy}{dx}\right)_2$

Evaluate $\int_0^1 \frac{1-e^{-x}}{x} dx$ using trapezoidal rule and Simpson's 3/8 rule.

Solve $\frac{dy}{dx} = x + y$; y(1) = 1 for the interval 1 (0.1) 1.2, using method of Taylor series.

Solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, where y(0) = 1, to find y(0.1) using Runge-Kutta method.

5.

The table for $f(x)$ is given below. Evaluate $\frac{d}{dx}f(x)$ and $\frac{d^2}{dy^2}f(x)$ at x = 0.1

x	0.0	0.1	0.2	0.3	0.4
$f(x)$	1.000	0.9975	0.9900	0.9776	0.9604

Evaluate $\int_0^{\pi} \frac{\sin^2 x}{5+4\cos x}dx$ using Simpson's 3/8th rule.

Solve $\frac{dy}{dx} = \log(x+y)$; $y(1) = 2$ for $x = 1.2$ and $x = 1.4$ using Euler's modified method taking h = 0.2.

6. Evaluate $^{0}\int 1$ dx/1+x^2 using the Trapezoidal rule with h=0.2.

7. Evaluate $^{5.2}\int 4$ log x dx by
   i) Trapezoidal rule
   ii) Simpson's (⅓)rd rule
   iii) Simpson's (⅜)th rule.

8. Using Taylor's method, find y(0.1) correct upto 3 decimal places from dy/dx+2xy=1, y(0)=0.

9. Use second order Runge-Kutta method to approximate y when x=0.1 given that dy/dx=x+y and y(0)=1.

10. Use the Euler method to estimate y(0.5) of the equation dy/dx=x+y+xy, y(0)=1 with h=0.25.