

- N.B. : (1) Question No.1 is compulsory.  
 (2) Attempt any four questions out of remaining six questions.  
 (3) Assume any suitable data whenever required.

1 a) Draw the flowchart and write a program in C/C++ for modified Euler's method to solve the given differential equation. (10)

b) i) Find the maximum relative error in u where  $u = \frac{5xy^2}{z^3}$  at  $x = y = z = 1$  if the error in x, y, z is 0.001. (05)

ii) Explain different types of errors that occur in Numerical calculations. (05)

2 a) Solve the following system of equations by using Gauss-elimination method. (10)

$$\begin{aligned} 3x + 4y + 5z &= 18 \\ 2x - y + 8z &= 13 \\ 5x - 2y + 7z &= 20 \end{aligned}$$

b) Find a positive root of the equation  $xe^x = 2$ , by method of Regula falsi method. (10)

3 a) Derive the Lagrange's interpolation formula and express the given function as sum of partial fractions----- (12)

$$\frac{x^2 + x - 3}{x^3 - 2x^2 - x + 2}$$

b) Find the minimum value of the function from the following table--- (08)

x	0.20	0.3	0.4	0.5	0.6	0.7
F(x)	0.98182	0.8975	0.8873	0.8862	0.8935	0.9086

4 a) Compute x (0.2) for the differential equation  $\frac{dx}{dt} = \frac{x^2 - 2t}{x^2 + t}$  with initial conditions  $t = 0, x = 1$  using 2<sup>nd</sup> order Runge-Kutta method. Assume step size  $h=0.1$ . (10)

b) Find the least square line  $y = a + bx$  for the given data ---

x	-2	-1	0	1	2
y	1	2	3	3	4

5 a) Derive Newton Cote's integration formula and hence Simpson's 1/3<sup>rd</sup> and Simpson's 3/8<sup>th</sup> rule. (10)

b) Compute  $\int_0^{0.6} e^x dx$  taking  $n=6$  by Simpson's 1/3<sup>rd</sup> rule. (10)

6 a) Obtain  $y(0.6)$  given,  $\frac{dy}{dx} = x + y$ ,  $y(0)=1$ ,  $h = 0.2$  by Adam's method. (10)

b) Derive Newton Raphson's method formula and write a program in C/C++ to find the root of equation by the same method. (10)

7 a) The following are data from the steam table— (10)

Temperature (°C)	140	150	160	170	180
Pressure (Kgf/cm <sup>2</sup> )	3.685	4.84	6.302	8.076	10.225

Using Newton's formula, find the pressure of the steam for a temperature of 142 °C.

b) Write short notes— (10)

i) Golden search method

ii) LU decomposition method.