MA-8491 Numerical Methods
Important 13Mark Questions

Unit I

1. Determine the largest eigen value and the corresponding eigen vector of the matrix

$$\mathbf{A} \cdot = \begin{vmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{vmatrix}$$

2. Apply Gauss-Seidal method to solve the equations
   28x + 4y – z = 32
   x + 3y + 10z = 24
   2x + 17y + 4z = 35.

Unit II

1. Find an approximation polynomial for f(x) using Lagrange's interpolation for the following data:

x:	0	1	2	5
y = f(x):	2	3	12	147

2. The following values of x and y are given:

X:	1	2	3	4
Y:	1	2	5	11

Unit III

1. Use Romberg's method to evaluate $\int_0^1 \frac{dx}{1+x^2}$ correct to 4 decimal places. Also compute the same integral using three-point Gaussian quadrature formula. Comment on the obtained values by comparing with the exact values of the integral which is equal to $\frac{\pi}{4}$.
2. Find the first derivative of f(x) at x = 2 for the data f(-1) = -21, f(1) = 15, f(2) = 12 and f(3) = 3, using Newton's divided difference formula.

Unit IV

1. Solve the initial value problem $\frac{dy}{dx} = x - y^2$, y(0) = 1 to find y(0, 4) by Adam's Bashforth predictor corrector method and for starting solutions, use the information y(0, 1) = 0.9117, y(0, 2) = 0.8494. Compute y(0, 3) using Runge Kutta method of fourth order.
2. Find the value of y at x= 0.1 from $\frac{dx}{dy} = x^2y - 2$, y(0) = 1 by Taylor's series method.

Unit V

1. Solve the Laplace equation over the square mesh of side 4 units, satisfying the boundary conditions:
   u(0, y) = 0, u(4, y) = 12 + y, 0≤y≤4
   u(x, 0) = 3x, u(x, 4) = x^2, 0≤x≤4.
2. Solve the Poisson equation $V^2u = -\frac{160}{x^2y^2}$ over the square mesh with sides x = 0, y = 0, x = 3, and y = 3 with u = 0 on the boundary and mesh length- 1 unit.