Name of Course	: **B.A. (Prog.)**
Unique Paper Code	: **62357602**
Name of Paper	: **DSE: Numerical Analysis**
Semester	: **VI**
Duration	: **3 hours**
Maximum Marks	: **75 Marks**

Attempt any four questions. All questions carry equal marks.

1. Find an interval of unit length which contains the smallest positive root of the equation $f(x) = x^4 - x - 10 = 0$. Taking the end points of this interval as initial approximations, do two iterations each of the Secant method and Regula Falsi Method.

2. Find the number of significant digits for the following:

2410, 2.41,0.00241, 2.410×10^4, 2.4100×10^4, 2.41000×10^6.

If $x = 0.278143 \times 10^4$ and $y = 0.278456 \times 10^4$, find the number of significant digits in $x + y, x - y, xy$.

3. Given the following system of equations

$$x_1 + x_2 + x_3 = 1$$
$$4x_1 + 3x_2 - x_3 = 6$$
$$3x_1 + 5x_2 + 3x_3 = 4$$

(i) Find the solution using the Gauss- Jordan method.

(ii) Perform two iterations of the Gauss-Seidel method starting with $X^{(0)} = (1, 1, 1)$.

4. Generate the forward and backward difference table for the data

x	0	0.2	0.4	0.6	0.8
f(x)	0.12	0.46	0.74	0.9	1.2

Hence interpolate the values of $f(0.1)$ and $f(0.7)$ by using Gregory Newton forward and backward differences Interpolation formulae respectively.

5. Approximate the second order derivative of $f(x) = e^x$ at $x_0 = 0$, taking $h =$ 1,0.1,0.01 by using the formula

$$f''(x) \approx \frac{f(x_0 - h) - 2f(x_0) + f(x_0 + h)}{h^2}$$

Also approximate the derivative of $f(x) = 1 + x + x^2 + x^3$ at $x_0 = 0$, taking $h = 1, 0.1, and\ 0.01$ by using the formula

$$f'(x_0) \approx \frac{f(x_0 + h) - f(x_0)}{h}$$

Find the order of approximations in both the cases.

6. Find the approximate value of $I = \int_0^1 \frac{dx}{1+x^3}$ using the Trapezoidal rule with 2, 4 and 8 equal subintervals. Improve the result by Romberg integration.