[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6400 **K**

Unique Paper Code : 2352204701

Name of the Paper : Numerical Methods, DSC

Name of the Course : **Bachelor of Arts / Bachelor of Science (Programme)**

Semester : VII

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All the **six** questions are compulsory. Attempt any **two** parts from each question.
3. Each question carries equal marks.
4. Use of Non-Programmable Scientific Calculator is allowed.

1. (a) Round-off the number 46.82135 correct to four significant digits and then calculate the absolute, relative and percentage errors.

   (b) Determine the number of significant digits in the following numbers:

   (i) 235700

   (ii) 0.0036

   (iii) 4.56700

   (iv) 30.00056

   (v) 4.5×10^8

P.T.O.

(c) Perform three iterations of Bisection Method to find root of $x^2 - 2 = 0$ in $]1,2[$.

2. (a) Using Secant Method, find a real root of the equation $xe^x - 1 = 0$, given that the root lies between 0 and 1. Perform three iterations, by taking $x_0 = 0$ and $x_1 = 1$.

(b) By performing three iterations of Regula-Falsi method, find a root of the equation $3x + \sin(x) - e^x = 0$ in $]0,1[$.

(c) Do three iterations of the Newton Raphson's Method to find cube root of 25, taking initial approximation $x_0 = 3$.

3. (a) Using Gauss Elimination method, solve the following system of linear equations:

$$2x - y + 3z = 9$$

$$x + y + z = 6$$

$$x - y + z = 2$$

(b) Find the Lagrange interpolating polynomial which fits into the given data. Also, approximate the value of f(10)

x	5	6	9	11
f(x)	12	13	14	16

(c) Show that : $\mu = \frac{1}{2}\left[E^{1/2} + E^{-1/2}\right]$

(Note: Symbols have their own meaning)

4. (a) Starting with initial vector (x,y,z) = (0,0,0) perform three iterations of Gauss Seidel Method to solve the following system of equations :

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

(b) Find the unique polynomial P(x) of degree 3 or less using Newton's interpolating Formula for the following data :

x	0	2	3	6
f(x)	648	704	729	792

(c) Calculate the 3rd divided difference of $\frac{1}{x}$, based on the points x_0, x_1, x_2, x_3.

5. (a) Evaluate $I = \int_0^{\pi/2} \sqrt{\sin x}\, dx$ using Simpson's rule.

(b) Use the Taylor's expansion for a function f to derive the central divided difference formula of the first order derivative at x_i with step-size h,

$$f'(x_i) = \frac{f(x_{i+1}) - f(x_{i-1})}{2h}.$$

(c) Given the differential equation $y' = x^2 + y$ with $y(0) = 1$, compute $y(0.02)$ using Euler's method and step size, $h = 0.01$.

6. (a) Approximate $y'(1)$ and $y'(2)$ using backward difference formula if

x	–1	0	1	2	3
y	0.5	1	2	4	8

(b) Consider the differential equation $\frac{dy}{dt} = t^2 - y$ with $y(0) = 1$. Use Euler's method to compute $y(3)$ with step-size $h = 1$.

(c) Use the Trapezoidal rule with $n = 4$ to evaluate $\int_3^7 x^2 \log x \, dx$.