[This question paper contains 4 printed pages.]

Your Roll No. .....

Sr. No. of Question Paper : 1607 **A**

Unique Paper Code : 42357618

Name of the Paper : DSE – NUMERICAL METHODS

Name of the Course : **B.Sc. Mathematical Sciences / B.Sc. (Prog.)**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **two** parts of each question.
3. **All** questions carry equal marks.

Q 1(a) If X = 2.536, find the absolute error and relative error when, X is truncated to two decimal digits. (6.25)

(b) Find the relative error of the number 6.4, if both of its digits are correct. (6.25)

(c) Write the order of convergence of Bisection Method, Secant Method and Newton-Raphson Method. Also name these methods in decreasing order w.r.t. rate of convergence. (6.25)

P.T.O.

(d) Determine the number of significant digits in the following numbers. (6.25)

(I) 0.6500025, (II) 0.000232317, (III) 50.00045, (IV) 8×10^{-9}.

Q. 2(a) Perform five iterations of the Bisection method to obtain the smallest positive root of the equation $f(x)=x^3+2x-2=0$. (6.25)

(b) Using Regula-Falsi method compute the real root of the equation $x^2=7$. Correct to four decimal places. (6.25)

(c) Using Newton-Raphson Method compute $\sqrt{17}$ correct to four decimal places. (6.25)

(d) Using Secant method, find the smallest positive root of the equation $x^3+3x^2=1$ correct to three decimal digits. (6.25)

Q. 3(a) Solve the following system of equations AX= b where (6.25)

$$A=\begin{bmatrix}2 & 0 & -2\\ 3 & -4 & -4\\ -2 & 2 & -1\end{bmatrix},\ b=\begin{bmatrix}-10\\ -8\\ 3\end{bmatrix},$$

using Gauss elimination method by using partial pivoting.

(b) Find the interpolating formula for (6.25)

x	0	1	2	3
y	1	2	4	8

in Newton form.

(c) Consider the following table: (6.25)

x	-1	2	4	5
y	-5	13	255	625

Use Lagrange interpolation to estimate (0.25).

(d) Find a cubic polynomial which take the following values using Newton forward difference formula y(1)= 24, y(3)= 120, y(5)= 336, y(7)= 720. Also, find y(8)? (6.25)

Q. 4(a) Perform three iterations to solve the linear system (6.25)

8x+ y- z = 8,
-x+7y -2z = 4,
2x+ y+9z = 12,

Using Gauss-Jacobi iteration method by taking the initial approximation as $(x_0,y_0,z_0)=(0,0,0)$.

(b) Find the unique polynomial P(x) of degree 2 or less such that P(1)= 1, P(3)= 27, P(4)= 64, using Newton divided difference formula. Estimate P(1.5). (6.25)

(c) Solve the following system of equations (6.25)

6x+ 2y+ 2z = 8,
6x+2y +z = 4,
x+ 2y- z = 12,
using Gauss Jordan Method.

(d) Obtain the piecewise linear interpolating polynomial for (6.25)

x	0.5	1.5	2.5
f(x)	0.125	3.375	15.625

Interpolate at x = 2.0.

Q. 5(a) Apply Richardson extrapolation when $f(x)=e^{-x}+Sinx+x^3, x=1.2, h=0.4$ using central divided difference formula f'(x)= $\frac{f(x+h)-f(x-h)}{2h}$. (6.25)

(b) Compute $\int_1^6 x^3\,dx$ by trapezoidal rule with n = 4. (6.25)

(c) Find Richardson extrapolation of f(x)= e^x-Sin x when x = 1, h = 0.5, h = 0.25 using central divided difference formula f'(x)= $\frac{f(x+h)-f(x-h)}{2h}$. (6.25)

(d) Compute the value of $\int_1^2 \frac{dx}{x}$ with h = 0.25 using Simpson's rule. (6.25)

P.T.O.

Q. 6(a) Using Euler modified method, obtain a solution of $\frac{dy}{dx} = x + |\sqrt{y}|$,y (0) = 1 for the range [0, 0.6] in steps of 0.2. (6.25)

(b) Use Euler's method and its modified form to obtain y(0.2), y(0.4), and y(0.6) correct to three decimal places, given that $y' = y - x^2$ with initial condition y(0) = 1. (6.25)

(c) Compute the value of $\int_0^1 \frac{dx}{1+x^2}$ using trapezoidal rule with h = 0.25. (6.25)

(d) Compute the value of $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's three eight rule. (6.25)