

MCSE-004

NUMERICAL AND STATISTICAL
COMPUTING

Book 1

1. Define relative and percentage error. Find the relative and percentage error when the value of $\pi = \frac{22}{7}$ is approximated to 3.14.
2. Find the value of 'e', correct to 3 decimal places.

$$e = 1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

3. Evaluate the sum $S = \sqrt{7} + \sqrt{5} + \sqrt{3}$ to 4 significant digits and find its absolute and relative errors.

Book-1 (Unit 2)

- Bisection Method
- Regula-falsi Method
- Newton-Raphson Method
- Secant Method

➤ Bisection Method

4. Find an approximate value of the root of the equation $x^3 + x - 1 = 0$, near $x = 1$, using the Bisection method twice.

➤ Regula-falsi Method

5. Obtain the positive root of the equation $x^2 - 1 = 0$ by Regula Falsi method.

➤ Newton-Raphson Method

6. Use the Newton-Raphson method to find the root of the equation $x^3 - 2x - 5 = 0$. Perform two iterations. Use initial approximation $x_0 = 2$.

➤ Secant Method

7. Find the root of the equation $xe^x = \cos x$ using the Secant method, correct to four decimal places. Do three iterations.

Book-1 (Unit 3)

- Gauss Elimination Method
- LU Decomposition Method
- Jacobi Method

➤ Gauss Elimination Method

8. Write two pitfalls of Gauss elimination method.
9. Solve the following system of equations using Gauss-Elimination method with partial pivoting :

$$x_1 + x_2 + x_3 = 6$$

$$3x_1 + 3x_2 + 4x_3 = 20$$

➤ LU Decomposition Method

10. **Solve the equations**

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

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

by LU decomposition method.

➤ Jacobi Method

10. Solve by Jacobi's method, the following system of linear equations :

$$2x_1 - x_2 + x_3 = -1$$

$$x_1 + 2x_2 - x_3 = 6$$

$$x_1 - x_2 + 2x_3 = -3$$

Book 2

Book-2 (Unit 1)

- Newton's forward interpolation
- Newton's backward interpolation
- Lagrange's interpolation formula

➤ Newton's forward interpolation

11. Obtain the forward difference interpolating polynomial from the following set of nodes :

x	f(x)
0	0
1	7
2	26
3	63
4	124
5	215
6	342
7	511

12. Estimate the missing term in the following data using forward difference :

x	1	2	3	4	5
f(x)	3	7	?	21	31

➤ Newton's backward interpolation

13. From the following data, estimate the value of $f(2.25)$ using Backward Difference Formula :

X:	0	0.5	1.0	1.5	2.0	2.5
f(x):	1.0	3.625	7.0	11.875	19	29.125

➤ lagrange's interpolation formula

14. Find the Lagrange interpolating polynomial that fits the following data :

x	0	1	2	5
$f(x)$	2	3	12	147

Book-2 (Unit 2)

- Simpson's $1/3$ Rule
- Simpson's $3/8$ rule
- Trapezoidal rule
- Weddle's rule

➤ Simpson's 1/3 Rule and Simpson's 3/8 rule and

15. Evaluate the integral $\int_0^1 \frac{dx}{1+x}$ using
Simpson's $\frac{3}{8}$ th rule with $h = \frac{1}{3}$.

16. Calculate the value of the integral
 $\int_4^{5.2} \log x \, dx$ by using

(i) Simpson's 1/3 rule,

(ii) Simpson's 3/8 rule.

➤ Trapezoidal rule

16. Evaluate $\int_0^1 \frac{dx}{1+x}$ using composite

Trapezoidal rule with $n = 2$ and 4 .

➤ Weddle's rule

17. Calculate the value of the integral

$$\int_4^{5.2} \log x \, dx$$

by Weddle's rule.

Book-2 (Unit 3)

- Euler's Method
- Runge Kutta Method

➤ Euler's Method

18. Determine the value of y when $x = 0.1$.

Given that $y(0) = 1$ and $y' = x^2 + y$. Use

Euler's method.

➤ Runge Kutta Method

18. Apply the fourth order Runge-Kutta method to the following differential equation :

$$\frac{dy}{dx} = -2xy^2$$

$$y(0) = 1$$

Obtain $y(0.2)$, taking $h = 0.2$.

Book 3

19. A farmer buys a quantity of cabbage seeds from a company that claims that approximately 90% of the seeds will germinate if planted properly. If four seeds are planted, what is the probability that exactly two will germinate? (Page 13)

20. If a bank receives on an average $\lambda = 6$ bad Cheques per day, what is the probability that it will receive 4 bad checks on any given day (Page 15)