

**MASTER OF COMPUTER
APPLICATIONS (MCA) (REVISED)**

Term-End Examination

December, 2024

**MCSE-004 : NUMERICAL AND
STATISTICAL COMPUTING**

Time : 3 Hours

Maximum Marks : 100

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **three** questions from the rest.*

(iii) *Use of calculator is allowed.*

-
1. (a) Evaluate the sum $S = \sqrt{7} + \sqrt{5} + \sqrt{3}$ upto 4 significant digits and find its absolute and relative errors. 5

- (b) Consider the solution of quadratic equation :

$$x^2 + 111.11x + 1.2121 = 0$$

using five-decimal digit floating point chopped arithmetic. 5

- (c) Determine the value of y when $x = 0.1$.
Given that $y(0) = 1$ and $y' = x^2 + y$, use Euler's method. 5

- (d) Find the root of equation correct to three decimal digits using Secant method : 5

$$x^3 - 2x - 5 = 0$$

- (e) Find an approximate value of the root of equation $x^3 + x - 1 = 0$ near $x = 1$, using the method of Regula-Falsi. 5

- (f) A polynomial passes through the points $(1, -1)$, $(2, -1)$, $(3, 1)$ and $(4, 5)$. Find the polynomial using Newton's forward interpolation. 5

- (g) Suppose that the amount of time one spends in a bank to withdraw cash from an evening counter is exponentially distributed with mean ten minutes, that is $\lambda = \frac{1}{10}$. What is the probability that the customer will spend more than 15 minutes in the counter ? 5

(h) Write short notes on the following : $2\frac{1}{2} + 2\frac{1}{2}$

(i) Non-linear Regression

(ii) Acceptance-Rejection Method

2. (a) What are the pitfalls of Gauss Elimination method ? Solve the following systems of equations :

$$2x + 4y + 6z = 22$$

$$3x + 8y + 5z = 27$$

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

using the Gauss Elimination method. 10

- (b) Find the minimum number of iterations needed by the Bisection method to approximate the root $x = 3$ of $x^3 - 6x^2 + 11x - 6 = 0$ with error tolerance 10^{-3} . 6

- (c) Explain the terms Accuracy and Precision with suitable example. 4

3. (a) Solve the following system of equations by Jacobi method, determine the result for three approximations : 7

$$3x + 4y + 15z = 54.8$$

$$x + 12y + 3z = 39.66$$

$$10x + y - 2z = 7.74$$

- (b) Solve the following system of equations by Gauss-Seidel method : 7

$$x + 4y - z = 5$$

$$x + y - 6z = -12$$

$$3x - y - z = -4$$

- (c) What are Random Variables ? Differentiate between Discrete and Continuous Random Variables. 6

4. (a) Compute the integral $\int_1^2 \frac{2x}{1+x^2} dx$ by applying Gauss-Legendre formula. 6

- (b) Using Lagrange's interpolation formula, find the interpolating polynomial for the following data : 6

X	<i>f</i> (x)
0.1	1.40
0.2	1.56
0.3	1.76
0.4	2.00
0.5	2.2813

- (c) Using the Runge-Kutta method, find $y(0.1)$

for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$; $y(0) = 1$. Take

$$h = 0.1.$$

8

5. (a) Calculate the correlation for the following heights (in inches) of fathers (X) and their sons (Y) :

X	Y
66	67
67	68
67	65
68	68
69	72
70	72
72	71

Obtain the equations of lines of regression.

Also estimate the value of X for Y = 70. 10

- (b) Three groups of children contain 3 girls and 1 boy, 2 girls and 2 boys, 1 girl and 3 boys respectively. One child is selected at random from each group. Show that the chance that the three selected children consist of 1 girl and 2 boys is $\frac{13}{32}$.

6

- (c) What is the utility of residual plot ? What are its disadvantages ?

4

x x x x x x x