

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

Term-End Examination

June, 2023

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

Time : 3 Hours

Maximum Marks : 100

Note : *Question No. 1 is compulsory. Attempt any
three questions from the rest. Use of
calculator is allowed.*

1. (a) Let $a = 0.345 \times 10^0$, $b = 0.245 \times 10^{-3}$ and
 $c = 0.432 \times 10^{-3}$. Prove that : 5

$$(a + b) + c \neq a(b + c).$$

- (b) Solve the quadratic equation
 $x^2 + 9.9x - 1 = 0$ using two decimal digit
floating arithmetics with rounding. 5

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(c) Evaluate $\int_1^2 \frac{1}{x} dx$ using Simpson's $\frac{3}{8}$ rule
using $h = 0.25$. 5

(d) Find solution using Trapezoidal rule : 5

x	$f(x)$
0.0	1.0000
0.1	0.9975
0.2	0.9900
0.3	0.9776
0.4	0.8604

(e) Approximate the positive square root of $x^2 - 2$, choosing $x_0 = 1.5$ and $x_1 = 1$. Do four iterations, using Secant method. 5

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

(g) Find the smallest positive roots of $x^2 - 3x + 1 = 0$, choosing a suitable iteration function, that coverages. Do three iterations of fixed point iteration method. Start with $x_0 = 0.5$. 5

- (h) A book contains 100 misprints distributed randomly throughout its 100 pages. What is the probability that a page observed at random contains at least two misprints ? 5
2. (a) Find the minimum number of iterations required to find the root of $x^3 - 2x - 5 = 0$, correct to two decimal places, in the interval (2, 3) with error of tolerance 0.5×10^{-2} . 6
- (b) Find the value of x, y, z in the following system of equations by Gauss Elimination method : 8
- $$2x + y - 3z = -10, -2y + z = -2, z = 6$$
- (c) The population of a city in the census is given below. Estimate the population of the city for the year 1995 using Lagrange's interpolation. 6

Year (x)	Population (y) (in thousands)
1991	46
2001	66
2011	81
2021	93

3. (a) Calculate the correlation coefficient for the following heights (in inches) of fathers (x) and their sons (y) : 6

x	y
65	67
66	68
67	65
67	68
68	72
69	72
70	69

- (b) Evaluate $I = \int_0^1 \frac{1}{(1+x)} dx$, correct to three decimal places, using (i) Trapezoidal and (ii) Simpson's 1/3rd rule with $h = 0.5$ and $h = 0.25$. 8

- (c) Using the Runge-Kutta method, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$.

Take $h = 0.2$. 6

4. (a) Develop the difference table for the data given below and use it to find the lowest degree polynomial : 8

X	Y
3	2.7
4	6.4
5	12.5
6	21.6
7	34.3
8	51.2
9	72.9

- (b) A bag contains 6 white and 9 black balls. Four balls are drawn at a time. Find the probability for the first draw to give 4 white and second to give 4 black balls in each of the following cases : 6

- (i) The balls are replaced before the second draw.
- (ii) The balls are not replaced before the second draw.

- (c) Explain random variables and compare discrete and continuous random variables. 6
5. (a) Solve the following system of equations using LU Decomposition method : 8

$$x_1 + x_2 + x_3 = 1$$

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

$$3x_1 + 5x_2 + 3x_3 = 4$$

- (b) Solve the following system of equations by Jacobi method. Determine the results for three approximations, using (0, 0, 0) as initial approximates : 7

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

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

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

- (c) What do you mean by the term “Accuracy” and “Precision” ? How error measures accuracy ? 5