

MCA (Revised)
Term-End Examination
December, 2022

**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 $a = 0.41$, $b = 0.36$ and $c = 0.70$. Prove that $\frac{(a-b)}{c} \neq \frac{a}{c} - \frac{b}{c}$. 5
- (b) Obtain the positive roots of the equation $x^2 - 1 = 0$ by using Regula-Falsi method. 5
- (c) Solve the following system of equations using Gauss elimination method : 5
- $$3x + 2y + 3z = 5$$
- $$x + 4y + 2z = 4$$
- $$2x + 4y + 8z = 8$$

(d) Calculate the value of the integral $\int_4^{5.2} \log x \, dx$ by using Trapezoidal rule. 5

(e) Solve the following initial value problem, using Euler's method :

$$y' = 1 + y^2, y(0) = 1$$

Find $y(0.8)$ taking $h = 0.2$. 5

(f) Find the root of the equation $x.e^x = \cos x$ using the Secant method, correct to four decimal places. 5

(g) Show that the moment generating function of a random variable X which is Chi-square distributed with ν degrees of freedom is : 5

$$M(t) = (1 - 2t)^{-\nu/2}$$

(h) Write short notes on the following : 5

(i) Acceptance – Rejection Method

(ii) Non-linear Regression

2. (a) Solve the following system of equations :

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

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

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

by using Jacobi method. Perform four iterations. 8

(b) Compute the square root of '9' using Newton's method. How does the error behave? 5

(c) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$ using Gauss-Legendre three-point formula. 7

3. (a) Estimate the value of $f(2.2)$ by using forward difference formula, determined from the following data : 10

x	f(x)
1	2.105
2	2.808
3	3.614
4	4.604
5	5.88
6	7.451
7	9.467
8	11.985

(b) Solve the initial value problem $10y' = x^2 + y^2$ with $y(0) = 1$ and $h = 0.1$ using the fourth order Runge-Kutta method. Also find $y(0.2)$ and $y(0.4)$. 10

4. (a) Given the following system of linear equations, determine the value of each of the variables using the LU decomposition method : 10

$$6x - 2y = 14$$

$$9x - y + z = 21$$

$$3x - 7y + 5z = 9$$

- (b) If $f(1) = -3$, $f(3) = 9$, $f(4) = 30$ and $f(6) = 132$, find the Lagrange's interpolation polynomial $f(x)$. Also find the value of $f(x)$ when $x = 5$. 10

5. (a) The following data is given for marks in Subject A and Subject B of a certain examination :

	Subject A	Subject B
Mean Marks	36	85
Standard Deviation	11	8

Given, the coefficient of correlation between Subject A and Subject B = ± 0.66 .

- (i) Determine the two equations of regression.
- (ii) Calculate the expected marks in Subject A, corresponding to 75 marks obtained in Subject B. 8

- (b) Write short notes on the following : 8
- (i) Normal Distribution
 - (ii) Poisson Distribution
 - (iii) Binomial Distribution
 - (iv) Chi-square Distribution
- (c) Write formulae for the following : 4
- (i) Composite Trapezoidal Rule
 - (ii) Composite Simpson's Rule
 - (iii) Simpson's $1/3^{\text{rd}}$ Rule
 - (iv) Simpson's $3/8$ Rule
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