

MCA (Revised)
Term-End Examination
June, 2007

**MCSE-004 (S) : NUMERICAL AND
STATISTICAL COMPUTING**

Time : 3 hours

Maximum Marks : 100

Note : Question number 1 is **compulsory**. Attempt any **three** questions from the rest. Use of calculators is allowed.

-
1. (a) Solve the quadratic equation $x^2 + 9.9x - 1 = 0$ using two decimal digit arithmetic with rounding. 5
- (b) Obtain the positive root of the equation $y^2 - 1 = 0$ by Regula Falsi method. 5
- (c) Solve the following system of equations :
- $$x_1 + x_2 + x_3 = 3$$
- $$4x_1 + 3x_2 + 4x_3 = 8$$
- $$9x_1 + 3x_2 + 4x_3 = 7$$
- by Gauss Elimination method. 6

- (d) Find the interpolating polynomial that fits the data given below :

$x_k :$	0	1	2	5
$f_k :$	2	3	12	147

using the Lagrange interpolation formula.

6

- (e) Solve the initial value problem $u' = -2tu^2$ with $u(0) = 1$ and $h = 0.2$ on the interval $[0, 1]$, by using fourth order classical Runge - Kutta method.

8

- (f) In partially destroyed laboratory record of an analysis of correlation data, the following results only are legible :

Variance of $x = 9$

Regression equations : $8x - 10y + 66 = 0$

$40x - 18y - 214 = 0$

What were

- (i) the mean values of x and y ?
- (ii) the correlation coefficients between x and y ?
- (g) Suppose that the amount of time one spends in a bank to withdraw cash from an evening counter is exponentially distributed with mean 10 minutes i.e $\lambda = 1/10$. What is the probability that the customer will spend more than fifteen minutes at the counter ?

6

4

2. (a) Find the smallest positive root correct upto 3 decimal places for the equation $x^7 + 9x^5 - 13x - 17 = 0$ by using Newton-Raphson method. Give any two drawbacks of Newton-Raphson method. 8

(b) Solve the following system of linear equations by using Jacobi's method and perform three iterations : 6

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

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

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

(c) Find the value of e correct to three decimal places. 6

3. (a) What is the interpolating polynomial for $f(x) = x^2 + \sin \pi x$ through (0, 0); (1, 1); (2, 4) ? What is the error when $x = 1/2$? What is the maximum error ? 6

(b) Calculate the value of the integral $\int_4^{5.2} \log x \, dx$ by using Simpson's 1/3 rule and Simpson's 3/8 rule. 10

(c) Write short notes on : 4

(i) Euler's method

(ii) Runge-Kutta method

4. (a) 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 ? 6

(b) Show that the moment generating function of a random variable X which is chi-square distributed with ν degrees of freedom is $M(t) = (1 - 2t)^{-\nu/2}$. 8

(c) Let X have the Weibull distribution with following probability density function :

$$f(x) = \begin{cases} \alpha \lambda e^{-\lambda x^\alpha} x^{\alpha-1} & \text{if } x > 0 \\ 0 & \text{if } x < 0 \end{cases}$$

Find F^{-1} . 6

5. (a) Solve the following system of linear equations by using Gauss-Seidel method :

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

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

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

Perform 3 iterations. 6

(b) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$

using Gauss - Legendre three point formula. 6

(c) Differentiate between (any **two**) :

8

- (i) Discrete Random Variables and Continuous Random Variables
- (ii) Linear Regression and Non-Linear Regression
- (iii) Direct methods and Iterative methods of root finding

