

MCA (Revised)
Term-End Examination
December, 2007

**MCSE-004 : 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) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its absolute and relative errors. 4
- (b) Find the root of the equation $2x = \cos x + 3$ correct to three decimal places. 4
- (c) Use the Newton - Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$. 5

- (d) Use Lagrange's interpolation formula to find the value of $\sin(\pi/6)$ given $y = \sin x$. 6

x	0	$\pi/4$	$\pi/2$
$y = \sin x$	0	0.70711	1.0

- (e) Determine the value of y when $x = 0.1$. Given that $y(0) = 1$ and $y' = x^2 + y$. Use Euler's method. 6

- (f) Determine the constants a and b by the method of least squares such that $y = ae^{bx}$ fits the following data : 7

x	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

- (g) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which 8

- (i) neither car is used
(ii) some demand is refused

2. (a) What are the two pitfalls of the Gauss Elimination Method ? 6

- (b) Solve the following system, using Gauss Elimination Method : 7

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

$$3x + 2y + 3z = 18$$

$$x + 4y + 9z = 16$$

- (c) Use secant method to find the roots of the equation 7

$$f(x) = 0.5 e^x - 5x + 2$$

3. (a) Find the minimum number of intervals required to

evaluate $\int_0^1 \frac{dx}{1+x}$ with an accuracy 10^{-6} , by using

the Simpson rule. 6

- (b) Evaluate $\int_0^1 \frac{dx}{1+x}$

using composite trapezoidal rule with $n = 2$ and 4 . 6

- (c) Solve the initial value problem

$$\frac{dy}{dx} = y - x \quad \text{with } y(0) = 2 \text{ and } h = 0.1$$

Using fourth order classical Runge - Kutta Method, find $y(0.1)$ and $y(0.2)$ correct to four decimal places. 8

4. (a) Show that the moment generating function of a random variable X which is chi-square distributed with v degrees of freedom is

$$M(t) = (1 - 2t)^{-v/2} \quad 8$$

- (b) An irregular six faced die is thrown and the expectation that in 10 throws it will give five even numbers is twice the expectation that it will give four even numbers. How many times in 10000 sets of 10 throws would you expect it to give no even number ? 6

- (c) Write short notes on : 6

- (i) Acceptance Rejection Method
- (ii) Non-linear regression

5. (a) The population of a town in the decennial census was as given below :

Year	1891	1901	1911	1921	1931
Population : y (in thousands)	46	66	81	93	101

Estimate the population for the year 1895 using forward difference table. 6

- (b) A chemical engineer is investigating the effect of process operating temperature on product yield. The study results in the following data :

Tem (°C) (X)	Yield % (Y)
100	45
110	51
120	54
130	61
140	66
150	70
160	74
170	78
180	85
190	89

Determine the Goodness to fit parameter 'R' and comment on whether the predicted line fits well into the data or not.

8

- (c) Define

6

- (i) Absolute and Relative Errors
- (ii) Bisection Method

