

06004 MCA (Revised)
Term-End Examination
December, 2015

**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 non-scientific calculator is allowed.*

1. (a) Solve the quadratic equation $4x^2 + 8x - 21 = 0$ using two decimal digit arithmetic with rounding, using any **one** of the following methods :

(i) Regula-Falsi

(ii) Secant

(iii) Bisection

6

(b) Round off the number 4.5126 to 4 significant figures and find the relative percentage error.

4

(c) Obtain the positive root of the equation $x^2 - 1 = 0$ by Newton-Raphson method, correct to two decimal places. 8

(d) Explain the two pitfalls in the Gauss Elimination Method. 4

(e) Solve the following system of linear equations using LU decomposition method : 6

$$6x_1 - 2x_2 = 14$$

$$9x_1 - x_2 + x_3 = 21$$

$$3x_1 + 7x_2 + 5x_3 = 9.$$

(f) What is the lowest degree polynomial which satisfies the following set of values, using forward difference polynomial ? Also find the polynomial. 6

x	0	1	2	3	4	5	6	7
f(x)	0	7	26	63	124	215	342	511

(g) Calculate the value of the integral

$$\int_4^{5.2} \log x \, dx \text{ by Trapezoidal Rule.}$$

Assume $h = 0.2$.

Compare the numerical solution with the exact solution. 6

2. (a) What do you mean by the terms "Accuracy" and "Precision" ? How are they related to significant digits ? 4
- (b) Show that the equation $x^3 - 6x - 1 = 0$ has a root in the interval $] -1, 0[$. Obtain this root using Successive Iteration or Bisection method. 8
- (c) Find the Lagrange interpolating polynomial of degree 2 approximating the function $y = \ln x$ defined by the following values mentioned in the table. Hence determine the value of $\ln 2.7$. 8

x	2	2.5	3.0
$y = \ln x$	0.69315	0.91629	1.09861

3. (a) Solve the initial value problem
 $u' = -2tu^2$, with $u(0) = 1$, $h = 0.2$ on the interval $[0, 1]$. Use the fourth order classical Runge-Kutta method. 8
- (b) Solve the following system of equations using Gauss elimination with partial pivoting : 8
- $$2x + y + z = 10$$
- $$3x + 2y + 3z = 18$$
- $$x + 4y + 9z = 16$$
- (c) What is the utility of residual plots ? What is the disadvantage of residual plots ? 4

4. (a) If a bank receives on an average $\lambda = 6$ bad cheques per day, what is the probability that it will receive 4 bad cheques on any given day, where λ denotes the average arrival rate per day?
- (b) A hosiery mill wants to estimate how its monthly costs are related to its monthly output rate. For that the firm collects data regarding its cost and output for a sample of nine months as given by the following table :

Output (tons)	Production Cost (thousands of dollars)
1	2
2	3
4	4
8	7
6	6
5	5
8	8
9	8
7	6

- (i) Draw the scatter diagram for the data.
- (ii) Find the regression equation when the monthly output is the dependent variable (x) and monthly cost is the independent variable (y).
- (iii) Use this regression line to predict the firm's monthly cost if they decide to produce 4 tons per month.

- (c) An individual's IQ score has a $N(100, 15^2)$ distribution. Find the probability that an individual's IQ score is between 91 and 121. 4

5. (a) Evaluate the integral $I = \int_0^{\pi/2} \sin x \, dx$ using

two-point Gauss-Legendre formulae. Compare with the exact solution and the exact value is $I = 1$. 8

- (b) The following values of the function $f(x)$ for the values of x are

$$f(1) = 4, f(2) = 5, f(7) = 5 \text{ and } f(8) = 4.$$

Find the value of $f(6)$ and also the value of x in the interval $[1, 8]$ for which $f(x)$ is maximum or minimum. 8

- (c) Round off the number 4.5126 to four significant figures and find the relative percentage error. 4