No. of Printed Pages : 5

MCSE-004

03045

MCA (Revised)
Term-End Examination
December, 2016

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 $a = 0{\cdot}345 \times 10^0$, $b = 0{\cdot}245 \times 10^{-3}$ and $c = 0{\cdot}432 \times 10^{-3}$. Using 3-digit decimal arithmetic with rounding, prove that $(a + b) + c \neq a + (b + c)$. *3*

(b) Obtain the positive root of the equation $x^2 - 1 = 0$ by Regula-Falsi method, correct up to 2 decimal places. *6*

(c) Solve the following linear system of equations using Gauss Elimination method : *6*

$$x_1 + x_2 + x_3 = 3$$

$$4x_1 + 3x_2 + 4x_3 = 8$$

$$9x_1 + 3x_2 + 4x_3 = 7$$

(d) From the following data, estimate the value of f(2·25) using Backward Difference Formula : *6*

X :	0	0·5	1·0	1·5	2·0	2·5
f(x) :	1·0	3·625	7·0	11·875	19	29·125

(e) Calculate the value of the integral $\int_{4}^{5.2} \log x \, dx$ using

(i) Trapezoidal rule,

(ii) Simpson's $\frac{1}{3}$ rule.

Assume h = 0·2. Compare the numerical solutions with the exact solution. *2×4+2=10*

(f) Explain the concept of Exponential Random Variable with a suitable example. *5*

(g) Find a polynomial of degree ≤ 2 with the properties P(1) = 5, P(1·5) = – 3, P(3) = 0. *4*

2. (a) Given the following system of linear equations, determine the value of each variable using LU decomposition method : *8*

$$6x_1 - 2x_2 = 14$$
$$9x_1 - x_2 + x_3 = 21$$
$$3x_1 + 7x_2 + 5x_3 = 9$$

(b) Evaluate $\int_1^6 [2 + \sin(2\sqrt{x})]\, dx$ using Simpson's rule with 11 points. *8*

(c) If a bank receives on an average $\lambda = 6$ bad cheques per day, what is the probability that it receives 4 bad cheques on any given day ? *4*

3. (a) Evaluate the integral $I = \int_1^2 \frac{2x\, dx}{1 + x^4}$ using the Gauss-Legendre 1-point, and 2-point quadrature rules. Compare with the exact solution. *8*

(b) Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) : *8*

X :	65	66	67	67	68	69	70	72
Y :	67	68	65	68	72	72	69	71

(c) A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls from the box at random. Find the probability that among the balls drawn there is at least one ball of each colour. *4*

4. (a) Solve the initial value problem

$u' = -2t\,u^2$ with $u(0) = 1$ and $h = 0{\cdot}2$

on the interval [0, 1]. Use the fourth order classical Runge-Kutta method. *10*

(b) Estimate the missing term in the following data which represents a polynomial of degree 3 : *4*

x :	1	2	3	4	5
f(x) :	3	7	?	21	31

(c) Evaluate the integral $\int_0^6 (x^2 + x + 2)\,dx$

using Trapezoidal rule, with $h = 1{\cdot}0$. *6*

5. (a) Three groups of children contain respectively 3 girls and 1 boy, 2 girls and 2 boys, and 1 girl and 3 boys. One child is selected at random from each group. Show that the chance that the three selected children consist of 1 girl and 2 boys is $\frac{13}{32}$. *6*

(b) Find the most likely price in Bombay corresponding to the price of ₹ 70 at Kolkata from the following data :

	Kolkata	Bombay
Average Price	65	67
Standard Deviation	2·5	3·5

Correlation coefficient between the prices of commodities in the two cities is 0·8. *6*

(c) Fit a straight line to the following data with x as the independent variable :

x	0	1	2	3	4
y	1·0	1·8	3·3	4·5	6·3

Hence find the difference between the actual value of y and the value of y obtained from the fitted curve when x = 3. *8*