No. of Printed Pages : 7

MCSE-004

MCA (Revised)

Term-End Examination

06321

June, 2017

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) Evaluate the relative error of the function $f = xy^2z^3$, if $x = 37{\cdot}1$, $y = 9{\cdot}87$, $z = 6{\cdot}052$ and $\Delta x = 0{\cdot}3$, $\Delta y = 0{\cdot}11$, $\Delta z = 0{\cdot}016$. 5

(b) Use the Newton-Raphson method to find the root of the equation $x^3 - 2x - 5 = 0$. 5

(c) Using the data $\sin(0{\cdot}1) = 0{\cdot}09983$ and $\sin(0{\cdot}2) = 0{\cdot}19867$, find the value of $\sin(0{\cdot}15)$ by Lagrange interpolation. Obtain the truncation error also. 5

(d) A taxi hire firm has two taxies 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 the day on which

(i) neither taxi is used, and

(ii) some demand is refused. 7

(e) Determine the constants a and b by the method of Least Squares such that $y = ae^{bx}$ fits the following data : 8

X	Y
2	4·077
4	11·084
6	30·128
8	81·897
10	222·62

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

(g) Evaluate $\int_0^1 \frac{dx}{1+x}$ using composite Trapezoidal rule with n = 2 and 4. 5

2. (a) Solve the initial value problem

$$\frac{dy}{dx} = y - x \text{ with } y(0) = 2 \text{ and } h = 0{\cdot}1$$

using fourth order classical Runge-Kutta method. Find y(0·1) and y(0·2), correct to four decimal places. 10

(b) An automobile engineer is investigating the effect of engine temperature on engine oil consumption. The study results show the following data :

Temp (°C)	Consumption (%)
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 lines fit well into the data or not. *10*

3. (a) Find the cubic polynomial using Newton's forward interpolation formula, which takes the following values : 7

X	f(X)
0	1
1	2
2	1
3	10

(b) Use Simpson's $\frac{1}{3}$ rule to find $\int_{0}^{0 \cdot 6} e^{-x^2} \, dx$

by taking seven ordinates. 6

(c) Solve the following differential equation by Euler's method :

$$\frac{dy}{dx} = \frac{y - x}{y + x}, \text{ given } y(0) = 1.$$

Find y approximately for $x = 0 \cdot 1$ in five steps. 7

4. (a) Solve the following system of equations using Gauss-Elimination method with partial pivoting : 7

$$x_1 + x_2 + x_3 = 6$$

$$3x_1 + 3x_2 + 4x_3 = 20$$

$$2x_1 + x_2 + 3x_3 = 13$$

(b) Find an approximate root of the equation $\sin x = \frac{1}{x}$; $x \in [1, 1{\cdot}5]$ (x is measured in radians). Carry out computations up to 3^{rd} stage, using Bisection method. 6

(c) Form a backward difference table for $y = \log x$ and determine the value of $\nabla^3 y_{40}$ from the table. The initial data to be used for generating the backward difference table is as follows : 7

X	Y
10	1·0000
20	1·3010
30	1·4771
40	1·6021
50	1·6990

5. (a) 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 ? 7

(b) Apply Gauss-Seidel iteration method to solve the following system of equations :

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Perform three iterations. 7

(c) A real root of the equation $f(x) = x^3 - 5x + 1 = 0$ lies in the interval (0, 1). Perform three iterations using Regula-Falsi method to obtain this root. 6