MASTER OF COMPUTER APPLICATIONS (MCA) (REVISED)

Term-End Examination

June, 2024

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) Determine the number of iterations required to obtain the smallest positive root of $x^3 - 2x - 5 = 0$ correct upto two decimal places, using Bisection Method.   5

P. T. O.

(b) Given $a = 0.41, b = 0.36$ and $c = 0.70$.

Prove $\dfrac{(a - b)}{c} \neq \dfrac{a}{c} - \dfrac{b}{c}$.   5

(c) Solve the following system of equations by using Gauss Elimination Method :   5

$$x + 4y - z = -5$$

$$x + y - 6z = -12$$

$$3x - y - z = 4$$

(d) Solve by Jacobi's Method, the following system of linear equations :   5

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

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

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

(e) Find the value $\int_0^{0.6} e^x \, dx$, taking $n = 6$, correct to five significant figures using Simpson's $\dfrac{1}{3}$ rule.   5

(f) Solve the IVP using Euler's Method $y' = 1 + y^2$, $y(0) = 1$. Find $y(0.2)$ taking $h = 0.2$. 5

(g) A bag contains 6 white and 9 black balls. 4 balls are drawn at a time. Find the probability for the first draw to give 4 white and the second draw to give 4 black balls in each of the following cases :

5

(i) The balls are replaced before the second draw.

(ii) The balls are not replaced before the second draw.

(h) Explain the concept of Accuracy and Precision variable with a suitable example. 5

2. (a) Write a short note on Rengula Falsi Method and the Secant Method. Use Regula Falsi Method to find the real-root of the equation $x^3 - x^2 - 2 = 0$. 10

(b) Evaluate the integral $I = \int_0^{\frac{\pi}{2}} \sin x\, dx$, using Gauss Legendre Formula. Compare the results with exact solution obtained by Simpson rule. The exact value of $I = 1$.   6

(c) How error differs from uncertainty. Briefly discuss the classification of errors.   4

3. (a) Solve the following systems of equations : 6

$$2x + 8y - 2z = -10$$
$$x + y - 6z = -12$$
$$6x - 2y - 2z = -18.$$

using LU Decompsition method.

(b) Calculate the value of the integral $\int_4^{5.2} \log x\, dx$ by using :   10

(i) Trapezoidal rule

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

(iii) Simpson's $\frac{3}{8}$ rule

(iv) Weddle's rule

(c) Write the pitfalls in the Gauss Elimination Method. 4

4. (a) Solve the initial value problem $\dfrac{dy}{dx} = y - x$ with $y(0) = 2$ and $h = 0.1$ using Fourth order classical Runge-Kutta Method. Find $y(0.1)$ and $y(0.2)$, correct to four decimal places. 10

(b) Find the smallest root of the equation $f(x) = x^3 - 6x^2 + 11x - 6 = 0$ by using Newton-Raphson Method. Give *two* drawbacks of Newton-Raphson Method. 10

5. (a) Given equations of two lines of regression are $4x + 3y + 7 = 0$ and $3x + 4y + 8 = 0$ find : 10

(i) Mean of x and mean of y

(ii) Regression coefficient of b_{yx} and b_{xy}

(iii) Correlation coefficient between x and y

(b) What do you mean by Pseudo-random number ? What is the practical advantage of the concept of random number generation ? 6

(c) Discuss any *two* of the following : 4

(i) Binomial distribution

(ii) Poisson distribution

(iii) Normal distribution