FACULTY OF ENGINEERING, UNIVERSITY OF LUCKNOW
Mid-Term Examination - 1
SEMESTER - III, 2023-24
CSE , AI

Student's Roll No. .....

Subject Code: CS-302 **Subject Title: Numerical & Statistical Techniques in CS**

Time: 1 Hrs. **Full Marks: 20**

Instructions: ***Attempt all sections.***

SECTION A

1. ***Attempt all of the following parts.*** **(1X5 = 5)**
   a) Write the formula for Muller's Method.
   b) Write the formula for Newton's Raphson method.
   c) Write the formula for Regula False Position method.
   d) The convergence in the Bisection method is Linear. (True or False).
   e) False position method has linear rate of convergence which is .....than that of the bisection method. (fill in the blank)

SECTION B

Answer any THREE parts from the following. **(5X3 = 15)**

2. Find the positive root of $x^4 - x = 10$ correct to three decimal places, using Newton-Raphson Method.
3. Evaluate the following (correct to four decimal places) by Newton's iteration method. (*i*) $1/\sqrt{14}$ (*ii*) $(30)^{-1/5}$
4. Find the root of the equation $\cos x = xe^x$ using the bisection method correct to four decimal places.
5. Find the real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to three decimal places.

FACULTY OF ENGINEERING AND TECHNOLOGY, UNIVERSITY OF LUCKNOW

Second Midterm

B.TECH. SEMESTER -III, 2023-24

Branches: CSE, CSE AI

Student's Roll No.....

Subject Code: CS-302 **Subject Title: Numerical and Statistical Techniques in CS**

Time: 1 Hrs. **Full Marks: 20**

Note: Attempt questions from each section as per instructions. The symbols have their usual meaning.

SECTION A

1. ***Attempt all parts of this question. Each part carries 1 mark.*** **(1 x5=5)**

a) State the Euler's formula for differential equation.

b) The value of n which is used to Waddle's Rule in Numerical Integration.

c) Formula for $\frac{d^2y}{dx^2}$ by Newton Forward Interpolation Formula.

d) Write down the Simpson's 1/3rd rule for solving $\int_0^2 y\ dx$ for h=0.05

e) Write down the Picard's Method of successive approximation for O.D.E.

SECTION B

Attempt any THREE questions of the following. Each question carries 5 marks. **(5 x 3=15)**

2. Find by Taylor's series method, the values of y at $x = 0.1, x = 0.2$ to five places of decimals from $\frac{dy}{dx} = x^2y - 1, y(0) = 1$

3. Apply Runge - Kutta method of 4th order, solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$ with $y(0) = 1$ at $x = 0.2$ *and* 0.4.(taking h=0.2)

4. Solve $\int_4^{5.2} log_e x\ dx$ by Trapezoidal Rule

5. From the following table given below, find $\frac{dy}{dx}$ & $\frac{d^2y}{dx^2}$ at 1.1

x	1.0	1.2	1.4	1.6	1.8	2.0
y	0	0.1280	0.5440	1.2960	2.4320	4

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B.Tech. (CS & AI) IIIrd Semester Examination, 2023

NUMERICAL AND STATISTICAL TECHNIQUES IN COMPUTER SCIENCE

Paper : CS–302

Time : 3 Hours] [*M.M. : 70*

Note :– Answer any *five* questions. All questions carry equal marks.

1. (a) Find the relative error in the function :

$$y = ax_1^{m_1} x_2^{m_2} \ldots\ldots\ldots\ldots x_n^{m_n}$$

(b) Find a real root of the equation $x \log x = 1.2$ by Regula-Falsi method, correct to four decimal places.

2. (a) Finding a root of the equation $x - \cos x = 0$, using the Bisection method to three decimal places.

(b) Find by Newton's method, the real root of $\sqrt{12}$.

3. (a) Find the missing values in the following table :

x	y
45	3.0
50	—
55	2.0
60	—
65	–2.4

(b) Show that :

(i) $\Delta \log f(x) = \log\left[1 + \frac{\Delta f(x)}{f(x)}\right]$

(ii) $\mu\delta = \frac{1}{2}(\Delta + \nabla)$

4. (a) Use Stirling's formula to evaluate $f(1.22)$, given :

x	$f(x)$
1.0	8.403
1.1	8.781
1.2	9.129
1.3	9.451

(b) The values of a function $f(x)$ are given below for certain values of x :

x	$f(x)$
0	5
1	6
3	50
4	105

Find the value of $f(2)$ using Lagrange's interpolation formula.

5. Find first, second derivatives of the following tabulated function at the point $x = 1.5$:

x	$f(x)$
1.5	3.375
2	7.0
2.5	13.625
3	24
3.5	38.875
4	59.0

6. Evaluate :

$$\int_2^{1.4} (\sin x - \log_e x + e^x)\, dx$$

by :

(i) Trapezoidal rule

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

(iii) Weddle's rule

7. (a) Using Taylor's series method obtain the solution of $\frac{dy}{dx} = x + y^2$ and $y = 1$, when $x = 0$. Find the value of y for 0.1, correct to four places of decimals.

(b) Using Picard's method, find a solution of $\frac{dy}{dx} = 1 + xy$ upto the third approximation, when $x_0 = 0$, $y_0 = 0$.

8. Use the Runge-Kutta fourth order method to find $y(0.2)$ with $h = 0.1$ for the initial value problem :

$$\frac{dy}{dx} = \sqrt{x+y}, y(0) = 1$$

9. Find the values of $u(x, t)$ satisfying the parabolic equation :

$$\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$$

and the boundary conditions $u(0, t) = 0 = u(8, t)$

and $u(x, 0) = 4x - \frac{1}{2}x^2$ at the points $x = i\,;\, i = 0,$

1, 2, ..., 7 and $t = \frac{1}{8}j, i = 0,1,2 \ldots\ldots$ 5.

10. Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = 0 = y$, $x = 3 = y$ with $\dot{u} = 0$ on the boundary and mesh length = 1.