MA-221(Numerical Analysis)
Course Instructor: Prof. Rajendra K. Ray
TA: Kajal Mittal, Niladri Bose
Lab Assignment-5
Date: 25/02/2025

Instructions:

- Answer all questions.

- Use the Newton-Raphson method to find the roots of the given equations.

- Ensure that the stopping criterion is set to an error tolerance of $\epsilon \leq 10^{-8}$.

- Implement your solutions in Python, MATLAB, and C++.

Questions

1. **Find the root of the equation:**

$$f(x) = e^x - 5x^2 + 2 = 0$$

   using the Newton-Raphson method. Take the initial guess $x_0 = 1$.

2. **Solve the equation:**

$$f(x) = \ln(x + 2) - \cos(x) = 0$$

   using the Newton-Raphson method. Use $x_0 = 0.5$ as the starting point.

3. **Determine a root of the equation:**

$$f(x) = x^3 - 4e^{-x} + 1 = 0$$

   using the Newton-Raphson method with an initial guess $x_0 = 1$.

4. **In optimization, the best learning rate η satisfies:**

$$f(\eta) = 50e^{-\eta} + 5\eta^3 - 30 = 0$$

   Find η using the Newton-Raphson method, with an initial guess $\eta_0 = 0.5$.

5. **Bonus Question:** Compare the results obtained using the Newton-Raphson method with the Fixed Point Iteration methods for any one equation.