INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

MA635P-Scientific Programming Laboratory

Lab Exercise-5 (21 Marks) Deadline: 13 February 2025, 5:00 PM

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1. Create an algorithm for Bisection method. [2.5]

2. Create an algorithm for Regula-Falsi method. [2.5]

3. Create an algorithm for Fixed Point Iteration method. [2.5]

4. Write a Python code for the developed for Bisection method and find the roots of the following equations. [5]

   (a) $x + 1 - 2\sin(\pi x) = 0, [0, 0.5]$

   (b) $x + 1 - 2\sin(\pi x) = 0, [0.5, 1]$

   (c) $x - \frac{1}{2^x} = 0, [0, 1]$

   (d) $e^x - x^2 + 3x - 2 = 0, [0, 1]$

   (e) $e^x - 2 = \cos(e^x - 2), [0.5, 1.5]$

5. Write a Python code for the developed for Regula-Falsi method and find the roots of the following equations **Caution**: Polynomials may have imaginary roots. [5]

   (a) $x^3 - 7x^2 + 14x - 6 = 0, [0, 1], [1, 3.2], [3.2, 4]$

   (b) $x^4 - 2x^3 - 4x^2 + 4x + 4 = 0, [-2, 1], [0, 2], [2, 3], [-1, 0]$

   (c) $x - \frac{1}{2^x} = 0, [0, 1]$

   (d) $e^x - x^2 + 3x - 2 = 0, [0, 1]$

   (e) $e^x - 2 = \cos(e^x - 2), [0.5, 1.5]$

6. Write a Python code for fixed point iteration method. Find all zeros (accurate within 10^{-5}) of $g(x) = x^2 + 10\cos x$ by using the fixed point method for appropriate iteration function f. **Caution**: You should find a self-map f such that $|f'| \leq k < 1$ for the method to converge. [3.5]