INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

MA635P-Scientific Programming Laboratory

Lab Exercise-6 (21 Marks) Deadline: 20 February 2025, 5:00 PM

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1. Create an algorithm for Newton-Raphson method. [2.5]

2. Create an algorithm for Secant method. [2.5]

3. Create an algorithm for Mullers method. [2.5]

4. Write a Python code for the developed for Newton-Raphson method and find the roots of the following equations. Use sympy to compute the derivative. [5]

   (a) $x + 1 - 2\sin(\pi x) = 0, x_0 \in [0, 0.5]$

   (b) $x + 1 - 2\sin(\pi x) = 0, x_0 \in [0.5, 1]$

   (c) $x - \frac{1}{2^x} = 0, x_0 \in [0, 1]$

   (d) $e^x - x^2 + 3x - 2 = 0, x_0 \in [0, 1]$

   (e) $e^x - 2 = \cos(e^x - 2), x_0 \in [0.5, 1.5]$

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

   (a) $x^3 - 7x^2 + 14x - 6 = 0, x_0, x_1 \in [0, 1], [1, 3.2], [3.2, 4]$

   (b) $x^4 - 2x^3 - 4x^2 + 4x + 4 = 0, x_0, x_1 \in [-2, 1], [0, 2], [2, 3], [-1, 0]$

   (c) $x - \frac{1}{2^x} = 0, x_0, x_1 \in [0, 1]$

   (d) $e^x - x^2 + 3x - 2 = 0, x_0, x_1 \in [0, 1]$

   (e) $e^x - 2 = \cos(e^x - 2), x_0, x_1 \in [0.5, 1.5]$

6. Write a Python code for fixed point iteration method. Find all zeros (accurate within 10^{-5}) of $g(x) = x^4 - 18x^3 + 111x^2 - 278x + 240$ by using the Mullers method for appropriate iteration function f. [3.5]