Name: **Registration No:**

Department of Physics, NITK

Even Sem, Jan 2025 - Apr 2025

MSc (2^{nd} Year), PH 755, Computational Physics

Assignment 2, Dated 06.02.2025. Submit it by 14-02-2025.

1. Consider the equation $x^3 - 2x + 2 = 0$
   (a) Solve this equation using Newton-Raphson. Start with an initial guess of 1. Write down the first 5 iterates. What is the solution?
   (b) Plot the function. Explain the behaviour seen in the previous part.
   (c) Identify approximate root, and solve it again. How many iterations does it take to arrive at the root with an accuracy of 10^{-8}
   (d) Now use Bisection method find the root. How many iterations does that take (start with $\delta_0 = 1$).
   (e) Compare your answer with the root finding algorithm available in scipy.optimize.
   Format:
   ```
   import scipy.optimize
   scipy.optimize.newton(function, x0, fprime)
   ```

2. Solve the equation $x\cos(x) - \sin(x) = 0$
   (a) Plot the function. What are the roots between [-20,20] approximately?
   (b) Find the roots using Newton Raphson with initial conditions 0, 2, 3, 3.8, 5. How many iterations did it take in each case?
   (c) Try this with your code and scipy.optimize.newton. Are results different? Explain the results.
   (d) Use a combined NR-bisection algorithm to find the roots. Compare the perfoance with the simple Newton Raphson.