Assignment 12. RK4 – 1st & 2nd order ODE Marks 10

Posted on 23.10.2025 @ 2:30 pm and due on 23.10.2025 @ 6:00 pm

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1. Use Runge-Kutta-4 method to solve and the following differential equation and compare with analytical form over the range $x \in [0, \pi/5]$. Use step sizes 0.1, 0.25, 0.45.

$$\frac{dy}{dx} = (x+y)^2 \quad \text{with} \;\; y(0) = 1 \quad \rightarrow \quad \tan^{-1}(x+y) = x + \frac{\pi}{4}$$

2. Use RK4 to solve the damped simple harmonic oscillator using the following initial values and parameters over a time range $[0, 40]$. Plot variation of x, v and total energy E with time t.

$$\ddot{x} + \mu\,\dot{x} + \omega^2 x = 0, \;\; \text{with} \;\; x(0) = 1.0, \; v(0) = 0.0 \;\; \text{and} \;\; k = 1.0, \; m = 1.0, \; \mu = 0.15$$