Perform the following tasks:

a) Find the range of the designed controller parameters for which the nonlinear chosen plant be stable, i.e., the maximum and the minimum values of k_p, k_i, k_d

b) According to the range of design parameters (k_p, k_i, k_d), choose suitable fuzzy membership functions for these parameters.

c) Design a fuzzy supervisory PI (or PID) controller for the system

d) Compare the performance of closed loop system with fuzzy supervisory PI (or PID) controller and traditional PI control scheme.