Series 10

Exercise 1

An unstable system has the following transfer function:

$$G(s) = G_{OC}(s)G_P(s)G_{OM}(s) = \frac{K}{(\tau_1 s + 1)(\tau_2 s - 1)}$$

Can this system be stabilized by a proportional controller? And by a PD controller?

Exercise 2

A process is described by the following differential equation:

$$\tau\dot{y}(t) + y(t) = Ku(t) \qquad y(0) = 0$$

a) Study the stability of this looped process using a PI controller.
b) What would be the effect of a pure delay of the process to be controlled on the stability of the closed system?

Exercise 3

Consider a semi-batch reactor in which A and B react to produce C. A is in excess in the reactor and B is added with a low volume flow rate q of concentration c_{B0}. Under these conditions, the volume of the reactor can be considered constant and the rate of the reaction proportional to c_B.

a) Evaluate the $C_C(s)/Q(s)$ transfer function.
b) Discuss the stability of the system.