WAT-E2130 EXAM 2 -- Process control June 07, 2023

Answer the following questions.

1. (4p) Explain the following control terms:
	1. Controlled variables.
	2. Manipulated variables.
	3. Disturbances.

Provide some practical examples related to wastewater treatment plants, specifying the instrumentation needed and their use in control loops.

1. (4p) Describe the typical elements of a feedback control loop and schematically include them in a block diagram. Present and discuss how a P feedback controller operates.
2. (6p) Figure 1 provides the process reaction curve (upper plot) resulting from a step-function change in the manipulated variable (lower plot). Answer to the following:
3. Given Figure 1, compute the parameters of process model in the form of $G\left(s\right)= \frac{Ke^{-αs}}{τs+1}$ .
4. Briefly explain the meaning of the parameters $K, α$ and $τ$.
5. Briefly explain how the model $G\left(s\right)$ can be used for tuning a PID controller.





Figure 1. Process reaction curve for question 3.

1. (6p) For controlling the plant schematically represented in Figure 2 you have the possibility of acquiring TWO sensors or analysers, answer to the following:
	1. Define the measuring instrumentation needed for the task, locate it into the plant. Identify the corresponding manipulated variables and define the corresponding control configuration.
	2. Define and justify reasonable values for the set-points of the controlled variables and a plausible range of operation for the manipulated ones.
	3. Discuss the possible effects of your control strategy on the plant performances, especially in terms of operating costs and effluent quality.



Figure 2. Plant layout for question 4