Question 1 (5 points)

Design a facultative lagoon for a temperate climate when the flow rate is 3800 m$^3$/d and the BOD$5$ is 200 mg/L. Use these steps:

a. Select a reasonable depth.
b. Calculate the surface area based on the BOD$5$ areal load.
c. Calculate the volume and hydraulic detention time.
d. Calculate the volumetric loading (kg BOD$5$/($1000$ m$^3$-day)).
e. If degradation in a facultative lagoon can be modeled as a first-order process with a degradation rate of 0.2 day$^{-1}$, what will be the effluent concentration from the lagoon?

Question 2 (5 points)

The aeration tank for a completely mixed aeration process is being sized for a design wastewater flow of 4500 m$^3$/d. The influent COD is 150 mg/L. The design effluent COD is 7 mg/L. Recommended design parameters are a sludge age of 10 days and MLVSS of 1400 mg/L. The expected Sludge Volume Index is 100 ml/g. Selection of these values takes into account the anticipated variations in wastewater flows and strengths. The kinetic constants from a bench-scale treatability study are $Y = 0.60$ mg VSS/mg COD and $k_e = 0.06$ per day.

Calculate:

a. the hydraulic residence time and volume of the aeration tank
b. the food/microorganism ratio
c. the sludge production rate
d. the sludge recycle ratio
e. the oxygen requirement.