CE 412 A: Water Supply & Wastewater Disposal Systems
Tutorial – 2022-23 II ● Part II: Wastewater Management
TUTORIAL 6 ● Tuesday, April 18, 2023

<u>Note:</u> Use the information and results of computations done in Tutorials 3, 4 and 5 to carryout exercises given in this tutorial.

Exercise 1: Estimate the underflow rate from Primary Sedimentation Tank (PST) if (i) TSS in the inlet is 150 mg/L, (ii) TSS removal efficiency is assumed as 60 %, and (iii) TSS concentration in the underflow is 1 %.

Exercise 2: Estimate the flow rate of thickened sludge and overflow from the thickener that is to be returned to the equalization tank if sludge from PST is thickened to 5 % solids concentration.

Exercise 3: Estimate the underflow rate from Secondary Sedimentation Tank (SST) based on the design done in Tutorial 5.

Exercise 4: Estimate the flow rate of thickened sludge and overflow from the thickener that is to be returned to the equalization tank if sludge from SST is thickened to 5 % solids concentration.

Exercise 5: Determine the size of the Anaerobic Digesters and Gas Domes for Thickened Sludge having 5 % solids produced separately from PST and SST in the STP designed using ASP in Tutorials 4 & 5. Assume that the COD of the sludge is 1.1 g/g of TSS and about 60 % reduction in COD occurs through gasification. θc for PST and SST sludge can be taken as 20 and 30 d. The minimum and maximum temperatures at the site are 15 and 40 ºC respectively.

Exercise 6: Area requirement for Sludge Drying Beds (SDB) is generally large and hence SDBs are provided only for a part of thickened sludge for emergency in case of failure of Centrifuge or Filter Press. Calculate the area requirement for sludge drying beds if 10 % of Primary and Secondary thickened sludge is applied to sludge drying bed. Assuming the water content of the sludge after drying to be 70 percent, determine the total weight of dried sludge per day and its density. Consider Drying time = 2 weeks; Solids loading to sludge drying bed = 1.5 kg solids (dry basis) /m^2/ cycle; Desired thickness of sludge cake = 20 cm; Minimum evaporation rate = 1 mm/day. Also calculate the flow rate of filtered liquid that is to be returned to the equalization tank.

Exercise 7: Design an oxidation pond for the IIT Kanpur (Latitude: 26°26'59.72"N, Longitude: 80°19'54.74"E, Elevation: 435 ft) to treat an estimate sewage flow of 4 MLD (Population of Campus = 20,000; Water Supply = 250 lpcd); Sewage generation = 80 % of water supply. Influent BOD: 100 mg/l. Desired Effluent BOD = 25 mg/l.