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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- MAY 2019

B. Tech 8th Semester

COURSE CODE: 14M31CE214 MAX. MARKS: 35

COURSE NAME: Process Design in Environmental Engg.

COURSE CREDITS: 03 MAX. TIME: 2 Hrs

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.* (***Assume any other necessary data suitably***)

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1. Design a facultative stabilization pond to treat 50000 m^3/day of municipal wastewater for a town (latitude 12 °N, elevation 400 m above MSL). Influent BOD_5 concentration 750 mg/L, influent faecal coliform concentration 10^8 / 100 ml. Average temperature in coldest month of the year 24 °C. Desired BOD_5 removal efficiency 97 %. Desired effluent faecal coliform concentration 1000 / 100 ml. **(7)**
2. Design a flow through aerated lagoon to treat a wastewater flow of 3800 m^3/d, including the number of surface aerators. The treated liquid is to be held in a settling basin with a 2 day detention time before being discharged. Assume the following conditions. Influent TSS 200 g/m^3, influent sBOD 200 g/m^3, effluent sBOD 30 g/m^3, effluent suspended solids after settling 20 g/m^3, Y = 0.65 g/g, Ks = 100 g/m^3, k = 6.0 g/g.d, k_d = 0.07 g/g.d for T = 20 to 25 °C. Total solids produced are equal to computed volatile suspended solids divided by 0.85. Soluble BOD removal rate constant k_{20} = 2.5 day^{-1} at 20 °C. BOD removal rate, $k_T = k_{20}\,(1.06)^{T-20}$, Summer air temperature = 30 °C, winter air temperature during coldest month = 6 °C, wastewater temperature during winter = 16 °C, wastewater temperature during summer = 22 °C, aeration constant: α = 0.85, β = 1.0, aerator oxygen transfer rate = 1.8 kg O_2/ kWh, oxygen saturation concentration = 8.0 g/m^3 (no temperature correction needed), oxygen concentration to be maintained in liquid = 1.5 g/m^3, lagoon depth = 3.3 m, design SRT = 5 day, power required for mixing = 8 kW/10^3/m^3. Conversion factor for BOD to COD = 1/1.6. **(13)**
3. Write brief notes on nitrification and denitrification process. **(4)**
4. Derive the mass balance solution for ideal flow in complete mix reactor and plug flow rector (Consider pulse input). **(4)**
5. Design an oxidation ditch. Assume following conditions: Wastewater flow = 0.15 m^3/capita/day, population = 40000, desired effluent BOD = 20 mg/L, TKN = 8 gms/ capita/day, BOD contribution = 45 gms/capita/day, sludge density index of return sludge = 1 %, F/M = 0.25 kg BOD/day/kg MLVSS, sludge decay co-efficient k_d = 0.12 day^{-1}, Y = 0.6, MLVSS = 2200 mg/L, suspended solids in effluent = 20 mg/L, assume 30 % of suspended solids as BOD contribution to total BOD in effluent. **(7)**