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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MID TERM (SUMMER SEMESTER EXAMINATION)- June-2017

M.Tech 4th Semester

COURSE CODE: 14M31CE214

MAX. MARKS: 50

COURSE NAME: Process Design in Environmental Engineering

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)

1. Design a flow through aerated lagoon to treat a wastewater flow of 3000 m³/d, including the number of surface aerators and their kilowatt rating. The treated liquid is to be held in a settling basin with a 2 day detention time before being discharged. Assume the following conditions and requirements: Influent TSS= 200 g/m³, Influent TSS are not degraded biologically, Influent soluble BOD= 200 g/m³, Effluent soluble BOD= 30 g/m³, Effluent suspended solids after settling= 20 g/m³, Kinetic coefficient: $Y = 0.65 \text{ g/g}$, $K_s = 100 \text{ g/m}^3$, $k = 6 \text{ g/g.d}$, $k_d = 0.07 \text{ g/g.d}$ for $T = 20^\circ\text{C}$ to 25°C . Total solids produced are equal to computed volatile suspended solids divided by 0.85. BOD removal rate constant, $k_{20} = 2.5 \text{ d}^{-1}$, 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 , Temperature coefficient $\theta = 1.06$, Aeration constant $\alpha = 0.85$, $\beta = 1.0$, Aerator oxygen transfer rate = $1.8 \text{ kg O}_2/\text{kwh}$, Elevation = 500 m, O₂ concentration to be maintained in liquid= 1.5 g/m^3 , Lagoon depth= 3 m, Design sludge retention time= 7 days, Power required for mixing= $8 \text{ kw}/10^3/\text{m}^3$, Proportionality factor, $f = 0.5$ (Assume any other necessary data suitably).
(10)
2. Design a two stage trickling filter to treat settled domestic sewage with a BOD₅ of 200 mg/L for an average flow of 10 MLD. Assume a peak factor of 2. The desired effluent BOD is 10 mg/L. Provide following information: (a) Volume and size of filter (b) Details of distributor for first stage filter.
(10)
3. A staged RBC system is to be designed using following data:
 - a. Inflow = 1000 m³/d, Influent BOD = 200 mg/L, Influent soluble BOD = 90 mg/L, Desired effluent BOD = 20 mg/L, Disk surface area of standard unit: 9300 m²
 - b. Desired effluent soluble BOD = 10 mg/L
 - c. Permissible organic loading : 4 – 10 g sBOD/m².d
8 – 20 g BOD/m².d
 - d. Maximum 1st stage organic loading: 12 -15 g sBOD/m².d
24 – 30 g BOD/m².d
(10)
4. Design a facultative stabilization pond to treat 4000 m³/d municipal wastewater for a town, latitude 12° N, elevation 350m above MSL. Influent BOD₅ concentration is 350 mg/l. Influent coli-form. Concentration is 10⁷/ 100 ml. Average temperature in coldest month of the year is 24° C. Desired BOD₅ removal efficiency 85%. Desired effluent coli-form concentration is 2000/ 100 ml. (Assume all other necessary data suitably).
(10)
5. (a) Difference between SRT and HRT (b) Objectives of secondary treatment (c) Types of trickling filter (d) Enumerate advantages and disadvantages of aerobic treatment of wastewater (e) Explain difference between conventional and extended aeration system.
(10)