B.E. CHEMICAL ENGINEERING FOURTH YEAR SECOND SEMESTER - 2022

Subject : ENVIRONMENTAL
BIOTECHNOLOGY   Full Marks : 70

Assume any missing data

1. Assuming suitable design criteria and following characteristics of domestic wastewater, design a upflow anaerobic sludge blanket reactor system to treat an average 5 MLD of wastewater. Assume up flow velocity is 0.5 m/h. Assume 80% BOD removal; for new cells production 20% of BOD removed and 50% fraction of influent VSS is as biodegradable; depth of reactor 6 m, 3 m depth of sludge blanket for 0.5 m/h upflow velocity. 60 kg/m^3 sludge concentration is in sludge blanket. Efficiency factor is 0.9. The reactor is rectangular shape and width is 17 m.

   Given data: Influent BOD   : 300 mg/l,
                   Influent COD   : 800 mg/l
                   Influent TSS   : 400 mg/l
                   Influent VSS   : 300 mg/l
                   Desired effluent BOD: 100 mg/l or less   [25]

or

Assuming suitable design criteria design a trickling filter to treat domestic wastewater flow of 7.5 MLD having influent BOD$_5$ is equal to 220 mg/L. The desired effluent BOD$_5$ is 25 mg/L or less. Maximum treatment efficiency of a single two stage trickling filter system is not more than 85%. Recirculation ratio 2.

[25]

2. It is proposed to design an activated sludge plant to treat 10 MLD of domestic wastewater, reducing the concentration of settled BOD$_5$ from 200 mg/L to 20 mg/L at 20C. Find the volume of aeration tank & hydraulic detention time if F/M=0.3d^{-1} and operating at 30 C temperature, X$_{MLVSS}$=3000mg/L,Q=2200m^3/d [Flow of activated sludge from the secondary settling tank]

[20]

Or

Assuming suitable criteria, design a facultative waste stabilization pond to treat 4 MLD flow of sewage having 300 mg/L BOD$_5$. Desired effluent BOD$_5$ is 30 mg/L. Assume BOD removal rate constant as 0.1 d^{-1} at 20 ^{0}C. The ponds are to operate at an altitude of 1000 m and 30^0 latitude in India. The wastewater temperature is 15 ^{0}C. Individual pond area and depth should not be more than 3 hectares and 1.5 m respectively. Organic loading rate is 182 kg BOD/ha/d. Hydraullic retention time 60 days on the basis of summer and winter conditions. Determine pond area, volume of pond, pond surface area and number of ponds.   [20]

[Turn over

3.   Briefly describe biosensors and its applications   **[10]**

Or

Briefly describe Bio-hydrometallury and its applications   **[10]**

4. For a new effluent treatment plant of a petrochemical Industry, which type of effluent treatment unit you suggest to be used (with brief description) and what will be the possible biodegradable product (with mechanism).   **[15]**