B.E. CHEMICAL ENGINEERING FOURTH YEAR FIRST SEMESTER - 2019

INDUSTRIAL POLLUTION CONTROL ENGINEERING

Time – Three hours   Full marks –100

Answer question number one and any three from the rest

Assume any missing data.

1. Answer the following question: (Any five)   [5 x 5 = 25]

    i)   Briefly describe bio-remediation and its application in wastewater treatment.

    ii)   Write down the property and environment impact of NO_2.

    iii) Briefly describe Buhler and Dano mechanical composting process.

    iv)   Write down the classification of solid waste.

    v)   Briefly describe cyclone collectors.

    vi)   Write down the effect of air pollution on human respiratory system.

2. Prove that for electrostatic precipitator $\eta = 1 - \exp(-(v_{pm} P L)/Q)$.   [10]

    A plate type electrostatic precipitator for use in a cement plant for removing dust particles consists of 10 equal channels. The spacing between the plates is 0.15 m, and the plates are 2 m high and 2 m long. The unit handles 10,000 m^3/hr of gas. What is the efficiency of collection? What should be the length of the plates for achieving 95% collection efficiency if other condition are the same. v_{pm} is 0.10.   [15]

3. Assuming the food to micro-organism ratio equal to 0.25 and hydraulic residence time (Volume/wastewater flow of 6 hours, compute a) volume of reactor, b) daily amount of BOD_5 fed to the reactor, c) the value of MLVSS (mg/L) to be maintained in the reactor of a conventional activated sludge plant designed to treat 5 MLD settled wastewater with 200 mg/L of BOD_5.   [15]

    What are the advantages and limitations of anaerobic treatment?   [10]

4. 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. Individual ponds should

not be more than 3 ha. Determine pond area, volume of pond, pond surface area and number of ponds.   **[25]**

5.   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 0.8. The reactor is rectangular shape and width is 17 m.

[25]

  Given data: Influent BOD : 300 mg/l,
        Influent COD : 700 mg/l
        Influent TSS : 400 mg/l
        Influent VSS : 300 mg/l
         Desired effluent BOD: 100 mg/l or less.