BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

Environmental Pollution Control (CHE F411)

Comprehensive Examination

Date – 05/12/2017 Maximum Time – 3 Hrs Marks – **40**

Part – A (Closed Book)

1. Explain with neat diagrams one method for measurement of NOx concentration in air and one method for total organic carbon measurement in waste water. [**2+2**]
2. Explain the difference between Type I, Type II and Type III sedimentation. The flow rate of waste water is 1 m^3/s containing particles which have a settling velocity of 0.7 cm/s. 90% of these particles are to be removed in the horizontal flow grit removal chamber. Determine the required surface area of the sedimentation tank. [**3+3**]
3. BOD_5 of a waste water sample is 200 mg/l. If the ultimate BOD of this waste water is 300 mg/l, what will be BOD_7 of this waste water? [**3**]
4. With neat figure and graph, explain three different modifications over the conventional activated sludge system for efficient utilization of oxygen in the aeration tank [**6**]
5. Define sludge volume index (SVI). Explain one method for removal of nitrogen from waste water. [**1+2**]
6. Classify the municipal solid wastes based on their moisture content and heating value. What are the different techniques followed for disposal of solid waste? [**3+1**]
7. What are the different treatment methods followed for hazardous wastes? [**3**]
8. Write the inverse square law relating radiation intensities. A hospital waste containing 100 μCi/L of ^{131}I is to be disposed of. How long must the radioisotope be held to meet the allowable discharge activity of 10^{-5} μCi/L?

   For I, $T_{1/2}$ is 8 days. [**2+3**]
9. Determine the sum of the following sound levels (all in dB): 65, 68, 70 and 67. Traffic noise data are shown in the table below: [**2+2+2**]

Time(s)	10	20	30	40	50	60	70	80	90	100
dB	65	60	70	72	68	64	75	62	78	74

Compute L_{60} and L_{eq}

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

Environmental Pollution Control (CHE F411)

Comprehensive Examination

Date – 05/12/2017 Time – 3 Hrs Marks – **40**

Part – B (Open Book)

1. Determine the minimum particle size which can be removed completely in a standard reverse flow cyclone having a barrel diameter of 1 m. What will be the percentage change in efficiency for the same particle size when the barrel diameter increases by 50%? The polluted air flow rate is 3 m^3/s, the temperature is 35^0C and the particle density is 1400 kg/m^3. [**5+5**]

2. The BOD results given below are observed on a sample of waste water at 20^0C:

T, days	0	2	5	10	20	35
BOD, mg/l	0	119	210	262	279	280

Waste water with the above characteristics flows (open to atmosphere) at 20^0C and at a velocity of 0.5 m/s with a flow depth of 1 m. if the dissolved oxygen content is 7 mg/l at the point of reference, what will be the dissolved oxygen concentration at a point 1 day distant from the point of reference? [**20**]

3. The effluent from a primary clarifier has the following characteristics:

Flow = $105 m^3/hr$; BOD_5 = 240 mg/l;

Growth constants:

K_s = 100mg/l; μ_m = 10 d^{-1}; k_d = 0.025 d^{-1}; Y = 0.8 mg VSS/mg BOD_5 removed; the design MLVSS is 3000 mg/l

This effluent is further treated in an activated sludge system in order to meet an effluent standard of 25 mg/l BOD_5 and 30 mg/l suspended solids (SS). Assuming that BOD_5 of the SS may be estimated as equal to 50% of the SS concentration, estimate the required volume of the aeration tank. [**10**]