B.E. CHEMICAL ENGINEERING FOURTH YEAR FIRST SEMESTER SUPPLEMENTARY EXAM 2018
INDUSTRIAL POLLUTION CONTROL ENGINEERING

Use a separate Answer-Script for each part

Time: Three Hours **Full Marks: 100**

Part-I
(50 Marks)

Answer any **5** questions

1. a) Explain the parallel plate precipitator.
   b) Before the installation of an electrostatic precipitator, the stack gas of a power plant contained 6.0 g particulates per m^3 of gas. The gas flow rate is 350 m^3/min and the new precipitator can remove 2500 kg particulates/day.
   1. What is the emission rate of particulates before and after pollution control in kg/day?
   2. What is the efficiency of the electrostatic precipitator?
   3. Will the new system meet an emission standard of 0.7 g/m^3? **5+5=10**

2. a) Explain with diagram the electrostatic precipitator used for controlling particulate contaminants.
   b) An electrostatic precipitator for use with standard air containing dust particles of 1.0 μm diameter is in the form of a cylinder 0.3 m diameter and 2.0 m long. The volumetric flow rate of air is 0.075 m^3/s. Compute the collection efficiency if the electric field strength is 100000 V/m and particle charge is 0.3×10^{-15} coulomb. [Given: $\mu_g = 1.81\times10^{-5}$ kg/m-s, Cunningham correction factor, $C = 1 + \frac{2\lambda}{d_p}\left(1.257 + 0.4e^{-0.55d_p/\lambda}\right)$]. **5+5=10**

3. a) Discuss briefly thermal incineration and catalytic oxidation of gaseous pollutants.
   b) A conventional cyclone with diameter 1.0 m, air entrance height 0.5 m and width 0.25 m, handles 3.0 m^3/s of standard air of viscosity 1.81×10^{-5} kg/m-s. Using, effective number of turns a gas makes in traversing the cyclone, Ne=6, determine the cut-size and the collection efficiency as a function of particle diameter for particles of density 2000 kg/m^3. **5+5=10**

4. a) Describe the microflocculation and macroflocculation.
   b) Assume that 40 kg of a) alum (mol. wt. 666.5) and b) ferrous sulfate and lime as $Ca(OH)_2$ is added per 4000 m^3 of waste water. Also assume that all insoluble and very slightly soluble products of the reactions, with the exception of 15 g/m^3 $CaCO_3$, are precipitated as sludge. How many kg of sludge/1000 m^3 will result in each case? **5+5=10**

5. a) Classify the solid waste.
   b) Write the advantages and disadvantages of sanitary landfilling methods.
   c) Describe with suitable sketches the different phases of refuse stabilization. **2+3+5=10**

6. a) Classify the disposal methods of solid waste.
   b) Write the different methods of composting of solid waste.
   c) Explain the Indore and Nusoil processes for composting of solid waste. **2+3+5=10**

Ref. No. : Ex/ChE/T/413/2018(S)

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INDUSTRIAL POLLUTION CONTROL ENGINEERING

Time – Three hours **Full marks –50**

Use separate answerscript for Part I and Part II

Part II

Answer any two questions

1. Calculate the BOD removal efficiency for the single stage high rate trickling filter. BOD loading is 700 g/m^3/d and recirculate ration is 0.60. **[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]**

2. i) What is activated sludge process? Briefly describe. **[10]**

   ii) Calculate the volume of an oxidation ditch to treat the flow from a community of population 800. The sewage flow rate is 100l/head/d. The BOD of the effluent is 300 mg/L. MLSS concentration is 4000 mg/L and decay ratio is 0.025 per day, Y=0.5 and solids retention time is 20 days. The effluent BOD should not exceed 20 mg/l. **[10]**

   Write down the factors affecting biodegradation. **[5]**

3. **I)** A sanitary landfill is being designed to handle solid waste generated by a tank having a population of 1,00,000. The waste generation on the average is 0.2 kg/person/day. It is expected that the waste will be delivered by a truck to the landfill site on a 5 day/week basis. The men density of the refuse spread is 100 kg/m^3. The solid waste is spread in 1.5 m layers and compacted to 0.3 m. the landfill will use 0.15 m of soil for daily cover. An intermediate cover of soil of 0.2 m is used to complete the cell and a final cover 1.0 m over the stack of 2 cells is recommended. Calculate a) annual volume required for the landfill. B) annual horizontal area covered by the solid waste **[15]**

   ii) Briefly describe bag filters and its advantage **[10]**