Thapar University, Patiala - 147004
End Semester Examination (2nd Semester, 2008-09)
M.Tech (Environmental Sciences & Technology)
Time: 03 hours EN-113: Industrial Wastewater Management
Marks: 50

Note: Attempt any FIVE full questions.

1. a) What are the sources and nuisance potential of
   i) Thermal water  ii) Acids/alkalies in receiving waters?
   b) Add notes on i) Significance of byproduct recovery
   ii) Milk and various milk products associated with dairy
   c) Define flocculant suspension. Explain the settling of
      flocculant particles. (3, 3, 4)

2. a) What is the need for hardness removal from industrial
    water? Explain the lime-soda method used.
    b) Water containing 2.5 moles of Calcium bicarbonate and
       1.5 moles of Calcium Sulfate is softened using lime and soda.
       How many grams of Calcium carbonate solids are produced
       using a) the method of equivalent weight b) the balanced
       equations. (4, 6)

3. a) Explain the wastewater treatment options of sugar
    industry.
    b) Explain the working and flow diagram of combination
       of UASB reactor and activated sludge system. (5, 5)

4) Distinguish between
   i) Municipal sewage and industrial wastewater
   ii) Pathogens and non-pathogens
   iii) Preventive maintenance and corrective maintenance
   iv) Screening and skimming (2, 3, 4)

5) a) What are the objectives involved with treatability studies
    of wastewater samples in the laboratory? By quoting a
    treatability study, discuss the type of data generated from
    it and its further applications. (P.T.O)
b) A stream with flow 0.6 m$^3$/s and pollutant level 8 mg/L receives an industrial wastewater with flow 10 million litres per day and pollutant level 125 mg/L. Permitted standard for treated effluent and in stream for the pollutant are 20 mg/L and 2.5 mg/L. Propose the degree of waste treatment to satisfy i) Effluent standard system ii) Stream standard system.

c) Why are the pesticide residues considered harmful in water and wastewater? Discuss a few removal techniques applicable to pesticides.

(3,3,4)

6) a) What are the methods adopted for treating soluble organics from industrial waste? Explain the mechanisms associated with i) wet combustion process ii) Biodisc system.

b) Discuss the principles involved with the following sludge treatment methods -
   i) Sludge thickening ii) Sludge Elutriation

c) The data shows the operation of an anaerobic digester.
   - Volume of digester = 2 m$^3$
   - Working volume = 90 percent
   - Feed loading rate = 4/1.
   - Volatile solids in feed = 85 percent
   - Gas generation = 2100 litres per day
   - Methane content in gas = 55 percent
   - Efficiency of feed digestion = 50 percent

   Calculate i) Gas production in m$^3$/kg VS added
   ii) Methane production in m$^3$/kg VS added
   iii) Quantity of digested sludge produced in kg/day

(4,3,3)

The secret of success is... work...
   ... work...
   ... work...