Major Examination, CEL 796
Department of Civil Engineering, I I T, Delhi
09 May, 2007

Time: 120 minute | Maximum Marks: 100

1. Explain why the yield changes as the growth rate changes. [10]

2. Explain why the TOC tells nothing about the pollution potential of an organic compound [10]

3. The specific growth rate of a bacterial culture can be characterized by the Monod equation. The culture is being grown in a reactor in which the specific growth rate can be held constant at a value of 0.15 hr-1. Determine the substrate concentration for each of the following situations:
   a. μ_m = 0.60 hr^{-1}, Ks = 200mg/L
   b. μ_m = 0.25 hr^{-1}, Ks = 50mg/L

   Also determine in which (if any) of the situations the use of the first order approximation would be justified.

   [15]

4. It is required that a wastewater flow of 2 mld with a strength of 300 mg/L BOD_5 be treated to remove 90% of the BOD_5. To achieve this, a 8 m deep filter will be constructed and plastic media will be used. A treatability study has shown that n=0.5 and Ko = 0.25 min^{-1} at 20 °C. If the critical wastewater temperature is expected to be 10°C, what size filter should be required? Recirculation will not be used.

   [15]

5. Discuss the role that hydrogen plays in determining the nature of the soluble end products formed by the nonmethanogenic bacteria.

   [10]

6. Discuss the relative merits of lime and soda ash for pH control in an anaerobic reactor [10]

7. Three PFR's are available for an aqueous reaction of first order. The reactor volumes are 10, 20 and 30 liters. Determine the arrangement which gives the minimum effluent concentration. Feed containing 15 mol/liter of A is available at 10 liters/hr. The rate constant k =1.3 hr^{-1}. Determine also the effluent concentration.

   [15]

8. Design a Constructed Wetland based sewage treatment plant for a small town located in the state of Haryana. This town has a population of 12000 persons. The expected BOD_5 of the wastewater is 180 mg/L.

   What would be the annul consumption of the bleaching powder for this plant if the wastewater is to be disinfected before the final disposal. [15]