16318(D)   - 1 DEC 2016

M. Tech 1st Semester Examination

Advanced Waste Water Treatment

WRE-111

Time : 3 Hours   Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Discuss the relative merits of the separate and the combined system of sewage, and give the conditions favourable for the adoption of each one of them.   (10)

   (b) The following observations were made on a 3% dilution of waste water.
   Dissolved oxygen (DO) of aerated water used for dilution = 3 mg/l
   Dissolved oxygen (DO) of diluted sample after 5 days incubation= 0.8 mg/l
   Dissolved oxygen (DO) of original sample= 0.6 mg/l
   Calculate the BOD of 5 days and ultimate BOD of the sample assuming that the deoxygenation coefficient at test temp is 0.1.   (10)

2. Data from a unseeded domestic waste water BOD test are:
   5 ml of waste in 300 ml bottle, initial DO of 7.8 mg/l and 5 days DO equal to 4.3 mg/l, compute
   (a) BOD
   (b) Ultimate BOD
   Assuming a k-rate of 0.10 per day   (20)

SECTION - B

3. (a) Design a suitable rectangular tank (provided with mechanical cleaning equipment) for treating the sewage from a city, provided with an assured public water supply system, with a maximum daily demand of 12 million litres per day. Assume suitable values of detention period and velocity of flow in the tank. Make any other assumption, wherever needed.   (10)

   (b) With the aid of sketches, describe the principle involved in the design and construction of the following: (1) Grit chamber (2) Sludge digestion tank (3) Imhoff tank.   (10)

4. Determine the size of a high rate trickling filter for the following data:

   (i) Sewage flow = 4.5 Mld

   (ii) Recirculation ratio = 1.5

   (iii) BOD of raw sewage = 250 mg/l

   (iv) BOD removal of primary tank = 30%

   (v) Final effluent BOD desired = 30 mg/l   (20)

SECTION - C

5. (a) Differentiate between aerobic and anaerobic treatments of sewage, giving major end products. Describe one treatment method in each category.   (10)

   (b) What do you understand by digestion of sewage sludge? Give a neat sketch of separate digestion tank and explain its working.   (10)

6. Design the activated sludge units for the following data:

Population served = 50, 000

Average sewage flow = 180 lpcd

BOD of raw sewage flow = 200 mg/l

Raw sewage suspended solids = 300 mg/l

BOD removal in primary treatment = 35%

Overall BOD reduction desired = 80%　　　　　(20)

SECTION - D

7. (a) Explain the following processes in detail: (1) Reverse osmosis (2) Ultra filtration (3) Electro dialysis (4) Desalination.　　　　　(10)

(b) Describe the principle of tertiary treatment and adsorption and the factors effecting adsorption.　　　(10)

8. (a) Explain the importance of determination of solids in sewage. How do you determine the suspended solids in a given sample of waste water? Explain the methods of dissolved solid removal from waste water.　　(15)

(b) What are various methods to remove dissolved solids?
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SECTION - E

9. Write short notes (in about 50 words) on the following:

(1) Grit Chambers　　　(2) Cesspool

(3) Dispersion trenches　(4) Imhoff tank

(5) Sludge digester tank　(6) Septic tank

(7) Oxidation ditch　　　(8) Oxidation pond

(9) Sludge drying　　　(10) COD　　(10×2=20)