Paper Code: ENV 13

Roll No.										

M. TECH.
(SEM I) ODD SEMESTER EXAMINATION, 2015-16
WASTE WATER TREATMENT

[Time:-3 Hours] [Max Marks: 100]

Note: Attempt All Questions. All Questions carry equal marks. Assume any data suitably, if required:-

1. **Attempt any FOUR parts of the following: [5x4=20]**
   a. What are water borne diseases? Enumerate the name of important water borne diseases caused by bacteria/ virus along with name of bacteria/ virus and describe how you would control these diseases?
   b. What is the effect of pH on wastewater treatment? In a wastewater treatment plant, the pH values of incoming and outgoing waters are 7.2 and 9.4 respectively. Assuming a linear variation of pH with time, determine the average pH value of water.
   c. What are B-coli and E-coli? Why E-coli is used as indicator organism?
   d. Define the term population equivalent. Calculate the population equivalent of a city given that average sewage from city is $95x10^6$ liters per day and the average 5-day BOD is 300 mg/L.
   e. What is the difference between COD and ThOD. What is the significance of BOD/COD ratio and COD/TOC ratio?
   f. Data from an unseeded domestic wastewater BOD test are: 5 mL of waste in 300 mL bottle, initial DO of 7.8 mg/L, and 5-day DO is 4.3 mg/L. Compute BOD for 5 days at 27°C and Ultimate BOD, assuming deoxygenation constant as 0.1 at 20°C.

2. **Attempt any TWO parts of the following: [10x2=20]**
   a. Define various types of Settling. A rectangular grit chamber is designed to remove particles with a diameter of 0.2 mm, specific gravity 2.65. Settling velocity for these particles has been found to range from 0.016 to 0.022 m/sec, depending on their shape factor. A flow through velocity of 0.3 m/sec will be maintained by proportioning weir. Determine the channel dimensions for a maximum wastewater flow of 10,000 cu m/day.
   b. How will you determine the optimum dose of coagulant by JAR test? Design a suitable rectangular sedimentation tank for treating the city, with a maximum daily demand of 12 MLD. Make suitable assumptions where needed.
   c. Define the term settling velocity. In a continuous flow settling tank 3 m deep and 60 m long, what flow velocity of water would you recommend for effective removal of 0.025 mm particles at 25°C. The specific gravity of particles is 2.65 and kinematic viscosity of water is $0.01 cm^2/s$.

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3. Attempt any TWO parts of the following: [10x2=20]

a. Explain self-purification of streams and indicate how sun-light helps in such purification. Draw a neat labeled diagram of stratified lake showing Biological zones in the lake.

b. Discuss the working of Contact Beds and Intermittent Sand Filter.

c. Write short notes on the following:

(i) Oxygen Sag Curve (ii) Breakpoint chlorination (iii) Sewage Sickness

4. Attempt any TWO parts of the following: [10x2=20]

a. Determine the size of a high rate trickling filter for the following data: sewage flow=5 MLD, recirculation ratio=1.4, BOD of raw sewage=250 mg/L, BOD removed in primary tank=30% and final effluent BOD desired=35 mg/L.

b. Distinguish between Primary treatment and secondary treatment of wastewater. Draw the flow diagram for sewage treatment using activated sludge process.

c. An average operating data for conventional activated sludge plant is as follows:

- Wastewater flow=36000 m^3/d
- Volume of aeration tank=1100 m^3
- Influent BOD=240 mg/L
- Effluent BOD=25 mg/L
- Mixed Liquor Suspended Solids (MLSS)=2400 mg/L
- Effluent suspended solids=30 mg/L
- Waste sludge suspended solids=9600 mg/L
- Quantity of waste sludge=230m^3/d

Based on information above determine:

a. Aeration period(hrs)
b. Food to microorganism ratio(F/M) (kg BOD per day /kg)
c. Percentage efficiency of BOD removal
d. Sludge age (days)

c. Write short notes on following:

(i) RBCs (ii) Extended aerated lagoons (iii) Mechanically Aerated Lagoons

5. **Attempt any two parts of the following: [10x2=20]**

a. Explain briefly UASB with suitable diagram. Also define the different units and its function.

b. (i)Write short note on duckweed pond for waste water treatment.

(ii)Describe briefly fluidized bed and expanded bed reactor.

c. Discuss septic tank and what are its advantages and disadvantages. Design a septic tank for the

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following data: No. of people=100, sewage/capita/day=120 litres, de-sludging period=1 year, L: B=4:1.

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