

**B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING FOURTH YEAR,
SECOND SEMESTER EXAM 2022**

WASTE TREATMENT ENGINEERING

Full Marks: 70

Use Separate Answer scripts for each Part

Time: 4 hr

PART: I (35 Marks)

Group A

Answer any one question

5×1 = 5

1. What is the purpose of providing primary sedimentation tank in wastewater treatment? What is the expected BOD and SS removal in primary sedimentation tank?
2. What is the working principle of an activated sludge reactor? Why it is called so?

Group-B

Answer any two questions

15×2 = 30

3. Write short note on any three

3×5 = 15

- (i) Vermicomposting
- (ii) Stages of biogas production
- (iii) Incineration
- (iv) Purpose of primary treatment
- (v) Trickling filter

4. (a) What are the different design aspects of aerobic composting?

(b). The data given here are for the anaerobic digestion of an industrial solid waste whose solid concentration is high: organic fraction of SW, i.e., TS (Total solids) = 1.6t, moisture content in TS = 25%, digestion period = 30 days, VS = 93% of TS, BVS = 75% of VS, expected BVS conversion efficiency = 95%, gas production = 0.5 m³/kg of BVS destroyed, energy content of biogas = 18,630 kJ/m³ = 4440 kcal/m³, kerosene equivalent of biogas = 0.62 L/m³, price of kerosene = Rs. 50000/kl. Determine the volume of gas produced from 1.6 t of organic solid waste, energy content of the gas, and its market value.

5+10 = 15

5. (a) What is the purpose of special treatment in waste management?

(b) A fruit and vegetable processing unit generates 1 t of solid waste that needs to be stabilized aerobically. Estimate the amount of oxygen required to oxidize the waste.

It may be assumed that the initial composition of the biodegradable organic material to be decomposed is [C₆H₇O₂(OH)₃]₅ and final composition of the residual organic matter is [C₆H₇O₂(OH)₃]₂. After the oxidation process, 40% of the material is available as compost.

3+12 = 15

[Turn over

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SECOND SEMESTER – 2022**

Subject : WASTE TREATMENT ENGINEERING Time : 4 hr Full Marks : 70

Part- II (35 Marks)

Use Separate Answer scripts for each Part

Answer any five questions:

7x5=35

1. What do you mean by the total solid content of waste water? How the total solid content of wastewater can be further classified? What is the difference between volatile suspended solid and fixed suspended solid? 1+3+3=7
2. What do you mean by BOD_u ? Deduce a relationship between BOD_5 and BOD_u . 2+5=7
3. What are the different steps of nitrification process of wastewater. How the nitrification process is related to the oxidation of carbonaceous matter -explain with a curve. 2+5=7
4. Explain the Role of $HgSO_4$ and Ag_2SO_4 in COD estimation process. 3.5+3.5=7
5. Draw a growth characteristic pattern for single species batch culture and deduce the kinetics of different phases. 7
6. Explain the effect of seed acclimation and presence of algae on BOD test. 3+4=7
7. Deduce a general expression for calculation of BOD. Using that expression find out the BOD value a 10 ml wastewater taken in a 300 ml bottle filled up with dilution water. The control bottle and sample bottle were incubated at 20 °C for 5 days. Initial DO of the sample= 2.5 mg/L, DO of blank= 8.5 mg/L, DO of the sample at the end of experiment= 3.5 mg/L. 5+2=7