

2123

M. E. (Bio-Technology)
Third Semester

ME-BIO-302 (a): Biological Waste Water Engineering

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section. State clearly your assumptions.

x-x-x

- 1) Write briefly: (2×5=10)
- a) Chemical and biological pollution.
 - b) Waste to energy.
 - c) Bioremediation.
 - d) Biosorption.
 - e) Oxidation Ponds.

SECTION – A

- 2 a) The ultimate BOD of a wastewater sample is estimated as 87% of COD. The COD of this waste water is 300mg/L. Considering first order BOD reaction are constant ($k= 0.23$) per day and temperature coefficient $\theta=1.047$, Calculate BOD value after three days of incubation at 27°C for this wastewater.
- b) Define BOD, Ultimate BOD and COD. Write a kinetics and significance for the estimation of BOD Test. (5, 5)
- 3.a) Explain the following:
- i) Waste water characteristics.
 - ii) Purpose of sedimentation in sewage treatment.
 - iii) Methods of waste water treatment. (2× 3= 6)
- b) An industrial waste with an inlet BOD₅ of 800 mg/L must be treated to reduce the exit BOD₅. The inlet flow rate is 400 m³ /hr. the kinetic parameter have been estimated for waste as $\mu_m=0.20 \text{ hr}^{-1}$, $K_s= 50 \text{ mg/L}$ of BOD, $Y_{X/S}=0.5 \text{ g of cell/g of BOD}$ and $K_d = 0.005 \text{ hr}^{-1}$. A waste treatment unit of 3200 m³ is available. If you operate at a value of $\Theta_c = 120 \text{ hr}$. If the BOD removal is attained in well-mixed activated sludge process.
- Find:
- i) Substrate concentration (S) in reactor.
 - ii) Cell mass concentration (X).
 - iii) Food to microorganism ratio (F/M).
 - iv) Utilization rate (U). (4)

- 4.a) Design a trickling filter to treat waste water released from fruit-processing unit. The following data are given:

Flow rate of waste water = 35,000 m³/d
Influent BOD = 550 mg/L
Effluent BOD = 25 mg/L
Temperature Data: a) summer = 30°C
b) Winter = 15°C

The following data have been experimentally determined:

BOD removal rate constant at 25°C = 0.1 d⁻¹
Temperature correction coefficient = 1.08
Specific area of conventional filter packing material = 100 m³/ m²
Filter height = 12 m
Any other data may be assumed if required, give reasons.

Contd.....P/2

(2)

- b) Discuss activated sludge process and trickling filter with neat and clean diagram and explain merit and demerit of ASP and TF. (4, 6)

SECTION - B

- 5) Describe the merits and demerits about anaerobic waste water treatment and discuss the mechanism of anaerobic treatment processes. Explain anaerobic digester with neat and clean diagram. (10)

- 6.a) Explain biogas production and discuss the factors affecting on biogas production.

- b) Explain *In situ* and *Ex situ* bioremediation with suitable examples. (4)

- 7) Write a notes on:

- a) UASB.
- b) Biosorption of heavy metals.
- c) Bio augmentation.
- d) Bio-filtration.

(2½ × 4 = 10)