

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2455

Roll No.

B. Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

ENVIRONMENTAL ENGINEERING—II

Time : 3 Hours

Total Marks : 100

Note : Attempt *all* questions and assume suitable value of parameters, if not given in questions.

1. Attempt any *four* of the following : (4×5=20)
 - (a) How are the organic contents measured in waste water samples ? Discuss any one method in detail.
 - (b) Discuss advantages and disadvantages of BOD and COD test.
 - (c) What is the maximum permissible limit of nitrate in drinking water ? Also discuss the detrimental effects of excess nitrate.
 - (d) What is M.P.N. ? How it is measured ?
 - (e) What is Theoretical Oxygen Demand (ThOD) ? Determine the ThOD for Glycine ($\text{CH}_2(\text{NH}_2)\text{COOH}$).
 - (f) What size of sample expressed as a percent is required if the 5 day BOD is 400 mg/l and the total oxygen consumed in the BOD bottle is limited to 2 mg/l ?

2. Attempt any *two* of the following : (2×10=20)
 - (a) Define :
 - (i) Discrete Particles

- (ii) Flocculating Particles
 - (iii) Dilute Suspension
 - (iv) Concentrated Suspension.
- (b) Describe the four functional zones of long-rectangular settling tank.
- (c) Name and discuss the four mechanisms thought to occur during coagulation.

3. Attempt any *two* of the following : (10×2=20)

- (a) A rapid sand filter has a bed depth of 0.7 m. It is composed of sand grains that have a specific gravity of 2.65 and shape factor of 0.82. The porosity of the bed is 0.45 throughout. The sieve analysis of the sand is shown below :

Sieve No.	Mass retained (%)	Average particle size mm
1	0.87	1.0
2	8.63	0.71
3	21.30	0.54
4	28.10	0.46
5	23.64	0.38
6	7.09	0.32
7	3.19	0.27
8	2.16	0.23
9	1.02	0.18

Determine the head loss through the bed if the flow rate is 5.0 m/s and water temperature is 17°C.

- (b) Design rapid gravity filter for producing a net filtered water flow of 250 m³/hr. The relevant data is :
- (i) Quantity of back wash water used = 3% of output
 - (ii) Time lost during back washing = 30 minutes

- (iii) Design rate of filtration = $5 \text{ m}^3/\text{m}^2/\text{hr}$
 - (iv) Length to width ratio = 1.25 – 1.33 : 1
 - (v) Under drainage system = central manifold
 - (vi) Size of perforations = 9 mm
- (c) Design a secondary circular sedimentation tank to remove alum floc with following data :
- (i) Average output from settling tank = $250 \text{ m}^3/\text{hr}$
 - (ii) Amount of water lost in desludging = 2%
 - (iii) Average design flow = $255.1 \text{ m}^3/\text{hr}$
 - (iv) Minimum size of alum floc to be removed = 0.8 mm
 - (v) Sp. gr. of alum floc = 1.002
 - (vi) Expected removal efficiency = 80%
 - (vii) Assumed performance of settling = very good
($h = 1/8$)
 - (viii) Kinematic viscosity of water at $20^\circ\text{C} = 1.01 \times 10^{-6} \text{ m}^2/\text{s}$
4. Attempt any *two* of the following : (2×10=20)
- (a) Design a facultative aerated lagoon to serve 40,000 people. For sewage flow @ 180 lpcd = 7200 cu.m/day. Raw $\text{BOD}_5 = 277 \text{ mg/l}$ and final BOD_5 is not to exceed 30 mg/l in winter. Average ambient air temperature in January is 18°C and in summer 37°C . 10
 - (b) Design a facultative stabilization pond to treat $5000 \text{ m}^3/\text{d}$ municipal wastewater, BOD_5 230 mg/l, from a town (population 25,000 persons) located in Central India, latitude 22-N, elevation 100 m above sea level. The average temperature is 18°C . The effluent from the pond is to be used for irrigation. 10
 - (c) (i) Discuss various modifications of activated sludge process (ASP). Also explain role of F/M ratios in ASP. 5
 - (ii) Write and explain NRC's and Eckenfelder's equation for Trickling filter.

5. Answer any *four* of the following : (4×5=20)
- (a) Write various steps involved in Anaerobic process. At which step the alkalinity will be maximum ?
 - (b) What are low rate and high rate anaerobic digesters ?
 - (c) What is UASBR ? Draw a schematic diagram of a UASBR reactor.
 - (d) Write short notes on Duck weed pond.
 - (e) Discuss nutrients removal in wastewater a tertiary treatment.
 - (f) What is septic tank ? Discuss advantages and disadvantages of centralized vs. decentralized wastewater treatment.