Code : 011723

B.Tech.7th Semester Special Examination,2016

Environmental Engineering-II

Time : 3 hours *Full Marks : 70*

Instructions :

*(i) There are **Nine** questions in this paper.*

*(ii) Attempt **Five** questions in all.*

*(iii) **Questions No.1 Is Compulsory.***

(iv) The marks are indicated in the right hand margin.

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1. Choose the correct option. Answer any seven. 2×7=14

I. Oxygen consuming property of the waste water expressed in terms of oxygen that consumed biochemically is

(a) BOD

(b) COD

(c) TOC

(d) All

II. Eutrophication is

(a) An improved quality condition of water bodies

(b) A process of carbon cycle in water bodies

(c) Accumulation of plant nutrients in water bodies

(d) Accumulation of pollutants including heavy metals in water bodies.

III. The average time in days for which biomass are retained in the biological reactor is

(a) Mean cell residence time

(b) Hydraulic retention time

(c) Over flow rate

(d) F/M ratio

IV. In anaerobic process, conversion of higher molecule compound into lower compound is known as

(a) Hydrolysis

(b) Acidogenesis

(c) Methanogenesis

(d) None of above

V. The main objective of secondary treatment of municipal wastewater

(a) Removal of BOD

(b) Removal of pathogens

(c) Removal of plant nutrients

(d) All

VI. The sum of ammonia nitrogen and organic nitrogen is

(a) Nitrate nitrogen

(b) Total nitrogen

(c) Kjeldahl nitrogen

(d) None of above

VII. A wastewater treatment unit has dimension 1.5 m wide, 20.0 m long and maintaining wastewater depth 2.0 m. If the wastewater flow through the unit is 0.5 m^3/s, calculate the detention time

(a) 20 seconds

(b) 0.2 minutes

(c) 2 minutes

(d) 2 hours

VIII. The correct relation between theoretical oxygen demand, Biochemical oxygen demand and chemical oxygen demand is

(a) TOD>BOD>COD

(b) TOD>COD>BOD

(c) BOD>COD>TOD

(d) COD>BOD>TOD

IX. For a given discharge efficiency of sedimentation tank can be increased by

(a) increasing depth of tank

(b) decreasing depth of tank

(c) increasing surface area of tank

(d) decreasing surface area of tank

X. The food to microorganism ratio in activated sludge process is defined as

(a) $S_i/\Theta X$

(b) $\Theta S_i/X$

(c) $Si/Q \Theta$

(d) $\Theta/X S_i$

Where S_i = inflow BODS, Θ =hydraulic detention time, X=concentration of biomass in aeration tank

2. What do you understand by sewer appurtenances ? List their name and discuss each with the help of neat sketches. 14

3. (a) List the various physical characteristics of sewage.

(b) Calculate 1 day 37°C BOD of sewage sample whose 5 day 20°C BOD is 100 mg/L. Assume K_D at 20°C=0.1. 3+11

4. (a) Differentiate between mean cell residence time and hydraulic detention time.

(b) An activated-sludge system is to be used for secondary treatment of 10,000 m^3/d of municipal wastewater. After primary clarification, the BOD is 150 mg/L, and it is desired to have not more than 5 mg/L of soluble BOD in the effluent. A completely mixed reactor is to be used, and pilot-plant analysis has established the following kinetic values: Y = 0.5kg/kg, k_d=0.05d^{-1}. Assuming an

MLSS concentration of 3000 mg/L and an underflow concentration of 10,000 mg/L from the secondary clarifier and mean cell residence time = 10 days, determine (1) the volume of the reactor (2) the mass and volume of solids that must be wasted each day and (3) the recycle ratio. 3+11

5. (a) Describe in brief the various methods employed for the disposal of septic tank effluent.

(b) A wastewater treatment plant influent has TSS concentration of 250 mg/L. If the average effluent TSS concentration is 20 mg/L, What is the removal efficiency for TSS? If the flow rate 5 ML/d, how many kilograms of suspended solids are discharged in the effluent each day? 8+6

6. A wastewater treatment plant consists of primary treatment units followed by an activated sludge secondary treatment system. The primary and secondary sludge are mixed in a gravity thickener and sent to further treatment. Wastewater, treatment plant and sludge characteristics are given below:

Wastewater		Treatment plant		sludge	
Influent SS	200 mg/L	Primary clarifier diameter	25 m	Primary	5.0%solids
influent BOD	225 mg/L	Removal Efficiency of primary clarifier	for SS:58% for BOD: 32%	Secondary	0.75% solids
Effluent BOD	20 mg/L	Aerator (reactor) volume	2900 m_3	Thickened	4.0 % solids
Flow	19,000 m3/d	MLSS in aerator	3500 mg/L		

Determine (a) total solids loading (in kilogram per day) to the sludge thickener, and (b) the per cent volume reduction by the thickener. Given that fraction of BOD converted to excess solids is 0.41, 0.37 and 0.33 for the food to microorganism ratio 0.4, 0.3 and 0.2 respectively. 14

7. (a) List the various materials which can be recovered from the municipal solid waste generated from a typical indian city.

(b) Describe in brief the various methods employed for the disposal municipal solid waste. 5+9

8. (a) Differentiate between conventional and high rate trickling filter.

(b) A 2 m deep trickling filter with a diameter of 18 m is operated with a recirculation ratio of 1.5 The raw wastewater flow rate is 2.5 ML/d and the 5-day BOD of the raw wastewater is 210 mg/L. Assuming that the primary tank BOD removal efficiency is 30%, compute the hydraulic as well as organic load on the trickling filter. 6+8

9. Design an oxidation pond employing following data

Population to be served	= 8000
Water supply	= 180 lpcd
BOD generation	= 34 gpcd
BOD loading rate	= 210 kg/ha/d
Effluent BOD	= 30 mg/L
Rate constant at 20°C(k)	= 0.1/d
Mean monthly temperature	= 30°C max. and 10°C min.

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(iii) Define a queue. Explain the basic elements of queue.

(iv) Define reliability. Draw Bath-tub-shaped Failure Rate curve.

(v) Limitation of game theory

9. A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is as given bellows:

Production per day	Probability
196	0.05
197	0.09
198	0.12
199	0.14
200	0.20
201	0.15
202	0.11
203	0.08
204	0.06

The finished mopeds are transported in a specially designed 3 storeyed lorry that can accommodate only 200 mopeds. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10, Stimulate the process to find out: 14

(i) What is the average number of mopeds waiting in the factory?

(ii) What will be the average number of empty space on the lorry?

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