

END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] DECEMBER 2017

Paper Code: ETCE-311

Subject: Wastewater Engineering and Reuse

Time: 3 Hours

Maximum Marks: 75

Note: Attempt all questions as directed. Internal choice is indicated. Make necessary assumptions wherever required and clearly state them.

- Q1 (a) Explain the use of rational formula for the design of drains draining Indian catchments. Up to how much hectares of catchments it can be safely used? (5)
- (b) Why circular section is more commonly used in the construction of sewers? What are the advantages of egg - shaped section and under what condition of flow does it become more useful? Will you recommend its use, for sanitary sewer and if not why? (5)
- (c) What is sewage farming? What are its advantages over the method of disposal of sewage by dilution? What precaution should be taken in its operation to prevent health hazard either to farm workers or to the consumer using the produce. (5)
- (d) Give a line diagram of the method of purifying sewage from outfall sewer to the effluent discharge points in the river. (5)
- (e) Explain the problems commonly encountered in the maintenance of sewers. Also describe the method employed to tackle these problems. (5)

- Q2 (a) Differentiate: (6)
- (i) Inlet time and channel flow time
- (ii) Critical rainfall duration and critical rainfall intensity
- (iii) Non-silting and Non-scouring velocity.
- (b) A 30 cm diameter sewer having an invert slope of 1 in 150 was flowing full. What would be the velocity of flow and discharge? Is the velocity self cleansing? Assume $n = 0.013$. What would be velocity and the discharge when the same is flowing at 0.20 and 0.80 of the full depth? (6.5)

OR

- Q3 (a) State the routine tests carried out in the laboratories at sewage treatment plants and explain the significance each of them. (6)
- (b) The 7 days 20°C BOD of a sample of sewage is 300 ppm and its 3 days 37°C BOD is 500 ppm. Find out the value of de-oxygenation constant k and then estimate its 5 days 30°C BOD. (6.5)
- Q4 (a) Differentiate between aerobic and anaerobic treatment of sewage, giving major end products. Name one treatment method with schematic details in each category. (6)
- (b) Design an aerated lagoon to serve for 5000 persons at 100 lpcd, BOD of raw sewage is 200 mg/litre. (6.5)

OR

- Q5 (a) Design a grit chamber for a horizontal velocity of 25 cm/sec and a flow which ranges from a minimum of 25000 cu.m/day to a maximum of 1,00,000 cu.m/day. Average flow is 62500 cu.m/day. (6)
- (b) Explain Type I, II, III and IV settling. (6.5)

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- Q6 (a) Design the complete activated sludge treatment plant for the following data:

Population served	50,000
Average sewage flow	180 l.p.c.d
BOD of raw sewage	200 mg/litre
Raw sewage suspended solids	300 mg/litre
BOD removal in primary treatments	35%
Overall BOD reduction desired	90%

Also calculate the aeration requirements and explain with sketches, how it is to be provided. (12.5)

OR

- Q7 (a) What is nitrification & De-nitrification? Explain air stripping process? Why air stripping is employed in waste water treatment? (6)
 (b) Why digestion of sludge is necessary? Explain with a neat sketch of digestion tank its working. (6.5)
- Q8 (a) Explain the various types of aeration adopted in activated sludge process. (6)
 (b) Explain in detail about laying, jointing and testing of sewers. (6.5)
- OR
- Q9 Write short notes on:
 (a) One and two pipe system of plumbing. (3)
 (b) Inverted Syphon (3)
 (c) Factors governing the selection of pump in sewage pumping station (3)
 (d) Grease and oil traps (3.5)

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