

B.E. (Civil Engineering) 4th Year 1st Semester Examination, 2025**(1st / 2nd Semester / Repeat / Supplementary / Annual / Biannual)****Sub: Wastewater Engineering**

Full Marks: 100

Time: Two hours/Three hours/Four hours/ Six hours

(50 marks for each part)

Use a separate Answer-Script for each part

No. of Question	Part-I	Marks
	Answer Question-1 and 2 and any <i>three</i> from the rest	
Q.1)	Fill in the blanks with appropriate word(s): - The treatment units where removal of pollutants occurs through chemical and biochemical reactions are called -----. - Large screen has opening size larger than ----- mm. - The phenomenon of separation of biomass from the surface of the filter media of a Trickling Filter is called -----. - In activated sludge process the value F/M ratio varies in the range of -----. - MLVSS is the acronym of -----. ----- equation is used for calculating efficiency of a trickling filter.	(1*6)
Q.2)	- What are the significances behind the treatment of wastewater? - What are the adverse effects that will be caused if a bar screen is not provided in the sewage treatment plant? - What do you mean by i) F/M ratio and ii) Mean cell residence time (MCRT) - What do you mean by settleability of sludge? How it is expressed and measured?	2 (2+2) (2+2) 4
Q.3)	- What do you mean by Grit Particles? What are the significances of velocity control sections in the design of Grit Chambers? - A grit chamber is to be designed to remove particles having mean diameter of 0.2 mm and specific gravity of 2.65. The mean temperature of operation is assumed to be 25°C. A flow through velocity of 0.3m/sec will be maintained by proportional flow weir. Determine the channel dimensions for a peak sewage flow of 12,500m³/ day.	2+3 5

Form A: Paper –Setting Blank

Ref No. – Ex/CE/5/T/402/2025

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No. of Question	Part-I	Marks
Q.4)	A township having a population of 72,500 persons is producing domestic sewage @ 123 lpcd having an average 217 mg/l of BOD₅. Design a high rate single stage trickling filter for treating the sewage. Assume that the primary clarifier removes 35% of BOD. Given: i) Organic Loading rate = 6132 Kg/hect-m/day ii) Surface Loading rate = 128 million-litre/hect/day (including re-circulated sewage) iii) Recirculation Ratio = 1.20 iv) Desired BOD₅ in the final effluent = 30 mg/l.	10
Q.5)	a) What are the major sources of oily and greasy substances in a municipal sewage? Why the oily and greasy substances are necessary to be removed before entering into further treatment units? b) Design a rectangular skimming tank on the basis of a peak design wet weather flow of 0.682m³/sec. Assume a minimum detention period of 4 min and the velocity of rise of air bubble of 0.23m/min.	2+3
Q.6)	a) Discuss with the help of a neat diagram on the significance of "Overflow Rate" in the context of design of a continuous flow primary clarifier. b) Design a primary clarifier for an activated sludge process for a maximum water demand of 14 million-litre per day (MLD) and detention period of 2 hours. The horizontal flow through velocity is given as 0.3 m/sec. Consider a rectangular tank provided with mechanical cleaning equipment and 80% of supplied water converted into sewage.	5 5

Full Marks :- 100

Time: THREE HOURS (3)

Use a separate Answer-Script for each part

Part II(Marks:50)

	Answer any Four (4) Questions. Assume any relevant data if not given. 2 (two) marks are reserved for neatness and to the point answers	
Q1.	Answer the following questions briefly (any six) a) Why sewers are not designed with full flow ? b) Why partial separated flow are observed in domestic street sewer ? c) What is the necessity of employing Drop Manhole? d) Under what condition Inverted siphons are provided? e) What are the limiting velocities of flow in sewer? f) Why temperature and time are necessary to describe to express BOD of waste water sample? g) Justify the same value of BOD and COD h) Under what condition initial and ultimate BO values are same?	(6x2 =12)
Q 2	Prove that for a circular sewer, proportionate discharge can be expressed as following form $q/Q = [\alpha/360 - \sin \alpha/2\pi] [1 - 360 \sin \alpha / 2\pi\alpha]$ Where α is the central angle.	12
Q 3.	A city main combined sewer is proposed to carry sewage of 11 lakh populations with 225 lit/cap/day water supply. The sewage factor is 0.80. It serves 60 sq.Km area. The equivalent rainfall of 12 mm in a day. The sewer requires transporting coarse sand of .0.80 mm diameter with specific gravity 2.60. Assume Manning's 'n' '0.013.' 'k' is 0.04. The sewer runs full condition .Determine the size of the circular sewer. From following information .peak factor 2.5.lean factor 0.30.Gradient I in 1400. Assume other relevant data if necessary. Check the velocities in all flow conditions.	12

4. a) b)	What are the different sewer pipes are used for wastewater collection system? Discuss their relative merits and demerits. Draw a neat sketch of a manhole At what distance interval it is provided ?	6+ 6 =12
5. a) b)	In a BOD test, 4ml of sample sewage with zero D.O. is mixed with 296 ml of dilution water with 8.0 mg/l of dissolved oxygen .After 5 days incubation, at 20 degree Celsius, mixture content shows DO value as 4,7 mg/l.What is the value of B.O.D after 5 days in mg/l ? The BOD_t of a sewage sample is found to be 165 mg/L .at 20 degree C°. The rate constant value is 0.10 per day. What will be BOD_u at same temperature? Deduce the necessary equation for solving the problem.	5+7