Ref No. – **Ex/CE/5/T/402/2024(S)**

B.E. (Civil Engineering) 4th Year 1st Semester Supplementary Examination, 2024

(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 *three* from the rest	
Q.1)	**Fill in the blanks with appropriate word(s):**	(1×6)
	a) The treatment units where removal of pollutants occurs through chemical and biochemical reactions are called ----------.	
	b) Large screen has opening size larger than ---------- mm.	
	c) The phenomenon of separation of biomass from the surface of the filter media of a Trickling Filter is called ----------.	
	d) In activated sludge process the value F/M ratio varies in the range of ----------.	
	e) MLVSS is the acronym of ----------.	
	f) The supernatant liquor emanating from anaerobic digester is recycled back to ----------.	
Q.2)	a) What are the adverse effects that will be caused if a bar screen is not provided in the sewage treatment plant?	2
	b) What do you mean by i) F/M ratio and ii) Mean cell residence time (MCRT)	(2+2)
	c) What do you mean by settleability of sludge? How it is expressed and measured?	(2+2)
	d) Describe with the help of pertinent reactions the 'Alkaline Fermentation' stage of Anaerobic Digestion.	4
Q.3)	a) What do you mean by Grit Particles? What are the significances of velocity control sections in the design of Grit Chambers?	2+3
	b) A grit chamber is to be designed to remove particles having mean diameter of 0.2mm 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 12,500m^3/ day.	5

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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 BOD_5. 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/hec-m/day** ii) Surface Loading rate = **128 million-litre/hec/day** (including re-circulated sewage) iii) Recirculation Ratio = **1.20** iv) Desired BOD_5 in the final effluent = **30 mg/l.**	10
Q.5)	a) Differentiate between discrete and turbulent settling. b) Design a secondary clarifier for an activated sludge process for an average flow of **22 million-litre per day (MLD)** and peak flow of **42 MLD**, operating with a MLSS concentration of **3250 mg/L**. Considering a circular tank find out the dimensions. Exercise the necessary checks.	2 8
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

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Bachelor of Engineering (Civil Engineering) 4 th Year first SEM.Supplemetary Examination 2024

SUBJECT: ;- **Wastewater Engineering**

Full Marks .- 100

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~ THREE HOURS

Use a separate Answer-Script for each part

No. of Questions	Part II(Marks:50)	Marks
	Answer any four (4) Questions. Assume any relevant data if not given. 2 (two) marks are reserved for neatness and to the point anwers	
Q1. a)	Distinguish sewer and sewerage.	
b)	Describe different types of sewer with respect to point of generation ,designated use and collection purpose. Draw neat sketches .	3+9
Q2 . a)	What is the minimum velocity in sewer? What is its justification?	
b)	Prove that for a circular sewer, proportionate discharge can be expressed as following form $q/Q = [\ \alpha/360 - \text{Sin}\ \alpha/2\pi\ ][\ 1 - 360\ \text{Sin}\alpha / 2\pi\alpha\ ]$	2+10
Q 3	A city main sewer is proposed to carry sewage of 245000 populations with 180 lit/cap/day water supply. The sewage factor is 0.80. The sewer runs full condition .Determine the size of the circular sewer. From following information Assume slope 1in 1000, .n= 0.013.peak factor 2.5.lean factor 0.30. Check the velocities in all flow conditions.	12
Q 4. a)	Under what condition drop manholes are provided? Draw a neat labeled sketch of a drop manhole.	
b)	What are the different sewer pipes are used for wastewater collection system? Discuss their relative merits and demerits .	7+ 5
Q5 .a)	In a BOD test, 6 ml of sample sewage with zero D.O. is mixed with 294 ml of dilution water with 8.5 mg/l of dissolved oxygen .After 5 days incubation, at 20 degree Celsius, mixture content shows DO value as 4,5 mg/l.What is the value of B.O.D after 5 days in mg/l ?	

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SUBJECT: ;- **Wastewater Engineering**

Full Marks .- 100

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~ THREE HOURS

Use a separate Answer-Script for each part

No. of Questions	Part II(Marks:50)	Marks
b)	The BOD_5 of a sewage sample is found to be 165 mg/L .at 20 degree C^0. The rate constant value is 0.23 per day.What will be BOD_U at same temperature? Deduce the necessary equation for solving the problem.	5+7