

Ref No. –EX/CE/ 5/T/402/2024

BACHELOR OF ENGINEERING (CIVIL ENGINEERING) EXAMINATION 2024
4TH YEAR, I ST Semester Examination 2024

SUBJECT: WASTEWATER ENGINEERING
(Name in full)

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

Full Marks:100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Question	Part-I	Marks
	<p style="text-align: center;">Answer Question-1 and 2 and any <i>two</i> from the rest</p>	
Q.1)	<p>A. Fill in the blanks with appropriate word(s):</p> <p>a) The treatment units where removal of pollutants occurs through physical forces are called -----.</p> <p>b) Small screen has opening size smaller than ----- mm.</p> <p>c) Removal of non-biodegradable organics usually occurs in the ----- treatment units.</p> <p>d) In activated sludge process the value of sludge age varies in the range of -----days.</p> <p>e) Sludge Volume Index is expressed in the unit of -----.</p> <p>f) Oily matters when combine with detergent form-----.</p> <p>g) Growth of ----- in upper reaches of a trickling filter adds oxygen to the percolating wastewater.</p> <p>h) ----- equation is used for calculating efficiency of a trickling filter.</p> <p>B. State whether the under-mentioned statements are True or False with necessary justifications:</p> <p>a) Efficiency of a skimming tank can be increased considerably by passing chlorine gas along with air bubbles.</p> <p>b) In activated sludge process solid retention time is usually less than hydraulic retention time.</p> <p>c) Sloughing in trickling filter is only a function of organic loading rate of the filter.</p>	<p>(1*8)=8</p> <p>(2*3)=6</p>
Q.2)	<p>a) What are the adverse effects that will be caused if a bar screen is not provided in the sewage treatment plant?</p> <p>b) What do you mean by i) F/M ratio and ii) Solid Retention Time (SRT)</p> <p>c) What do you mean by "Settleability of Sludge"? How it is expressed and measured?</p> <p>d) Describe the phenomenon called "Sloughing".</p>	<p>3</p> <p>2+2</p> <p>2+3</p> <p>4</p>

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No. of Question	Part-I	Marks
Q.3)	a) What do you mean by Grit Particles ? What are the significances of velocity control sections in the design of Grit Chambers? b) A grit chamber is to be designed to remove particles having mean diameter 0.2mm and specific gravity of 2.65 . The mean temperature of operation assumed to be 25°C . A flow through velocity of 0.3m/sec will be maintained proportional flow weir. Determine the channel dimensions for a peak sewa flow of 13,500m³/ day .	2+3 5
Q.4)	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
Q.5)	A township having a population of 73,000 persons is producing domestic sewage @ 125 lpcd having an average 225 mg/l of BOD ₅ . Design a high rate single stage trickling filter for treating the sewage. Assume that the primary clarifier removes 38% of BOD. Given: i) Organic Loading rate = 6422 Kg/hect-m/day ii) Surface Loading rate = 124 million-litre/hect/day (including re-circulated sewage) iii) Recirculation Ratio = 1.20 iv) Desired BOD ₅ in the final effluent = 30 mg/l .	10

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No. of Questions	Part II (Marks: 50)	Marks
	<p align="center">PL. ANSWER QUESTION 1 (Compulsory) and any three (3) Questions from the rest Assume any relevant data if necessary. One mark is kept for neatness.</p> <p>Q 1. Answer any 4 (Four) from the following :-</p> <ol style="list-style-type: none"> Why Egg shaped section is preferred to choose as sewer for conveyance of combined sewage? What is a drop manhole? Under what condition it is employed? What is partially separated sewer system? Do you feel it is convenient to provide in municipality? Write down the limiting application of stoneware pipes in municipal sewage collection. How chloride concentration in sewage quality indicates the intensity or degree of pollution load? Distinguish between sewage and sewerage. Briefly write down the purpose of relief sewer. <p>Q2.</p> <ol style="list-style-type: none"> Explain the different types of solids present in wastewater with their sources and relative importance in sewage characteristics. A50 ml sewage sample is collected from an intercepting sewer location. The dry empty weight of the beaker is 12.560 gm.the sample with beaker is put in an hot air oven at 104 ° C upto evaporated to dryness .Then it is get cooled and taken its total weight and found 12.740 gm.Then the sample is filtered through a filter paper of weighing 0.5225 gm.in dry condition .Then residue with dried filter paper is weighed again and found to be 0.6120 gm.Estimate total solids and volatile solids concentration in mg/L.Assume VSS / TSS = 0.68. 	<p align="center">(4x2.5= 10)</p> <p align="center">(6+7 =13)</p>

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	<p>Q 3. . a) Prove that in case of partially filled sewer section Proportionate hydraulic mean radius is equal to $1 - (360^\circ \sin \alpha / 2\pi\alpha)$ where α is central angle of circular sewer section. Draw a neat sketch on this problem.</p> <p>b) The maximum rainfall intensity of an area is 30mm/hr on the basis of 2 years frequency record. The population of the city area is 22000 with rate of water supply as 180 liters per head. Sewage factor is 0.80. Peak factor of sewage discharge is 2.75. The sewer drains about 25 hectares of catchment area. Assume coefficient of runoff is 0.65. The time of concentration is 25 minutes. Estimate the total volume of combined sewage of the area.</p> <p>Q4. a) What are BOD and COD? What is their significance in wastewater engineering? b) A sample of sewage contains BOD_5 at $20^\circ C$ as 250 mg/l. If the test could run at $30^\circ C$, how many days will the same value of BOD be obtained ? c) Determine the COD/TOC for glucose solution stoichiometrically.</p> <p>Q 5. a) Enumerate different sewer appurtenances normally required in municipal sewerage scheme. b) Draw a neat sketch of a manhole for an invert depth of 3500 mm from ground level. Assume diameter of sewer is 600 mm. Sidewalls are 375 mm thickness. Base slab is 250mm thick. Assume other relevant data.</p>	<p>7+6=13</p> <p>(3+ 6+4 =13)</p> <p>(5+8 =13)</p>
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