

Bachelor of Engineering (Civil Engineering) Supplementary Examination 2018

(4th Year 1st Semester)

Waste Water Engineering

Time: Three Hours

Full Marks: 100

Use separate answer script for each part

(50 marks for each part)

Part-1

Answer Question No. 1 and any Two from the rest. Any relevant data may be assumed, if needed.

1.
 - a) How is waste water(WW) treatment related with poor solubility of oxygen?
 - b) Discuss about the mode of expression of settleable solid along with reason.
 - c) Mention at least two basic natures of those organic compounds which can be magnified biologically?
 - d) Mention the biological units where photo-autotrophs are used with brief details.
 - e) What is '100-30' standard?
 - f) Define BOD₅.
 - g) Why nutrients are required to be added in waste water sometimes?
 - h) Draw a bar chart to compare COD, BOD₅, ThOD and BOD_u.
 - i) What should be the expression for calculation of 'time of concentration' for a starting manhole?
 - j) What is worst condition for calculation of ground water infiltration? 2x10=20

2. Classify total solids based on volatility and size. Discuss about removal/non-removal of each of the eight sub-groups in a conventional municipal WW treatment plant (a flow sheet may be drawn). 10

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3. a) Draw the 'BOD exertion' and 'BOD remaining' curves. b) Explain the factors affecting BOD rate constant.
 c) Describe the reasons for performing following steps during BOD test
 (i) dilution (ii) seeding (iii) incubation (iv) use of stoppers

4+3+8 = 15

4. a) Develop the expressions for discharge and velocity for circular pipe 'flowing full' conditions from Manning's Equation.

- b) Following database for analyzing an existing sewer are given:

- (i) Ultimate peak flow = 500 lps (ii) Present peak flow 400 lps (iii) Dia = 1050mm (iv) $n = n' = 0.013$
 (v) d/D at ultimate peak flow = 1.0

Calculate Q , V , S , and v at ultimate peak flow and v at present peak flow. Following table may be needed:

d/D	v/V	q/Q
1.000	1.000	1.000
0.900	1.124	1.066
0.800	1.140	0.988
0.700	1.120	0.838
0.600	1.072	0.671
0.500	1.000	0.500
0.400	0.902	0.337

All the notations used in this problem have usual meanings.

5+10= 15

B.E. (Civil Engineering) 4th Year 1st Semester Supplementary Examination, 2018
(1st / 2nd Semester / Repeat / Supplementary / Annual / Biannual)

Sub: Wastewater Engineering

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-II	Marks
Q.1)	<p align="center">Answer Question-1 and 2 and any three from the rest</p> <p>Fill in the blanks with appropriate word(s):</p> <p>a) The treatment units where removal of pollutants occurs through physical process are called -----.</p> <p>b) Fine screen has opening size smaller than ----- mm.</p> <p>c) The phenomenon of separation of biomass from the surface of the filter media of a Trickling Filter is called -----.</p> <p>d) In activated sludge process the value F/M ratio varies in the range of -----.</p> <p>e) MLVSS is the acronym of -----.</p> <p>f) ----- equation is used for calculating efficiency of a trickling filter.</p>	(1*6)
Q.2)	<p>a) What are the significances behind the treatment of wastewater?</p> <p>b) What are the adverse effects that will be caused if a bar screen is not provided in the sewage treatment plant?</p> <p>c) What do you mean by i) Organic Loading Rate and ii) Sludge Age</p> <p>d) What do you mean by settleability of sludge? How it is expressed and measured?</p>	<p align="center">4 2</p> <p align="center">(2+2) (2+2)</p>
Q.3)	<p>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?</p> <p>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.</p>	<p align="center">(2+3)</p> <p align="center">5</p>

Use a separate Answer-Script for each part

No. of Question	Part-II	Marks
Q.4)	Design a screen chamber on the basis of following data: i) Peak Design Wet Weather Flow = 1.297 m ³ /sec ii) Velocity through screen at peak design wet weather flow condition = 0.9 m/sec. iii) Population of the township = 2,25,000 iv) Depth of flow in the incoming conduit at peak design flow condition=1.12m Consider head loss at both no-clog and 55% clogged condition, and the inclination of the bar 70° with horizontal.	10
Q.5)	A township having a population of 72,500 persons is producing domestic sewage @ 122 lpcd having an average 213 mg/l of BOD ₅ . Design a high rate single stage trickling filter for treating the sewage. Assume that the primary clarifier removes 34% of BOD. Given: i) Organic Loading rate = 6176 Kg/hect-m/day ii) Surface Loading rate = 124 million-litre/hect/day (including re-circulated sewage) iii) Recirculation Ratio = 1.0 iv) Desired BOD ₅ in the final effluent = 30 mg/l.	10
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 secondary clarifier for an activated sludge process for an average flow of 21 million-litre per day (MLD) and peak flow of 43 MLD, operating with a MLSS concentration of 3050 mg/L. Considering a circular tank find out the dimensions. Exercise the necessary checks.	5 5