

Bachelor of Civil Engineering (Part Time) Examination 2018 (Old)

(3rd Year 2nd 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. Answers should be brief. Any relevant data may be assumed, if needed. Answer Question no first.

1.
 - a) What is waste water (WW)?
 - b) Name a WW parameter which is expressed in vol./vol. basis and name the most common unit also.
 - c) What is bio-magnification of an organic substance?
 - d) What are the sources of energy and carbon for photo-autotrophic microorganism?
 - e) Mention the product and two by-products of municipal WW treatment.
 - f) Why is 20°C chosen as standard temperature of incubation for BOD test?
 - g) Why are nutrients sometimes required to be added to WW?
 - h) Why is COD generally more than BOD?
 - i) What is the worst condition considered for calculation of ground water infiltration quantity?
 - J) 'Time of concentration is equal to inlet time for starting manhole'-explain.

2x10=20

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2. a) Classify 'total solids' based on size and volatility both. Then, comment about removal of each sub gr
- b) (i) What is the main importance of odour as a WW characteristic (WWC)?
- (ii) 'Turbidity is only a qualitative assessment of suspended solid'-explain with an example.
- (iii) Which physical WWC is most responsible for septicity of a tropical water body?
- (iv) What is the general effluent standard for disposal of hot water?
- (v) Describe the significance of colour as a WW parameter. 10+5 =15
3. a) Establish the relation between reaction constant K (base e) and K (base 10).
- b) In a BOD determination test, 6mL septic WW is taken in a standard BOD bottle and mixed with dilution water having DO value 9.1 mg/L. After 5 days of incubation at 20°C, the DO content of the mixture is 2.8 mg/L. Calculate the BOD of the WW sample.
- c) Why are dilutions and seeding done in BOD test?
- d) What may be the COD/TOC ratio for glucose? Is it a constant value for all organic compounds?

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a) 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 = 0.80

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.

b) Explain the followings with respect the table given in Q4 (a):

(i) at $d/D = 0.9$, $q/Q > 1.0$ (ii) d/D should be 0.8 and (iii) d/D should not be less than 0.5.

9+6 = 15

**B.E. Civil Engineering (Part Time) 3rd Year 2nd Semester Examination, 2018 (Old
(1st / 2nd Semester / Repeat / Supplementary / Annual / Biannual)
Sub: Wastewater Engineering**

Time: ~~Two hours~~ / Three hours / ~~Four hours~~ / ~~Six hours~~Full Marks
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Question	Part-II	Marks
Answer Question-1 and 2 and any three from the rest		
Q.1)	<p>Fill in the blanks with appropriate word(s):</p> <p>a) The treatment units where removal of pollutants occurs through chemical and biochemical reactions are called -----.</p> <p>b) Medium screen has opening size in between ---- & ---- mm.</p> <p>c) Oily matters when combine with detergent form-----.</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>g) Removal of heavy metals usually occurs in the----- treatment units.</p>	(1*6)
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 (MCRT)</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"? What are the factors responsible for sloughing?</p>	2 (2+) (2+) 4
Q.3)	<p>a) What do you mean by Grit Particles? What are the significances of velocity control sections in the design of Grit Chambers?</p> <p>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 13,500m³/ day.</p>	2+3 5

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No. of Question	Part-II	Marks
Q.4)	<p>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.</p> <p>Given:</p> <p>i) Organic Loading rate = 6132 Kg/hect-m/day</p> <p>ii) Surface Loading rate = 128 million-litre/hect/day (including re-circulated sewage)</p> <p>iii) Recirculation Ratio = 1.20</p> <p>iv) Desired BOD₅ in the final effluent = 30 mg/l.</p>	10
Q.5)	<p>a) Differentiate between discrete and turbulent settling.</p> <p>c) 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.</p>	2 8
Q.6)	<p>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.</p> <p>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.</p>	5 5