Bachelor of Civil Engineering (Part Time) Examination 2017 (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) Define wastewater (WW) with respect to its designated use.

    b) How is settleable solid expressed and why?

    c) Mention two basic characteristics of an organic waste to be bio-accumulated.

    d) What are the sources of energy and carbon for chemo heterotrophic bacteria?

    e) Mention the product and by-products of municipal WW treatment.

    f) Why is 5 day period chosen generally as standard period of incubation for BOD test?

    g) Why is nutrients removal necessary sometimes from municipal WW?

    h) Why is ThOD generally more than COD for a WW sample?

    i) What should be the quantity of ground water infiltration to calculate design sanitary WW flow?

    j) Define time of concentration related to calculation of design storm water runoff.

    2x10=**20**

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2. a) Name all the eight sub-groups of total solids, when it is classified based on size and volatility. Mention the sub-groups which are removed and/or transformed to other form in the following units of WW treatment plants (WWTP)

(i) primary sedimentation tank (b) primary clarifier (c) secondary clarifier (d) biological unit

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 RSH or thioalcohol?

(v) What is WW black as seen in open sewers?

10+5 =

3. a) If K= BOD rate constant base e, $K_{20}=0.13$/day, $K_{30}=0.2$/day, find the temperature coefficient.

b) The following observations were made on a 2% dilution of WW:

(i) DO of aerated water used for dilution = 5.0 mg/L

(ii) DO of diluted sample after 5 days incubation = 1.8 mg/L   (iii) DO of undiluted sample = 0.6 mg/L

K (base e) may be assumed as 0.35/day. Calculate BOD_u.

c) Why are dilutions and seeding done in BOD test? What are seed mixture and sample mixtures in relation to BOD test?

3+6+6 = 15

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WW

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 present peak flow = 0.75

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

10+5 =1

All the notations used in this problem have usual meanings.

.6 mg/L   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

n

6 = 15

B.E. Civil Engineering (Part Time) 3rd YEAR 2nd Semester Examination, 2017 (OLD)
(1st / 2nd Semester / Repeat / Supplementary / Annual / Biannual)
SUBJECT: WASTEWATER ENGINEERING

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

Full Marks 10   Tir
(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 *two* from the rest	
Q.1) a)	**Fill in the blanks with appropriate word(s):**	6*1=6
	a) The treatment units where removal of pollutants occurs through physical forces are called ---------------.	
	b) Small screen has opening size smaller than ----------- mm.	
	c) Removal of heavy metals usually occurs in the-------------- treatment units.	
	d) In activated sludge process the value of sludge age varies in the range of ----------days.	
	e) Sludge Volume Index is expressed in the unit of	
	f) Oily matters when combine with detergent form----------------.	
Q.2)	a) What are the significances behind the treatment of wastewater?	5
	b) What are the adverse effects that will be caused if a grit chamber is not provided in the sewage treatment plant?	4
	c) Differentiate between **Hydraulic Retention Time (HRT)** and **Mean Cell Residence Time (MCRT).**	3
	d) What do you mean by **settleability of sludge?** How it is expressed and measured?	(3+3)
Q.3)	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?	(3+4)
	b) Design a rectangular skimming tank on the basis of a peak design wet weather flow of **0.675m³/sec.** Assume a minimum detention period of 4 **min** and the velocity of rise of air bubble of **0.23m/min.**	6

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Full Marks 100
(50 marks for each part)

No. of Question	Part-II	Marks
Q.4) a)	A township having a population of **70,000** persons is producing domestic sewage @ **125 lpcd** having an average **223 mg/l** of BOD_5. Design a high rate single stage trickling filter for treating the sewage. Assume that the primary clarifier removes **36%** of BOD. Given: i) Organic Loading rate = **6198 Kg/hec-m/day** ii) Surface Loading rate = **127 million-litre/hec/day** (including re-circulated sewage) iii) Recirculation Ratio = **1.20** iv) Desired BOD_5 in the final effluent = **30 mg/l**.	13
Q.5) a) b)	a) *"Flocculation capacity of biomass is minimum during exponential phase of biomass growth"*- Justify this statement. 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 **41 MLD**, operating with a MLSS concentration of **3150 mg/L**. Considering a circular tank find out the dimensions. Exercise the necessary checks.	5 8