Form A: Paper –Setting Blank Ref No.: Ex/PG/CE/T/112E/6/2017

M.C.E 1st SEMESTER EXAMINATION, 2017

(1st /~~2nd~~ Semester / ~~Repeat~~ / ~~Supplementary~~ / ~~Annual~~ / ~~Biannual~~)

SUBJECT: WASTEWATER TREATMENT AND DISPOSAL

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 any *two* from the rest	
Q.1) a)	Draw a flowchart for a municipal sewage treatment plant showing all mandatory unit processes and operations including sludge treatment facilities.	7
b)	What are significances behind a **grit chamber** in a typical sewage treatment plant?	3
c)	Justify the statement with necessary mathematical expressions –**"The cross-section should be rectangular if a proportional flow weir is placed at the end of the grit channel to maintain constant flow velocity."**	5
d)	Discuss on the significance of **"Overflow Rate"** in the context of design of a continuous flow primary clarifier.	5
Q.2)	Design a screen chamber on the basis of following data: i) Peak Design Wet Weather Flow=**1.285m³/sec** ii) Velocity through screen at peak design wet weather flow =**0.9m/sec** iii) Population of the township= **2,47,000** iv) Depth of flow in the incoming conduit at peak flow = **1.14m**. v) Diameter of the incoming conduit= **1.51m** vi) Slope of the incoming conduit= **0.00043** vii) Velocity at peak design flow= **0.86m/sec.** Assume any necessary data.	15

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No. of Question	Part-I	Marks
Q.3) a)	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.**	7
b)	Design a proportional flow weir receiving a flow of **0.65 m³/sec.** Consider a symmetrical sharp-edged weir and depth of flow under peak flow condition as **1.6 m.** Assume the dimension of weir between **25** and **50 mm.**	8
Q.4) a)	Discuss on different forms of sedimentation found in a typical wastewater treatment plant?	7
b)	Design a suitable rectangular primary clarifier for treating municipal wastewater emanating from a city. The primary clarifier will comprise mechanical cleaning equipment. Assume a maximum daily water demand for the city as **11.5 MLD.** Assume the following: i) Detention Period= **2.0 hours** **ii)** Horizontal flow through velocity= **0.3 m/min** iii) Surface loading rate= **42 m³/day/m²**	8

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MASTER OF CIVIL ENGINEERING EXAMINATION, 2017
FIRST YEAR, 1ST Semester Examination

SUBJECT: WASTE WATER TREATMENT AND DISPOSAL

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~ Full Marks ~~30~~/100

Use a separate Answer-Script for each part

No. of Questions	Part II (Marks:50)	Marks

Answer Any Three(3) questions
Two marks are reserved for neatness and to the point answer
Assume relevant data if necessa

Q1.

a) What do you mean by biological treatment of waste water? Why biological process is preferred and economical in treating wastewater containing organics.
b)Classify bacteria on the basis of temperature sensitiveness.
c)Discuss the nature of biological growth in two conventional biological treatment system.
d)Establish the relation for determining biomass concentration in the aeration tank for activated sludge process with the help of mass balance equation and kinetic growth study in the following form.

$$X = \mu_m (S_o - S) / k (1 + k_d \Theta_c)$$

(3+2+3+8)

Q2.

a) Deduce from enzymatic activity (E) with substrate concentration (S) to estimate the specific growth rate of microbes (μ) with half saturation constant (K_s).

b) Determine the kinetic constants using the following experimental data as obtained from a bench –scale batch data.

Unit no.	Initial BOD mg/L	Final BOD mg/L	MLSS mg/L	HRT days
1	200	25	280	2.0
2	200	20	285	2.2
3	200	40	250	1.6
4	200	35	200	2.0
5	200	15	305	1.8
6	200	32	200	2.0
7	200	55	135	1.0
8	200	16	335	2.0

(6+10)

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MASTER OF CIVIL ENGINEERING EXAMINATION, 2017
FIRST YEAR, 1ST Semester Examination

SUBJECT: WASTE WATER TREATMENT AND DISPOSAL

Full Marks ~~30~~/100

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

Use a separate Answer-Script for each part

No. of Questions	Part II (Marks:50)	Marks

Q3.

a) Derive an expression proposed by Atkinson for an attached growth bioreactor to predict the effluent BOD concentration with necessary assumptions and mass balance theory with necessary sketch.

b) Determine the hydraulic retention time (HRT) and recirculation ratio (R) in connection with aeration tank using following data : -

i) Flow rate = 15,000 m^3/day
ii) Influent BOD = 265 mg/L
iii) BOD in the outlet = 30 mg/L
iv) BOD removal in primary treatment = 30%
v) Y = 0.5, vi) $K_a = 0.06\ d^{-1}$
vi) MLSS Concentration = 2000 mg/L, viii) Θ_c = 10 days
vii) Underflow concentration-10000mg/L

(8+8)

Q4.

a) Draw a flow diagram of a single stage trickling filter system with recirculation of effluent. Show that, efficiency of a trickling filter system depends on recirculation ratio. What is the limitation of above expression? State your assumption to establish the relationship.

b) Deduce Eckenfelder equation pertaining to fixed film bio tower.

c) Prove that, from mass balance relationship, the sludge age (Θ_c) for a complete mix-activated sludge plant, can be expressed as –

$$1/\Theta_c = -Y\,(S_0 - S)/\Theta X - K_d$$

All the notations are of usual meanings.

(4+5+7)