Ref No. –EX/PG/CE/ T/112E/2018

M. E. CIVIL ENGINEERING 1ST YEAR 1ST SEMESTER EXAMINATION, 2018
FIRST 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 I (Marks:50)	Marks
	Answer Any Three(3) questions Two marks are reserved for neatness and to the point answer Assume relevant data if not given	
Q1. (a)	What do you mean by " active sludge "? What is the significance in suspended growth reactor with particular reference to activated sludge process for biological treatment of wastewater?	2+3
(b)	Draw a neat flow diagram of activated sludge process and derive the necessary kinetic expression In following form on the basis of material balance approach in case of sludge recycling system for completely mixed system :- $S = \frac{Ks\,(1 + Oc\,k\,d)}{Oc(Yk - k\,d) - 1}$	11
Q2		
(a)	What are the different classifications of bacteria according to operating environmental system? How the different categories of bacteria as per temperature sensitiveness?	2+3
(b)	What are the roles of enzymes for microbial activity in organic wastewater stabilization? Illustrate your answer with examples.	4
(c)	A domestic wastewater containing BOD5 of 250 mg/L, is to be treated with completely mixed activated sludge process. The effluent BOD5 is to be equal to or less than 20 mg/L. The Flow rate is 20 MLD. Following data are given:- i) Return sludge concentration – 9000mg/l ii) MLVSS in the reactor - 2600 mg/ iii) Mean cell residence time – 10 days iv) Kinetic Co- efficient - Y= 0.65, kd= 0.06 Compute a) Recycle ratio b) Volume of the aeration tank.	7
Q3.		
(a)	Describe the functional mechanism of a fixed film reactor in biological wastewater treatment Process.	3
(b)	Show that the efficiency of a biofilter depends on recirculation ratio only as per Ten State Standards.	3

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No. of Questions	Part I (Marks:50)	M
(c)	Determine the values of kinetic constants using the data given in following table as derived from the laboratory experiments carried out in a model reactor of an activated sludge process without recycle.	

Unit NO	Si mg/l	S mg/l	Detention time ,day	Biomass concentration,mg/l
1	350	12	3.8	132
2	350	20	2.6	130
3	350	34	1.8	135
4	350	60	1.3	123
5	350	70	1.2	119

Q4

(a). Deduce Atkinson's model on fixed film reactor to predict effluent BOD concentration from material balance approach . 8

(b) The following data is obtained from Lab-Scale test units. Derive the Eckenfelder equation corresponding to this data.

Depth in m,	% BOD remaining at stated hydraulic loads, Q (litres/min—m2)				
	20	40	60	70	80
1.0	50	70	75	79	83
1.5	40	50	60	63	65
2.0	25	30	45	50	55
2.5	15	20	25	30	40

Use Graphical methods for this problem. 8

Form A: Paper –Setting Blank

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

SUBJECT: WASTEWATER TREATMENT AND DISPOSAL

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

Full Marks: 100

(40 marks for this part)

Use a separate Answer-Script for each part

No. of Question	Part-II	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)	Justify the statement with necessary mathematical expressions –**"The cross-section should be parabolic if a rectangular weir is placed at the end of the grit channel to maintain constant flow velocity."**	4
c)	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.	12

Form A: Paper –Setting Blank

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SUBJECT: WASTEWATER TREATMENT AND DISPOSAL

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

Full Marks: 100

(40 marks for this part)

Use a separate Answer-Script for each part

No. of Question	Part-II	Marks
Q.3) a)	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
b)	Design a proportional flow weir receiving a flow of **0.67 m³/sec.** Consider a symmetrical sharp-edged weir and depth of flow under peak flow condition as **1.65 m**. Assume the dimension of weir between **25** and **50 mm.**	6
Q.4) a)	Design an aerated grit chamber to remove particles having average diameter of 0.21mm and specific gravity 2.65. The mean temperature of operation is taken as 20°C. Given: i) Peak Design Wet Weather Flow =1.286m³/sec ii) Minimum detention time= 4.0 min at peak flow condition iii) Minimum air supply rate= 7.73 lps per m length iv) Minimum flow through velocity= 0.3m/sec v) Average water depth at mid-width= 3.66m	12