Form A: Paper –Setting Blank

Ref No.: Ex/PG/CE/T/116D/6/2017

M.CIVIL/ CHEMICAL/BIOPROCESS ENGG. 1st SEMESTER EXAMINATION, 2017

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

SUBJECT: WATER POLLUTION & CONTROL

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-I	Marks
	Answer Question-1 and any *two* from the rest	
Q.1) a)	What do you mean by **"Critical Time Period (t_c)"** in the context of stream sanitation? Deduce the necessary expression for estimation of **"Critical Time Period (t_c)"** after the mixing of a waste stream with a moving water body.	(2+5)
b)	**"Reaeration Rate Constant for water is generally greater than the Deoxygenation Constant"**- State whether the afore-mentioned statement is True or False with necessary justifications.	3
c)	What is the major hypothesis behind the **"Thomas Modification of Streeter-Phelps Oxygen Sag Equation"**	3
d)	Deduce the fundamental equation for explaining transport process in water bodies based on **conservation of momentum** considering constant cross-section and one dimensional flow.	7
Q.2) a)	Discuss in the context of Stream Sanitation the significances of the following terms: **i) Objective Function ii) Constraints**	(2+2)
b)	A stretch of river receives sewage from two townships having their separate sewage treatment plant. The computed values of pertinent parameters are as follows: i. **U_0= 3.4mg/L** of DO deficit ii. **U_1=(-)0.05mg/L** of DO deficit/percent treatment iii. **S_0=12.6mg/L** of DO deficit iv. **S_1= (-)0.06mg/L** of DO deficit/percent treatment v. **S_2=(-)0.08mg/L** of DO deficit/percent treatment Necessary of cost-related parameters are: i) **C_1= Rs. 33,00,000/-** ii) **C_2= Rs. 38,00,000/-** iii) **a_1= Rs. 42,00,000/-** per 100% treatment efficiency iv) **a_2= Rs. 29,00,000/-** per 100% treatment efficiency v) **D_{a1}= 2.4 mg/L** vi) **D_{a2}= 3.8 mg/L** Determine the optimized annual cost for the entire system graphically following the concept of system analysis.	11

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SUBJECT: WATER POLLUTION & CONTROL

Full Marks: 100

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

No. of Question	Part-I	Marks
Q.3) a)	Deduce the fundamental expression for **"O'Connor's Modification of Streeter-Phelps Oxygen Sag Equation"**	7
b)	Determine the average values of the **stream constants (K_1, K_2 and K_3)** for the following conditions: i. **Reach of the stream= 7.65Km** ii. **Average flow velocity= 0.179m/sec** iii. **Flow time= 0.437day** iv. **Flow rate at the upstream side= $2.62*10^6$ m^3/day** v. **Flow rate at the downstream side= $2.71*10^6$ m^3/day** vi. **Temperature during measurement= 24.3°C** Given:	8
Q.4) a)	State and explain the **"Fick's Law of Molecular Diffusion"**	4
b)	A medium-sized township discharges **16500 m^3/day** of untreated sewage into an adjacent river whose minimum flow rate is **3.1m^3/sec**. Given: i) Temperature of sewage as well as river water= **24°C** ii) **BOD_5** at **20°C** of raw sewage= **212 mg/L** iii) **BOD_5** at **20°C** of river water= **1.2 mg/L** iv) Initial DO deficit at the point of discharge of sewage= **1.84mg/L** v) **K_1=0.23/day ; K_2=1.15/day** both at **20°C** vi) **C_s** at **24°C= 8.58 mg/L**. Find out **critical time period** and **maximum DO deficit** graphically and compare with the analytical values.	11

Location	K_1 at 20 °C (per day)	BOD_{ult} at 20 °C (mg/L)	DO deficit (mg/L)
upstream side (a)	0.461	6.22	6.01
downstream side (b)	0.396	4.14	4.25

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M. CIVIL ENGG., CHEMICAL ENGG. & BIOPROCESS ENGG. 1st Semester EXAMINATION 2017

Subject: WATER POLLUTION AND CONTROL **Time: Three Hours** **Full Marks: 100 (50 for Each Part)**

Part: HALF-II

Use a Separate Answer-Script for Each Part

Answer any 3 (three) questions (Two Marks for Neatness)

(a)	Define 'water quality monitoring' as per ISO. Compare 'monitoring' with 'survey' and 'surveillance' in this regard.	3
(b)	Classify water quality as per CPCB in terms of 'Designated Best Use' of the water.	5
(c)	Explain the statement "The First Step of a Water Quality Monitoring Program is to set the Monitoring Objectives". Provide a summarized list of 'Water Quality Monitoring Objectives'. In this regard explain 'alarm function', 'control function', 'trend function' and 'instrument function'.	2 + 4 + 4
(a)	With a neat flow-chart briefly describe the different steps of a water quality monitoring program as per CPCB.	8
(b)	Provide a summarized list of general site selection criteria for surface water quality monitoring.	6
(c)	Briefly explain 'cross-sectional zonation' and 'longitudinal zonation' in connection with large scale sampling programs.	2
a)	Write down the sampling frequencies as per 'Protocol for Water Quality Monitoring' by GOI for assessment of 'Baseline' Water Quality and Water Quality 'Trend' for different surface and ground water sources.	4
b)	Briefly explain 'Grab Samples' and 'Composite Samples' in connection with water quality monitoring.	4
c)	Briefly explain the physical characteristics of an estuary with special emphasis to the terms like 'Flood Flow', 'Ebb Flow', 'Flood Flux', 'Ebb Flux' and 'Tidal Excursion Length'. What are the methods to estimate the Flux?	6 + 2
)	Briefly describe with neat diagrams, the physical and hydrological characteristics of a river with special emphasis to the terms like 'Vertical Mixing', 'Lateral Mixing' and 'Longitudinal Mixing'.	6
)	With neat diagrams briefly explain the stratification and mixing patterns encountered in lakes and reservoirs with special emphasis on 'Overturning' and 'Stagnation'. Depending on the frequency of overturns and nature of mixing classify the lakes.	8 + 2