Ref. No. Ex/PG/CE/T/116D/2018

M. CIVIL ENGG., CHEMICAL ENGG. & BIOPROCESS ENGG. 1st Semester EXAMINATION 2018

Subject: WATER POLLUTION AND CONTROL **Time: Three Hours** **Full Marks: 100 (60 for Part I)**

Part-I

Use a Separate Answer-Script for Each Part

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

1. (a)	Define 'water quality'. Explain its difference with the 'quality of the aquatic environment'.	4
1. (b)	Define 'water quality monitoring' as per ISO. Compare 'monitoring' with 'survey' and 'surveillance' in this regard.	4
1. (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 + 5 + 5
2. (a)	With a neat flow-chart briefly describe the different steps of a water quality monitoring program as per CPCB.	10
2. (b)	Write down the guidelines for sampling of (i) Surface Water and (ii) Ground Water for water quality monitoring.	5 + 5
3. (a)	Write down the physical, chemical and biological parameters to be monitored as per 'Protocol for Water Quality Monitoring' by GOI for assessment of 'Baseline' Water Quality and Water Quality 'Trend' for different surface water sources.	10
3. (b)	Provide a summarized list of general site selection criteria for surface water quality monitoring.	8
3. (c)	Briefly explain 'cross-sectional zonation' and 'longitudinal zonation' in connection with large scale sampling programs.	2
4. (a)	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'.	8
4. (b)	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.	10 + 2

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M.E. CIVIL/ CHEMICAL/BIOPROCESS ENGG. 1st YEAR, 1st SEMESTER EXAMINATION, 2018

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

SUBJECT: WATER POLLUTION & CONTROL

Full Marks: 100

Time: ~~Two hours~~/Three hours/~~Four hours~~/ ~~Six hours~~ (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)	Deduce the fundamental expression for **"O'Connor's Modification of Streeter-Phelps Oxygen Sag Equation".**	6
b)	What is the major hypothesis behind the **"Thomas Modification of Streeter-Phelps Oxygen Sag Equation"?**	4
c)	Deduce the fundamental equation for explaining transport process in water bodies based on continuity or conservation of mass considering three dimensional flow.	6
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: a. U_0= **3.3mg/L** of DO deficit b. U_1=**(-)0.04mg/L** of DO deficit/percent treatment c. S_0=**11.9mg/L** of DO deficit d. S_1= **(-)0.07mg/L** of DO deficit/percent treatment e. S_2=**(-)0.08mg/L** of DO deficit/percent treatment Necessary of cost-related parameters are: i) C_1= **Rs. 31,00,000/-** ii) C_2= **Rs. 37,00,000/-** iii) a_1= **Rs. 43,00,000/-** per 100% treatment efficiency iv) a_2= **Rs. 27,00,000/-** per 100% treatment efficiency v) D_{a1}= **2.5 mg/L** vi) D_{a2}= **3.7 mg/L** Determine the optimized annual cost for the entire system graphically following the concept of system analysis.	8

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

SUBJECT: WATER POLLUTION & CONTROL

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)	What are the basic physical mechanisms responsible for the transport of pollutants in fluid bodies?	3
b)	A medium-sized township discharges **18 * 10^4 cum/day** of sewage into an adjacent river whose minimum flow rate is **56 * 10^4 cum/day**. Given: i) Temperature of sewage as well as river water= **24°C** ii) BOD_5 at **20°C** of raw sewage= **210 mg/L** iii) BOD_5 at **20°C** of river water= **2.0 mg/L** iv) DO of raw sewage **=0.5 mg/L** v) DO after mixing = **85%** of C_s vi) Minimum DO to be maintained = **4.4 mg/L** vii) K_1**=0.23/day** ; K_2**=1.15/day** both at **20°C** viii) C_s at **24°C= 8.58 mg/L**. Find out the **degree of sewage treatment** required to satisfy river water quality criteria.	9
Q.4) a)	State and explain the **"Fick's Law of Molecular Diffusion"**	4
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= 7.66Km** ii. **Average flow velocity= 0.169m/sec** iii. **Flow time= 0.447day** iv. **Flow rate at the upstream side= 2.63*10^6 m^3/day** v. **Flow rate at the downstream side= 2.74*10^6 m^3/day** vi. **Temperature during measurement= 23.3°C** Given:	8

Location	K_1 at 20 °C (per day)	BOD_{ult} at 20 °C (mg/L)	DO deficit (mg/L)
upstream side (a)	0.441	6.02	6.31
downstream side (b)	0.384	4.04	5.35