Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1721806 **Date: 02/01/2014**

Subject Name: Environmental Modeling

Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	How many types of Environmental models are there? Explain each one in brief.	**07**
	(b)	Derive the differential equation for the mass balance of water as a conservative substance with numerous inputs and outputs from a water body.	**07**
Q.2	**(a)**	Explain and derive the Streeter Phelps equation for finding the DO deficit in a stream.	**07**
	(b)	Derive the mass balance equation for disposal of conventional pollutant in a river $C=C_o\exp(-kx/u)$ considering plug flow conditions.	**07**
		OR	
	(b)	Explain the types of equations used to find the growth rate of biomass in lakes.	**07**
Q.3	**(a)**	A municipal wastewater treatment plant discharges 66 m^3/min of treated effluent into a stream having flow of 500 m^3/min. The ultimate BOD of the mix is 15.5 mg/L and initial DO deficit of 1.5 mg/L. The de oxygenation constant is 0.2 /day and the average speed of river is 18 m/min and average depth is 3.0 m. Calculate (i) The BOD concentration at different time intervals. (ii) The DO deficit at different time intervals. Plot the DO Sag curve if the saturation value for DO at 20^0 C is 9.1 mg/L.	**12**
	(b)	Explain clearly the difference between Calibration and Simulation.	**02**
		OR	
Q.3	**(a)**	Enlist and explain the conventional water quality parameters in stream.	**06**
	(b)	Derive the equation to find the concentration of a biodegradable pollutant discharged into a lake.	**08**
Q.4	**(a)**	Estimate the resulting growth rate in a lake from following data. The maximum growth rate under ideal conditions is 1.1/day. NH_4+NO_3 as N / PO_4 as P Concentration ,µg/L: 60 / 7 Ks , µg/L: 30 / 7 Based on (1) Growth rate and (2) stiochiometry, which nutrient is likely to be most limiting for the plankton growth?	**07**
	(b)	What are the two phenomena on which the transport of toxic chemicals in water principally depends? Explain each.	**07**

		OR	
Q.4	**(a)**	Write a note on stratification and over turn in lakes of temperate regions.	**07**
	(b)	Highlight the objectives of environmental modeling.	**07**
Q.5	**(a)**	A lake has a surface area of 150 Km^2 and average depth of 15m. The annual rainfall is 0.5 m and evaporation from the lake is 0.6m.Runoff to the lake is 12.2 cm per year from a water shed area of 2000 Km^2.The phosphorus content of rain water is 0.01 mg/L.A total of 4.0 m3/s of water is withdrawn from the lake for water supply and 75% of it is returned to the lake with an added amount of phosphorus of 2.5 mg/L. Phosphorus loss to sediments is a first order process with a constant 0.003/d. Estimate the phosphorus content of the lake , if the phosphorus content of runoff is 0.085 mg/l.	**08**
	(b)	Explain the terms: (i) State variable (ii) Model parameters	**06**
		OR	
Q.5	**(a)**	Prepare alist of degradation reactions in water and explain any two.	**07**
	(b)	Calculate the volume of a lake over time if the sum of all inputs is $45m^3/s$ and outflows are 55 m^3/s and increasing $1m^3/s$ every day due to evaporation and water demand. Initial volume of the lake is $0.5x10^9$ m^3. Estimate the time in days when there will be no water in the lake.	**07**

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