Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – II • EXAMINATION – WINTER 2012**

**Subject code: 1721806 Date: 02-01-2013**

**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)** With the help of neat sketch , classify the lakes based on: **08**
(i) Temperature variations
(ii) Nutrient concentration

**(b)** Enlist and explain the objectives of environmental modeling. **06**

**Q.2** **(a)** Enlist and explain the importance of conventional parameters in river modeling. **07**

**(b)** Differentiate between River modeling and Lake modeling. **07**

**OR**

**(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.3** **(a)** Derive the Streeter Phelps equation for finding the DO deficit in a stream. **07**

**(b)** Enlist and explain the different types of Environmental models. **07**

**OR**

**Q.3** **(a)** Write a note on "Waste load allocation" for a river. **08**

**(b)** Explain the two phenomena on which the transport of toxic chemicals in water principally depends. **06**

**Q.4** **(a)** Derive the equation for finding the steady state concentration of a pollutant discharged in to a lake. **07**

**(b)** Write down the stoichiometric equation for finding the primary productivity in the lake. Highlight the importance of stoichiometry in the water quality management in lakes. **07**

**OR**

**Q.4** **(a)** A municipal waste water treatment plant discharges treated effluent in to a surface stream. The flow rate of waste water is 10,000 $m^3$/day, $BOD_5$ of 40 mg/L, DO concentration of 2 mg/L and temperature of $20^0$C. The stream (up stream from the point of waste water discharge) has a flow of 0.5 $m^3$/s, a $BOD_5$ of 3 mg/L, DO concentration of 6 mg/L and temperature of $20^0$C.The deoxygenation constant is 1.23 $d^{-1}$ & reaeration constant is 0.4 $d^{-1}$.Determine the critical DO deficit , assuming saturated DO concentration to be 9.1 mg/L (at $20^0$C ) **10**

**(b)** Write a short note on River Segmentation. **04**

**Q.5** **(a)** Explain the stoichiometric equation for finding the primary productivity in the lake. What is the importance of stoichiometry in the water quality management in lakes. **08**

**(b)** Enlist and explain the types of equations used to find the growth rate of **06**

biomass in lakes and explain each type.

**OR**

**Q.5** **(a)** Calculate the resulting growth rate in a lake from following data. The maximum growth rate under ideal conditions is 1.1/day. **07**

| | $NH_4$+$NO_3$ as N | $PO_4$ as P |
|---|---|---|
| Concentration ,µg/L | 60 | 7 |
| Ks , µg/L | 23 | 6 |

Based on (1) Growth rate and (2) stiochiometry, which nutrient is likely to be most limiting for the plankton growth?

**(b)** In a lake, it was observed that 0.4 µg per liter of phosphate was removed per day. Assuming the stoichiometric relationship for algal protoplasm, find out the nutrient uptake rate for nitrate and $CO_2$.Also estimate the rate of algal production in one month. **07**

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