Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 721806

Subject Name: Environmental Modelling

Date: 08 /07 /2010 **Time: 11.00am – 1.30pm**

Total Marks: 60

Instructions:

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

Q.1 **(a)** Derive the equation [Ce=W/Vβ] for the steady state concentration of a pollutant in the lake. **06**

(b) What are the objectives of environmental modeling? **06**

Q.2 **(a)** With the help of a neat sketch explain the elements in a mass balance using control volume concept. **06**

(b) If the stream has a mean velocity of 0.5 $ms^{-1}$and the concentration profile is given below from the field measurement, estimate the in-situ rate constant for BOD degradation below a wastewater discharge at x = 0.Ultimate BOD concentrations are given at the Km point where the sample was collected. **06**

X,Km	C ,mg L^{-1}
0	15.0
5	14.1
10	13.6
20	12.6
30	11.4
50	9.6
100	6.3
200	2.8

OR

(b) A tributary meets with a river. Calculate the initial concentration of dissolved oxygen, BOD of mix and temperature at the mixing point for use in D O model. **06**

River	Tributary
T =26.3 ^{0} C	T =24.9 ^{0} C
Cr=7.3 mg/L	Ct=6.8 mg/L
Lr=3.3 mg/L	Lt=6.0 mg/L
Qr=2000 m^3/d	Qt=500 m^3/d

Q.3 **(a)** What are the conventional pollutants? Why are they called so? Highlight the importance of each with the help of an example. **08**

(b) Define the terms calibration and verification relating to model. **04**

OR

Q.3 **(a)** Explain the terms: **04**

(i) State variable

(ii) Model parameters

(b) A city discharges 1.33 m^3/s of wastewater into a stream whose minimum rate of flow is 8.5 m^3/s .The velocity of the stream is about 3.2Km/h. The BOD_5 of waste is 200 mg/L and that of stream is 1.0 mg/L. The wastewater contains no DO while the stream has a DO of 9.2 mg/L. At 20^0C kd is 0.3 /d and kr is 0.7/d. Determine the critical DO deficit and its location. Plot a graph of DO sag curve for next 7 days. Take saturated DO concentration at 20^0C as 10.2mg/L. **08**

Q.4 **(a)** For a lake, it was observed that 0.32 µg per liter of phosphate was removed per day. Estimate the nutrient uptake rate for nitrate and CO_2.Also estimate the rate of algal production in one month. **06**

(b) Prepare a list of indicators for trophic status of the lake and explain any two. **06**

OR

Q.4 **(a)** For a lake showing signs of eutrophication, the surface area and average depth are 100 Km^2 and 20m respectively. The annual rainfall is 0.4 m and evaporation from the lake is 0.6m.Runoff to the lake is 0.125m 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 3.0 m3/s of water is withdrawn from the lake for water supply and 70% 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. The phosphorus content of the lake was measured as 0.07 mg/L, estimate the phosphorus loading due to runoff. **08**

(b) Explain the phenomena of stratification and overturn in lakes. **04**

Q.5 **(a)** Give the classification of lakes based on the biological productivity. **06**

(b) Explain in brief, uncertainty analysis related to environmental modeling particularly with respect to the types of errors. **06**

OR

Q.5 **(a)** Explain in detail ,the following from river modeling point of view: **08**

(i) Waste load allocation.

(ii) River segmentation

Give appropriate examples.

(b) Explain the terms relating to model calibration and verification: Validation and Simulation. **04**

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