GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. 2ND Semester Examination – June/July- 2011

Subject code:1721806

Subject Name: Environmental Modeling

Date:29/06/2011   **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)** Derive the Streeter Phelps equation for finding the DO deficit in a stream. **08**

  (b) Explain the objectives of environmental modeling. **06**

Q.2 **(a)** Derive the equation to find the concentration of a biodegradable pollutant discharged into a lake. **07**

  (b) Assuming plug flow conditions derive the mass balance equation for disposal of conventional pollutant in a river $C=C_o \exp (-kx/u)$ **07**

<div align="center">OR</div>

  (b) Using the mass balance approach, 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)** A municipal wastewater treatment plant discharges 1.1m^3/s of treated effluent into a stream having flow of 8.7 m^3/s. The ultimate BOD of the mix is 10.5 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 0.3 m/s and average depth is 3.0 m. Calculate **12**

  (i) The BOD concentration at different downstream distances.

  (ii) The DO deficit at different downstream distances.

  (iii)   The re aeration and de oxygenation rates.

  Plot the DO Sag curve if the saturation value for DO at 20^0C is 9.1 mg/L.

  (b) Explain the terms: (Any two) **02**

  (i) Calibration   (ii) Validation

  (iii)Simulation   (iv) Verification

<div align="center">OR</div>

Q.3 **(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from a water shed area of 2000 Km^2.The phosphorus content of rain water is 0.01 mg/L.A total of 4.0 m3/s of water is withdrawn from the lake for water supply and 75% of it is returned to the lake with an added amount of phosphorus of 2.5 mg/L. Phosphorus loss to sediments is a first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 run off is 0.085 mg/l. **08**

  (b) Enlist the types of equations used to find the growth rate of biomass in lakes and explain each type. **06**

Q.4 **(a)** Enlist and explain the different types of Environmental models. **07**

(b) Explain the two phenomena on which the transport of toxic chemicals in water principally depends. **07**

OR

Q.4 **(a)** Explain the phenomena of stratification and over turn in lakes of temperate regions. **06**

(b) Estimate the resulting growth rate in a lake from following data. The maximum growth rate under ideal conditions is 1.3/day. **08**

	$NH_4 + NO_3$ as N	PO_4 as P
Concentration ,$\mu g/L$	50	5
Ks , $\mu g/L$	25	5

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

Q.5 **(a)** Write a brief note on conventional parameters in stream. **08**

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

OR

Q.5 **(a)** Write short notes giving proper examples on **07**
    (i) Waste load allocation.
    (ii) River segmentation

(b) A wastewater having flow of 0.280 m3/s and ultimate BOD of 6.44 mg/L is discharged into a river having flow of 0.877 m3/s and BOD of 7 mg/L. The velocity of river is 0.650 m/s, Ka is 0.370 d^{-1} and Kd is 0.199 d^{-1} . Estimate the DO of the river at a distance 5.79 Km downstream form the point of disposal. The temperature of river and waste water both is 20^0 C and the saturated DO at this temperature is 7.9 mg/L. **07**

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