Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2721806 **Date: 27/05/2016**

Subject Name: Environmental Modeling

Time:10:30 am to 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 DO deficit in a stream **07**

(b) Derive the equation $C_e = W/Vb$ for steady state concentration of a pollution in lake. **07**

Q.2 **(a)** What is Environmental Modeling? Enlist and explain the types of models along with examples. **07**

(b) A stream has a mean velocity of 0.3m/s and concentration profile as given below. Estimate the first order rate constant k. **07**

x, km	c , mg/l
0	11
5	9.3
15	7.5
25	6.0
35	5.3
45	4.5

OR

(b) Write the mass balance equation for plug-flow stream with a first order decaying substance C. Solve for the steady state concentration as a function of rate constant(k), longitudinal distance x, mean velocity(u) & concentration at x=0 (c_0) **07**

Q.3 A city with dimension WXLXH(7km x 13km x 1.5km) had a wind velocity of 4m/s. The upwind concentration of SO_2 is 10µg/^{3}. The emission rate for the city is 4.5 x 10^{-6}. What is the concentration of SO_2 over the city? **14**

If the meteorological conditions described above occur 34% of time and for the remaining of time the wind blows at velocity of 8m/s and the same mixing height. What is the annual concentration of CO in this city.

OR

Q.3 **(a)** Write a note on óAermodô in quality model software, enlisting the data inputs required as well as the outputs of the model. **07**

(b) Highlight the chief features of Box model. **07**

Q.4 **(a)** Enlist the conventional pollutants. Highlight the importance of each with the help of an example. **07**

(b) Explain the following : **07**

(i) Waste load Allocation

(ii) River Segmentation

OR

Q.4 **(a)** A degradable material with a half life of 90 days enters a lake with a volume 2000 x 10^6 m^3. The inflow quantity is 700 x 10^6 m^3/yr with a concentration of 20mg/l. Estimate the concentration in lake at steady-state at the end of six months and its **07**

effective residence time at steady state. Assume that its initial concentration in lake is 0.25mg/l at t=0.

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

Q.5 **(a)** Give the classification of lakes based on the biological productivity. **07**

(b) With the help of a neat sketch explain the elements in a mass balance using control volume concept. **07**

OR

Q.5 **(a)** A lake receives annual rainfall of 0.4m and evaporation from lake is 0.6m. Runoff to the lake is 0.1m per year form a water shed area of 2000km^2. The phosphorus content of rain water is 0.02mg/l. For water supply, water is withdrawn at a rate of 3.0m^3/s and 65% of it is returned with added amount of phosphorus of 2.5mg/l. Phosphorus loss through the sediments is constant of 0.003d^{-1}. The Phosphorus content of lake was measured as 0.08 mg/l. If the surface area and average depth of lake are 100 km^2 and 10m respectively. Estimate the Phosphorus loading due to run off. **10**

(b) Enlist the assumption for deriving Streeter Phelps equation. **04**

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