B.Sc. Engg. (CEE)/ 8th Sem.

11 March 2024
10:00 A.M to 11:30 A.M

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid-Semester Examination | **Summer Semester: 2022 - 2023**
Course No.: CEE 4835 | **Full Marks: 75**
Course Title: Environmental Modeling | **Time: 1.5 Hours**

There are **3 (Three)** questions. Answer all **3 (Three)** questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks and corresponding CO and PO. Symbols convey their usual meanings. Assume reasonable data/values for any missing data/info.

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1. **(a)** Mathematical models cannot help us in the all stage of environmental. Draw a diagram showing the level of contribution of different scientific tools in recognizing, understanding, solving, and controlling environmental problems. **CO1, PO1: 4**

   (b) You have calculated the first order rate constant of Turag river is 10 day^{-1}. Briefly explain the meaning of this rate constant. **CO1, PO1: 6**

   (c) The Dhanmondi lake (volume = 4 x 10^7 m^3, Surface area= 5×10^6 m^2) has a steady state concentration of 10 µg/L of total nitrogen. In 2020, it receives an additional loading of 500 Kg/year from a detergent processing plant located close to Tejgaon industrial area. The calculated settling rate in 8 m/year. Compute the concentration in the system from 2020 to 2024. Also draw the shape parameters to assess the ultimate effect of the plant. Consider, the lake has similar inflow and outflow of $5X10^5$ m^3/year. (1 kg/m^3= 1µg/l) **CO2, PO2:15**

2. **(a)** Write down the mass balanced equation for a CSTR lake. Also, list down different variables and parameters of the equation. **CO1, PO1: 5**

   (b) Why is it preferable to use concentration as an indicator of impact on the environment? **CO1, PO1: 3**

   (c) Define diffusion, advection and mechanical dispersion from the perspective of **groundwater** contamination transport. **CO1, PO1: 7**

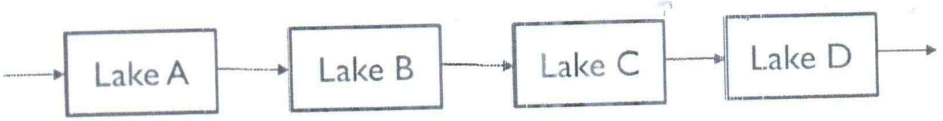
   (d) The Buriganga receives a total nitrogen loading of approximately 12×10^6 kg/year and in river concentration of 40 µg/L. The government wants to save the river from extensive eutrophication. For this reason, the authority was ordered to reduce the nitrogen loading to half of the previous loading. Compute the assimilation factor. What in river concentration would result from the nitrogen reduction action? **CO2, PO2:10**

3. **(a)** Name two most common methods of sensitivity analysis with necessary figures. **CO1, PO1: 3**

   (b) What is the difference between homogenous and heterogenous reactions? Show the effect of sewage when discharge on water bodies. **CO1, PO1: 5**

   (c) Four lakes are connected in series have the following characteristics: **CO2, PO2: 17**

	Lake			
Parameter	A	B	C	D
Volume (10^6 m^3)	5	4	3	3
Mean depth (m)	6	5	4	6
Surface area (10^6 m^2)	0.75	0.60	1.0	0.5
Loading (Kg/year)	500	400	100	75
Flow (10^6 m^3/year)	1	1	1	1



If the pollutant settles at a rate of 10 m/year, calculate the steady state chemical concentration in each lake. How much of the concentration in the fourth reactor due to the loading to the second reactor.