M. Sc. in Civil Engineering

February 24, 2023
Time: 2:00 PM–3:30 PM

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

TERM: MID SEMESTER EXAMINATION — SUMMER SEMESTER: 2021-2022
COURSE NO.: CEE 6305 — TIME: 1.5 Hours
COURSE TITLE: Surface Water Quality Modeling — FULL MARKS: 75

There are **3 (Three)** questions. Answer **ALL** questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. Symbols convey their usual meanings. Assume reasonable values for any necessary design data where required.

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1. **(a)** Explain major characteristics of Surface Water. Why should you maintain Clean Water Act? **(7)**

   (b) Explain the concept of developing a Water Quality Model with a suitable example. **(8)**

   (c) Discuss briefly the role of modeling in Water Quality Management. How do you apply SWQM in improving the water quality of the Turag river? **(10)**

2. **(a)** Describe the concept of the Mass-Balance method for estimating phosphorus pollution in lake water while taking into account the simple phosphorus model. **(12)**

   (b) Consider a lake with 300×10^6 m^2 of surface area for which the only source is the effluent from a wastewater treatment plant. The effluent flow rate is 0.55 m^3/s and its phosphorus concentration is 11 mg/L. The lake is also fed by a canal having 25 m^3/s with 5 g/m^3 of phosphorus. If the phosphorus settling rate is estimated to be 8.5 m/year, then, (i) estimate the average phosphorus concentration in the lake, (ii) what level of phosphorus removal at the treatment plant would be required to keep the average lake concentration below 0.090 mg/L? **(13)**

3. **(a)** Explain the concept of Mass-Transport approach in developing a Surface Water Quality Model. **(5)**

   (b) Explain the assumptions of DO model. Discuss the sources and sinks for this DO model **(5)**

   (c) A municipal wastewater treatment plant discharges 0.4 m^3/s of treated effluent having BOD_5 of 45 mg/L and DO of 1.5 mg/L into a stream that has a flow of 0.5 m^3/s and a BOD_5 of 3 mg/L and DO of 7.5 mg/L. The temperature of the river is 24^0C. The deoxygenation constant K_d is 0.22/day at 20^0C. The stream has a depth of 2.5 m and the average stream velocity is 0.18 m/s. **(15)**
   (i) Find the critical distance downstream at which DO is a minimum.
   (ii) Find the minimum DO.