CIVE 3331 - ENVIRONMENTAL ENGINEERING
Spring 2003

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Purpose: Exercises related to Lecture # 7. These exercises develop skills in selected environmental chemistry problems. Critical thinking is exercised in determination of analogies between lecture examples and the problems in this exercise set. Direct relationships to various accreditation objectives are highlighted in **Bold** type in the following sections. The exercises start on the next page.

Relevant ABET EC 2000 Criteria: Criterion 3 Program Outcomes and Assessment

(3-a) an ability to **apply knowledge of mathematics, science,** and engineering.
(3-e) an ability to identify, **formulate**, and **solve engineering** problems.
(3-k) **an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**

Relevant CEE Educational Objectives:

(3) Emphasize problem-identification, problem-formulation and communication skills, **problem-solving techniques** and the many facets of engineering design throughout the curriculum.

(5) Prepare every student to develop the skills for critical thinking and lifelong learning.

Relevant CEE Program Outcomes:

ii. **Students should acquire the ability to solve practical civil engineering problems by applying the knowledge of mathematics, science**, **engineering, modern techniques**, **skills and practical tools they gained in their courses.**

Exercise_007-1

(These exercises requires calculation and plotting of results)

For the following waste and river characteristics at the mixing zone, find the minimum downstream DO and the location downstream of this minimum. Plot the DO Sag curve as a function of distance, and one the curve include a horizontal line for the saturation DO.

Parameter	Wastewater	River
Flow (m^3/sec)	0.3	0.9
Ultimate BOD(mg/L)	6.4	7.0
DO(mg/L)	1.0	6.0
$k_D(day^{-1})$	--	0.2
$k_R(day^{-1})$	--	0.37
Q/A (m/s)	--	0.65
DO_{sat}	8.0	8.0

Sketch:

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Exercise_007-2

(These exercises requires calculation and plotting of results)

Just downstream of the outfall from a point source of pollution the DO of a river is 6 mg/L and the mix of the river and wastes has a BOD of 20 mg/L. The saturation value of DO is 9.0 mg/L. The de-oxygenation constant is k_d = 0.2/day.

a) Estimate the re-aeration coefficient using the O'Conner-Dobbin model assuming the river speed is 0.25 m/s and the average depth is 3 m.
b) Find the critical point downstream (in distance units)
c) Find the critical point downstream (in travel time units)
d) Find the minimum DO value.
e) If the outfall is the only source of BOD, what percent removal is needed to assure a minimum DO value of 5.0 mg/L or greater?
f) Plot the DO curve with and without the treatment required.
g) Does the location of the minimum change with treatment?

Sketch:

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