ENV 5666-U01 (15181) WATER QUALITY MANAGEMENT
Prerequisites: Permission of the Instructor
Department of Civil and Environmental Engineering
Florida International University
Spring 2023

Instructor: Professor Fuentes, Ph.D., P.E., B.C.E.E.
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Office Hours: M and W: 1:00 -2:30PM (first-come, first-served).
All other office hours by appointment.

Lecture location and time:
EC-2440; Wednesday: 6:25-9:05AM.

A. Course Description & Objective

The quality of our water resources is vital to the health and welfare of humans, communities, and environment in the planet. Their protection requires understanding of the laws, principles, and methods to then further develop mathematical models for simulation of the flow, fate, transport and effect of contaminants in surface water bodies. The *learning objective* of the course is to provide civil engineering and environmental engineering graduate students with a working knowledge of the fundamental role that physical, chemical, and biological processes play in deriving mathematical models that simulate the flow, fate and transport of contaminants in surface waters.

Course contents will then focus on a sequence of surface water quality modeling themes as follows: a) completely mixed and incompletely mixed systems and b) applications to lakes, rivers and streams, and estuaries. Examples of relevant questions are: How does concentration change along an inter-tidal river after a spill of a hazardous compound? What are the governing equations to effectively simulate the transport of arsenic through a system of interconnected lakes?

B. Textbook & Study Material

Required textbook/material:

1. *Chapra, S. C., "Surface Water-Quality Modeling,"* Waveland Press (re-issued 2008), ISBN 1-57766-605-4, Long Grove, Illinois.

2. Selected Reference Handouts (students must make their own copies from library reserves).

Although the text will assist you well during the course, you are expected to supplement its contents with class notes, handouts and recommended references. Each student is responsible for the timely study of assigned material in advance to scheduled lectures. Thorough study of fundamental theory, methodologies and their application, via examples and solving problems, are crucial in mastering the learning objective.

C. Use & Management of Class Time

Class time is used to present and discuss theory and applications. Lectures will follow the sequence of topics, as listed below. Lectures will focus on basic concepts and representative methodologies, with an analysis of applications.

Theme	**Topic (Study Assignment)**	**Estimated Lectures**
General Background Concepts: Acts, Programs, Basic Concepts		1
Part I – Completely Mixed Systems		
1.	Introduction: 1.1 to 1.5, Appendices	1.5
2.	Reaction Kinetics: 2.1 to 2.4	1.5
3.	Steady State: 3.1 to 3.3	1.5
4.	Particular Solutions: 4.1 to 4.7	1.5
5.	Feedforward Systems: 5.1 to 5.3	1.5
6.	Feedback Systems: 6.1 to 6.5	1.5
7.	Computer methods: 7.1 to 7.4	2
Part II – Incompletely Mixed Systems		
8.	Diffusion: 8.1 to 8.5	1
9.	Distributed Systems (Steady State): 9.1 to 9.3	2.0
10.	Distributed Systems (Time Variable): 10.1 to 10.5	1.5
11.	Control-volume Approach: Steady State: 11.1 to 11.8	1.5
12.	Control-volume Approach: Time Variable: 12.1 to 12.4	1.0
Part III – Aquatic Environments		
13.	River Systems: 14.1 to 14.6	1
14.	Estuaries: 15.1 to 15.4	1
15.	Sediments: 17.1 to17.6	1
16.	The Modeling Environment: 18.1 to 18.4	1
Part IV – Applications to Selected Indicators (advanced)		
17.	Streeter-Phelps: Point Sources: 21.1 to 21.6	1
18.	Streeter-Phelps: Distributed Sources: 22.1 to 22.3	1
19.	Model Examples: QUAL2E and Others: 26.1, 26.2	1

Graduate Student Presentations (to-be-assigned by instructor): selected from textbook's Parts III, IV, V and VI, depending on student's interest.

D. Grading Policies

Homework	15%
Exam 1	25%
Exam 2	25%
Graduate Student Presentations (assigned by instructor)	5%
Project	30% (proposal due on 03/08/23; written report due on 04/21/23; and oral presentation on 04/26/23)
Total Maximum	100

The instructor will assign problems as homework, so that students practice the application of concepts in problem solving in direct support of the exams. Homework is strictly due on the scheduled day at the beginning of the class. Late homework will not be accepted, receiving zero points. Homework will follow the requested format and template and a hard copy must be presented in engineering paper (or equivalent printed option). Students are responsible for timely discussing their homework approach and solutions with the instructor, during his scheduled office hours (or by appointment), in advance to the due day.

Questions and problems in exams will focus on assigned and covered material and related applications. Homework grading and return timing does not condition any exam content. Exams 1 and 2 will be respectively held on February 22 (No. 1) and March 29 (No. 2). Both exams will be held during most of the second lecture time on the scheduled days. Exams are open book, unless announced exceptions, will comply with the exam protocols of the National Council of Examiners for Engineering and Surveying, NCEES (www.ncees.org), including its approved calculators. During exams, the instructor and other proctor(s), if any, do not answer questions that relate to any concepts, methodology or equations that are part of the test questions and problem statements. *Exams must be individually completed by each student; unless directed by the instructor, any access to the Internet or any type of communication with any organization, individual, or website is considered a violation and may result in grade of "zero" in either the entire quiz or exam or parts of them.*

The instructor will assign each student a section from the textbook for the student to prepare and make a short presentation (i.e., 10 to 15 minutes) in *MSPowerPoint* to the class. Covered material should address, at much as possible, purpose and importance, theory, concept(s), description, applications, and current research needs. Maximum grade is 5 points, equally based on the quality of the presentation and effectiveness in delivery.

One student (or teams of up to 2 students, upon instructor's approval), will complete an engineering project (see Project Addendum for guidelines in course website). A one-page proposal, per guidelines, should be presented not later than March 8, 2023. The written project report is due on April 21, 2023. The oral presentation of the project will be held on April 26, 2023. The instructor may later announce other criteria either for homework, exams or presentations. PhD students may consider (upon instructor's approval), as an alternative to the above, writing a "review paper" (refer to the Project Addendum in the court website for details).

ADVICE: ANY QUESTIONS ABOUT GRADES WILL ONLY BE CONSIDERED WITHIN THE FIVE WORKING DAYS FOLLOWING THEIR ANNOUNCEMENT.

Version 01/20/2023 Final

Final grade is a function of the total number of points accumulated by the student at the end of the course, as follows:

93.3	≤ A	≤ 100.0	76.7	≤ C+	< 80.0
90.0	≤ A-	< 93.3	70.0	≤ C	< 76.7
86.7	≤ B+	< 90.0	60.0	≤ D	< 70.0.
83.3	≤ B	< 86.7		F	< 60.0
80.0	≤ B-	< 83.3			

E. Other Performance Policies

Reading assignments, a prime student's responsibility, must be completed prior to scheduled classes. Class attendance is required. A student with three unjustified absences will be dropped from the course with a DR on March 20. Students will automatically lose 0.4 points per unjustified absence after March 20, including those prior to March 20. No make-ups or incomplete grades will be considered, unless justified and documented.

F. Days to Remember (refer for confirmation to the FIU Spring 2023 Semester Calendar and Deadlines)

UG_Academic_Calendar.pdf (fiu.edu)

January 9:	Classes begin (Presentation assignments)
January 16:	Martin Luther king Day (University Closed)
March 8:	Project Proposal
February 27-March 4:	Spring break (University Open; No Classes)
March 20:	Deadline to drop a course with a DR grade. Last day to withdraw from the University with a WI grade.
April 22:	Classes end
April 21:	Engineering Project: Written Report Due
April 26:	Engineering Project: Oral Presentation
April 24-29:	Final Week
May 3:	Deadline (by 11:59) for faculty to submit grades

The instructor will comply and enforce all applicable FIU's Policies and Regulations. It is the students' responsibility to know all applicable policies and requirements. All students should refer, for details, to the *FIU Student Handbook* (which includes the Student Code of Conduct) at https://studentaffairs.fiu.edu/about/student-handbook/index.php

Students are deemed by the university to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the FIU Student Handbook. Misconduct includes, among other, *cheating, plagiarism, misrepresentation misuse of computer services, bribery, conspiracy and collusion, falsification of records and academic dishonesty*. For details visit Student Conduct and Academic Integrity | Division of Academic & Student Affairs | Florida International University (fiu.edu)

Version 01/20/2023 Final

Students should be aware of both Panthers Care and CAPS services for students, which support their well-being

G. Some Recommended References

The following books, for your consideration and use, may be checked out from the instructor, during his scheduled office hours, for up to 48 hours.

Water-Quality Engineering in Natural Systems, D. A. Chin, Wiley, 2013.

Environmental Systems Engineering, L. G. Rich, McGraw-Hill, 1973.

Aquatic Chemistry, W. Stumm and J. J. Morgan, John Wiley & Sons, Inc., 1996.

Principles of Surface Water Quality Modeling and Control, R. V. Thomann and J. A. Mueller, Harper & Row Publishers, New York, NY, 1987 (2).

Relevant Supporting USA Federal and State Agency Websites:

www.epa.gov www.usgs.gov www.nws.noaa.gov www.nrcs.usda.gov

www.dep.state.fl.us/water

Background Tour Websites (USEPA):

https://www.epa.gov/npdes/npdes-permit-basics

https://www.epa.gov/tmdl

https://www.epa.gov/tmdl/tmdl-modeling

Modeling and Models:

Environmental Modeling Community of Practice | US EPA

Surface Water Models to Assess Exposures | US EPA

Total Maximum Daily Load (TMDL) Models and Tools to Assess Exposures | US EPA