

Colorado State University  
Department of Civil and Environmental Engineering  
Spring 2019  
CIVE 542 Water Quality Modeling



**Instructor:** Dr. Ryan Bailey  
Email: [rtbailey@colostate.edu](mailto:rtbailey@colostate.edu)  
Office phone: 491-5045  
Office location: Engineering A207-A  
Office hours: MW 11:00 – 12:00

Class Time: MWF 2:00 – 2:50 pm  
Class Location: Engineering B101

**Class Website:** <http://info.canvas.colostate.edu/login.aspx/> The Canvas website will be used to post homework assignments, additional instructional material, announcements, etc.

**Textbook:** Surface Water-Quality Modeling (1997), Steven C. Chapra. Waveland Press, Inc.

**Prerequisites:** 2 semesters of chemistry; one course in hydrology or water quality.

**Course Description:** Chemical, physical, and biological processes defining surface water quality and other hydrologic feature that affect surface water quality; construction and application of computer models for lakes and streams.

**Objectives:** Familiarize students with concepts, terminology, chemistry, and math skills required to solve and model surface water quality problems.

**Topics Covered:**

- Introduction to surface water impairment; history of water quality modeling
- Chemical Reaction chemistry
- Completely Mixed Systems (lakes, ponds): oxygen, nutrients, pathogens
- Incompletely Mixed Systems (streams, rivers): oxygen, nutrients, pathogens
- Watershed Systems
- Model calibration, testing, sensitivity analysis
- Modeling for Total Maximum Daily Loads (TMDLs)
- Water Quality Models: LAKE2K, QUAL2K, SWAT, BASINS

**Teaching Philosophy:** The successful completion of this course requires your attention, hard work, and respect. In return, I will strive to create a classroom setting that encourages learning, critical thinking, and respect for all students. I will endeavor to meet your academic needs, and as such encourage all students to take advantage of the weekly office hours. **I enjoy helping students outside of the classroom.** However, please be respectful of my time, as I have other duties to perform within the department.

I teach mainly with board notes, with PowerPoint slides used to assist with visualizing the physical problems.

**Academic Integrity:** Academic dishonesty is extremely serious. University rules, including academic penalty and further investigation by the university authorities, will be strictly enforced in this course. Please review the CSU Student Code for details regarding these rules. I know that solution manuals are available for most textbooks on the internet. Copying from them not only will prevent you from learning, and thereby result in lower exam scores, but also may lead to dismissal from the course.

**Reading:** Besides chapters from the book that will supplement lecture material, you may be assigned journal papers and agency reports as reading material throughout the semester. These are chosen to enhance the material covered in lecture. There will be a short 5 minute quiz regarding the material of the paper/report at the beginning of the lecture indicated.

**Homework:**

- Homework sets will be assigned most weeks, due at the start of class on the date indicated on the assignment sheet. Late homework will be accepted, although the score will be decreased by 25% of the total possible points for each day that the assignment is late.
- Homework assignments must be typed or neatly hand-written on engineering paper. Often, Excel spreadsheets will accompany solutions and can be submitted in *Canvas*. Solution development must be shown in a step-by-step manner. Partial credit will be given. Students can collaborate on homework sets but each student must write and submit their own homework.

**Exams:** There will be two mid-term exams. The exams will be closed book, with 1 sheet (front and back) of notes and equations allowed.

**Semester Project:** A modeling project will be assigned, that is to be turned in by 5 pm on the day of the course's scheduled final exam. Late projects will not be accepted.

**Makeup exam policy:** For students who cannot attend regular exams due to university business duty, serious illness, or family emergency (all with written proof), a makeup exam may be arranged **AFTER** the regular exam.

**Course Grading:**

The grading breakdown is as follows:

- |                   |               |
|-------------------|---------------|
| • Reading Quizzes | 5%            |
| • Homework        | 45%           |
| • Mid-Term Exams  | 12.5% + 12.5% |
| • Final Project   | 25%           |

Term grades for this course will use the  $\pm$  grading system as described in the CSU catalog. Grades will be assigned according to the following range:

90 – 100%	A
80 – 89%	B
70 – 79%	C
60 – 69%	D
< 60%	F

This range will not be shifted up. However, it may be shifted down based on relative difficulty of homework exercises and exams. If, at the end of the semester, a student's score is 0.5% from a higher grade, then that student will receive the higher grade **if** the student's semester homework score is higher than the student's overall semester score.

**Tentative Course Outline**

*May change according to the discretion of the instructor*

Week	Date	Topic
1	Jan 22	Introduction to Water Quality Modeling
2	Jan 28	Completely Mixed Systems: Chemical Reactions
3	Feb 4	Completely Mixed Systems: Single Systems
4	Feb 11	Completely Mixed Systems: Multiple Systems
5	Feb 18	Model calibration, sensitivity analysis, TMDL assessment
6	Feb 25	LAKE2K background: hydrology and heat budgets
7	Mar 4	LAKE2K background: nutrients and microbes <b>Exam #1</b>
8	Mar 11	LAKE2K background: plants, sediment, pathogens
9	Mar 18	Spring Recess
10	Mar 25	Incompletely Mixed Systems: Distributed Systems
11	Apr 1	Incompletely Mixed Systems: Control Volume Approach
12	Apr 8	QUAL2Kw background: rivers and streams
13	Apr 15	QUAL2Kw background: DO, nutrients, solution strategy <b>Exam #2</b>
14	Apr 22	SWAT Model Details
15	Apr 29	SWAT (HAWQS), BASINS
16	May 6	Advanced Topics
17	May 14	<b>Project due in Dr. Bailey's office at 5 pm</b>