CIVE 542 Water Quality Modeling

MWF 9:00-9:50 AM in ENG B-3

INSTRUCTOR: Dr. Michael Gooseff
OFFICE: B-208 Engineering Building
TELEPHONE: 461-6057
EMAIL: mgooseff@engr.colostate.edu
OFFICE HOURS: Wednesdays 10 AM – 12 PM, Thursdays 11 AM – 12:30 PM or by appointment

REQUIRED TEXT: Chapra, S.C., 1997. Surface Water-Quality Modeling, McGraw-Hill, New York, NY., pp. 844.
OR Chapra, S.C., 2008. Surface Water Quality Modeling, Waveland Press, pp. 844.

GRADING:	Homework	35%
	Projects	35%
	Quizzes	30%

Final grades will be based on the weighted-average specified above and assigned as follows:

- A+ = 97-100%
- A = 93-97%
- A- = 90-93%
- B+ = 87-90%
- B = 83-87%
- B- = 80-83%
- C+ = 77-80%
- C = 73-77%
- C- = 70-73%
- D+ = 67-70%
- D = 63-67%
- D- = 60-63%
- F < 60%

I reserve the right to adjust your grades. Your grade will only improve if adjustments are necessary. Feel free to contact me during office hours or by appointment if you have grade-related questions or concerns.

COURSE GOALS:
Enable you to apply the fundamental principles of behind numerical simulations of biological, chemical, and physical processes in surface water systems. You will use a few common models available for free on the internet:
1) QUAL-2K (created and maintained by the US EPA),
2) SNTEMP (created and maintained by the US Geological Survey)
Many more are available and *all have their pros and cons*.

HOMEWORK:
Homework will be assigned weekly and is due at the **beginning of class** on the subsequent week (generally 1 week later). Late homework **will not** be accepted. Please present your work in an organized, clear fashion.

PROJECT:
During the semester, you will be working on a self-directed modeling project in which you will apply either 1) your own numerical surface water quality model, or 2) a model that is already available (several free ones exist) to a water quality problem of your choice. If you generate your own model, you can use any coding language (I strongly encourage you to use MATLAB) you choose. However, I may not be able to help you solve coding problems. You will work by yourself on this project and generate 2 products: 1) a report of your activity to be 'turned in' as a web page (rather than a hard copy report to hand in) and 2) an e-poster presentation that will be conducted at the end of the semester. You are expected to perform simulations of changes to water quality of a particular real-world system either in forecast or in hindcast. The choice of system, water quality parameter, and

model is yours. Application of already developed models is expected to be accompanied by more extensive data gathering and simulation than application of self-generated models. To help you make progress on this project, you will turn in the following items along the way:

1) Project Proposal – due **W, Sep. 18**, a 1 page proposal defining the problem, location, data needs, and model you intend to use. I'll grade these and get them back to you with feedback about either reigning you in or pushing you a little further on one aspect or another.
2) Project Update #1 – due **W, Oct. 16**, a 1 page narrative of the progress on your proposal. I would expect that by this point you would have identified data available, started to get familiar with the model of choice, etc. Please summarize how the pieces are coming together.
3) Project Update #2 – due **W, Nov. 13**, online; send me a link to a preliminary version of your project web page with summary information and status.

QUIZZES:

Your performance in this class will also be evaluated by bi-weekly quizzes. The quizzes will be ~25 minutes long and will likely have a mix of short answer, multiple choice, and numerical problems to solve.

ACADEMIC INTEGRITY

The University's statement on academic integrity, from which the following statement is derived (not verbatim), is available at **http://learning.colostate.edu/integrity/**

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at Colorado State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Conduct Code states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. All students are expected to act with civility, personal integrity; respect other students' dignity, rights and property; and help create and maintain an environment in which all can succeed through the fruits of their own efforts. An environment of academic integrity is requisite to respect for self and others and a civil community. Academic integrity includes a commitment to not engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty include cheating or copying, plagiarizing, submitting another persons' work as one's own, using Internet sources without citation, fabricating field data or citations, "ghosting" (taking or having another student take an exam), stealing examinations, tampering with the academic work of another student, facilitating other students' acts of academic dishonesty, etc. Students charged with a breach of academic integrity will receive due process and, if the charge is found valid, academic sanctions may range, depending on the severity of the offense, from F for the assignment to F for the course.

COURSE SCHEDULE (subject to change, if topics require more lecture time)

NOTE that Readings are FOR that particular lecture, e.g., for Lecture #5, you should read L 4 to be prepared for class.

Lec. #	*Week/Date*	*Topic*	*Reading*	*Assignments/Quiz*
1	1M – Aug 26	Introduction/Class Business	None	
2	1W – Aug 28	Units, Models & Reaction Kinetics	L 1, 2	
3	1F – Aug 30	Mass Conservation I - Mass Balance, CSTR Steady-State Solution	L 3	
	2M – Sep 2	*No Class – Labor Day Holiday*		
4	2W – Sep 4	Mass Conservation II - CSTR Steady-State Solution, Response Time	TBD	Homework #1 due
5	2F – Sep 6	Particular Solutions	L 4	
6	3M – Sep 9	Feedforward Systems of Reactors	L 5	Homework #2 due
7	3W – Sep 11	Feedback Systems of Reactors ** *end of regular drop period* **	L 6	
8	3F – Sep 13	Catch up…	TBD	Quiz #1
9	4M – Sep 16	Numerical Methods for Control-Volume Approach	L 7	Homework #3 due
10	4W – Sep 18	Diffusion	L 8	Project Proposal due
11	4F – Sep 20	Advection-Dispersion	TBD	
12	5M – Sep 23	Distributed Systems, Steady-State	L 9	Homework #4 due
13	5W – Sep 25	Distributed Systems, Time-Variable	L 10	
14	5F – Sep 27	Distributed Systems, Time-Variable	TBD	Quiz #2
15	6M – Sep 30	Steady-State Solutions for Control Volumes	L 11	Homework #5 due
16	6W – Oct 02	Steady-State Solutions for Control Volumes	L 12	
17	6F – Oct 04	Simple Time-Variable Solutions, Crank-Nicolson Scheme	L 13	
18	7M – Oct 07	Modeling Rivers & Streams, Routing Flow	L 14	Homework #6 due
19	7W – Oct 09	The Modeling Environment	L 18	
20	7F – Oct 11	Guest Lecture by Dr. Mazdak Arabi on SWAT applications		
21	8M – Oct 14	BOD and Oxygen Saturation	L 19	Quiz #3; Homework #7 due
22	8W – Oct 16	Gas Transfer and Oxygen Reaeration	L 20	Project Update #1
23	8F – Oct 18	Point Source Models (Streeter-Phelps)	L 21	
24	9M – Oct 21	Distributed Source Models	L 22	Homework #8 due
25	9W – Oct 23	Nitrogen	L 23	
26	9F – Oct 25	Catch up…	TBD	Quiz #4
27	10M – Oct 28	Photosynthesis	L 24	Homework #9 due
28	10W – Oct 30	Respiration	TBD	
29	10F – Nov 1	Sediment Oxygen Demand	L 25	
30	11M – Nov 04	Pathogens	L 27	Homework #10 due
31	11W – Nov 06	Eutrophication and Phosphorus Loading	L 28, L 29	
32	11F – Nov 08	Catch up…	TBD	Quiz #5
33	12M – Nov 11	Heat Budgets I	L 30	Homework #11 due
34	12W – Nov 13	Heat Budgets II	TBD	Project Update #2
35	12F – Nov 15	SNTEMP Model	TBD	
36	13M – Nov 18	Plant Growth & Nonpredatory Losses I	L 33	Homework #12 due
37	13W – Nov 20	Plant Growth & Nonpredatory Losses II	TBD	
38	13F – Nov 22	Predator-Prey and Nutrient/Food-Chain Interactions I	L 34	Quiz #6
Nov 25-29 – NO CLASS – Fall Recess… enjoy the break…				
39	14M – Dec 02	Predator-Prey and Nutrient/Food-Chain Interactions II	TBD	Homework #13 due
40	14W – Dec 04	Toxic Substance Modeling	L 40	
41	14F – Dec 06	Catch up…		
42	15M – Dec 09	Student Presentations		Quiz #7, Projects Due
43	15W – Dec 11	Student Presentations		
44	15F – Dec 13	Student Presentations		