CVEN 5534: Wastewater Treatment
Fall 2016

Instructor	Sherri Cook Office: S299 SEEC, Email: sherri.cook@colorado.edu Office Hours*: Tuesdays 4:20-5:20pm, Wednesdays 2-4pm *changes announced in class or by D2L
Course Time and Location	Tuesdays & Thursdays, 10:30-11:45am; SEEC S265 (maps: http://www.colorado.edu/even/about-us/map-and-directions/access-seec-environmental-engineering-computer-lab)
Course Homepage	D2L: https://learn.colorado.edu/
Course Prerequisites	This course is an upper-level graduate course that requires engineering problem solving skills and a basic working knowledge of chemistry, microbiology, and reactor design. The following skills/courses will be needed: • Engineering problem solving skills (e.g., BS in engineering field) • Graduate level critical analysis skills (e.g., one semester of graduate courses; experience interpreting/analyzing/synthesizing research articles) • Environmental Engineering Processes – CVEN 5464 • Environmental Microbiology – CVEN 5484 • Water Chemistry – CVEN 5404 *If a student is lacking any of these pre-requisites, see the instructor to discuss your participation in the course. Students without these courses can pass, but it requires a lot more work on the student's part, as those topics will not be taught and it's expected that the student knows them.*
Text *(required)*	Grady, C. P. L. Jr.; Daigger, G. T.; Love, N. G.; and Filipe, C. (2011) Biological Wastewater Treatment, Third Edition, CRC Press, Francis and Taylor Group. Referred to as "GDLF". This book is at the CU bookstore and is an Ebook: http://www.crcpress.com/product/isbn/9780849396793. Additional notes and lectures will be posted on D2L. Recommended: Tchobanoglous, G.; Stensel, H.D.; Tsuchihashi, R.; and Burton, F.L. (2013) Wastewater Engineering: Treatment and Resource Recovery, Fifth Edition, AECOM, McGraw-Hill. Referred to as "Metcalf & Eddy". A limited number of copies are available at the CU bookstore.
Software *(Bechtel access required)*	Students will have access to BioWin software through the Bechtel labs (ECCE 157). Students need to sign up for access to the Bechtel Lab at the 4th floor CEAE main office. This program will be used during class and required for homeworks, projects, and possibly for exams.
Course Description	Ever wonder what happens after you flush the toilet? Find the answer in CVEN 5534, where we will cover the biological, chemical, and physical processes used to treat municipal wastewater. This course will focus on the biological processes employed to treat domestic wastewater. Specifically, it will include the design of aerobic, anoxic, anaerobic, and suspended growth technologies to remove, recover, and/or transform organic and inorganic pollutants. To facilitate the design of these wastewater treatment systems, this course will include the study and application of fundamental concepts of microbiological processes and computational models. In addition to conventional treatment schemes, this course will cover more sustainable wastewater management approaches that aim to recover the resources found in wastewater, such as energy, nutrients, and water. *3.0 Credit Hours.*

Course Objectives	At the completion of the course, students should be able to: 1. Describe the biological, chemical, and physical processes that are used to treat municipal wastewater and that are used to recover resources (e.g., water, energy and nutrients) from wastewater. 2. Obtain and interpret results from biological process simulation software and apply towards design in order to meet effluent criteria. 3. Perform a preliminary design of the treatment process(es) needed to treat a specified influent, given effluent and/or energy criteria. 4. Justify the selection of treatment process(es) for a specified influent based on effluent regulatory requirements as well as relevant environmental and economic impacts.

Grading		
	Class Participation and Conduct	10%
	Homework	20%
	Quizzes	10%
	Project	10%
	Midterm Exam	25%
	Final Exam	25%

Class Participation and Conduct	Class sessions will regularly include activities during which students will work with partners to improve their understanding of course material. Partners may periodically be asked to submit <u>effort and professionalism assessments</u> of their peers (i.e., peer ratings) for in-class activities. These assessments, coupled with project team peer evaluations, instructor observations, and attendance, will be incorporated into the Class Participation and Conduct grades. This is an upper-level graduate course that you are taking to prepare yourself as a professional in the water field. You are expected to act professional and respectful during classroom activities. For written communications, your presentation must be professional (e.g., clean and organized papers and writing). For email communications, include "CVEN 5534" in the subject line and write well thought out and professional emails (e.g., correct grammar, clear writing, etc). Students are responsible for regularly checking their e-mails from me and for the announcements and materials posted on the D2L website.

Homework	Homework assignments will be due at the start of the class period. Late homeworks will be accepted, with 50% penalty, until 48 hours after due date; after that time, no late homeworks will be accepted. It is essential that each student complete homework assignments in order to fully grasp course concepts that will be tested on exams. Students are allowed (*and encouraged*) to discuss problem solving strategies with their classmates; however, each student must hand in solutions that have been generated individually. *Violations of the honor code will be strictly enforced.* To receive full credit, all steps to solving problems need to be presented in a clear and logical manner. All problem assumptions, known parameters, and governing equations should be clearly listed, and all assumptions should be adequately tested when feasible. A person who is technically literate should be able to read your problem solutions and easily follow the logic that you used. Points will be deducted for sloppy presentations. In addition: • Use only one side of engineering paper or white paper. • Write legibly and use pencil or black ink. • Include your name and page number on each page. • Staple all pages together. • Show all work and include units on all values. • Box the final answer.

Quizzes	To emphasize important concepts from the reading material and help prepare students for lectures and class discussions, quizzes will be given periodically. The quizzes will be open book and must be completed independently. Quizzes will be posted and are to be completed online on the D2L website by the specified deadline, which will also be announced in class. Quiz questions will be formulated from the assigned reading and objective questions (located at the back of each chapter in the text book).
Project	A small team modeling project will be assigned halfway through the semester. Details about the project will be given at that time. Grades will be based on both a written report and an oral presentation.
Exams	All exams will be closed note/closed book unless otherwise indicated. Exams will be a mixture of problems to be solved (modeled after the homework assignments) and conceptual questions. Equally (if not more) important is one's understanding of fundamental concepts. Exam concepts will be cumulative, so the second (Final) exam will build upon the first exam; however, approximately 50% of the second exam will focus on material from the second half of the class. Final exam schedules: http://www.colorado.edu/registrar/sites/default/files/attached-files/fall2016final_exam_schedule.pdf.
Re-Grading	Grades will not be discussed on the day the assignment is returned to the student. Re-grade requests <u>must be submitted in writing</u> and will be accepted for consideration up to one week after the assignment or exam has been returned. Students should be aware that the entire assignment will be re-graded by the instructor, not just the portion in question. Distribution of final grades will take into consideration an individual's performance relative to others in this class as well as the performance of previous classes. Historically, grade distributions have fallen along a traditional scale of: 90 – 100 = A+/A/A-; 80 – 89 = B+/B/B-, etc. A scaling factor may be added to a particular exam or assignment if I judge it to be necessary. Any scaling factors added will be announced as needed.

Approximate Course Schedule[1]:

DATE	TOPIC	READING (GDLF)	ASSIGNED	DUE (at start of class)
Aug 23	Course Introduction: WW Treatment Overview & History, Expectations (Midterm review)	Notes		
Aug 25	Course Introduction (cont)	Notes		
Aug 30	Wastewater Characteristics: Quantity	Notes	HW#1	
Sept 1	Wastewater Characteristics: Quality	Notes	Q#1(Ch. 2)	
Sept 6	Wastewater Characteristics: Quality Biochemical Operations: Classification	Notes Ch.1		
Sept 8	Biochemical Operations: Fundamentals	Ch.2		
Sept 13	Bioenergetics	Notes	Q#2(Ch.3.1-3.2) HW#2	Q#1(Ch. 2) HW#1
Sept 15	Solids Management	D.K. notes		
Sept 20*	Solids Management (cont)	D.K. notes		
Sept 22	Solids Management (cont)	D.K. notes	DK-HW#a	
Sept 27	Bioenergetics (cont) Stoichiometry & Kinetics	Ch. 3	Q#3(Ch.3, 9.6, 5)	Q#2(Ch.3.1-3.2)
Sept 29*	Solids Management (cont)	D.K. notes	DK-HW#b	
Oct 4	Stoichiometry & Kinetics (cont)	Ch. 3	HW#3	
Oct 6	Model Inputs: Approximate WW Characteristics	Ch. 9.6		
Oct 11	Simple Model: Aerobic Growth, Single CSTR	Ch. 5	Q#4(Ch.6)	HW#2
Oct 13	Simple Model (cont)	Ch. 5		Q#3(Ch.3, 9.6, 5)
Oct 18	Simple Model Review & Example	Ch. 6		
Oct 20	IWA Activated Sludge Model Introduction	Ch. 6		HW#3
Oct 25	ASM (cont) Material Review and Conceptual Application	Ch. 6		HW#4 (5pm)
Oct 27	Material Review and Conceptual Application			
Nov 1	MID-TERM EXAM *(final date to be set 2 weeks in advance)*	through simple model		
Nov 3	ASM (cont) and Multiple Activities	Ch. 6, 11	Q#5(Ch.7,12)	Q#4(Ch.6)
Nov 8	Biological Nutrient Removal	Ch. 7		
Nov 10	Biological Nutrient Removal (cont)	Ch.8, 14	Project	Q#5(Ch.7,12)
Nov 15*	Process Modeling using BioWin (Prof. Silverstein)	Notes, In Bechtel	Q#6(Ch.8,14) HW#5	
Nov 17	BioWin Exercises and Class Time for Projects	Notes, In Bechtel		
Nov 22	No Class – Fall Break			
Nov 24	No Class – Fall Break			
Nov 29	BioWin Exercises and Class Time for Projects	In Bechtel	Q#7(review)	Q#6(Ch.8,14)
Dec 1	Anaerobic Processes & Solids	Notes		HW#5
Dec 6	Designing for Sustainability			
Dec 8	Class Presentations			Q#7(review) Project Report
Dec 13	FINAL EXAM: 4:30pm – 7:00pm			

[1]This schedule is tentative and final due dates will be stated in class

University Policies
All of CU's Policy statements are important to this class. Please become familiar with the CU policies at http://www.colorado.edu/policies/ and take particular note of those policies listed below. Please do not hesitate to ask me for clarification about how any of these policies relate to our class.

Accommodation for Disabilities
If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu. If you have a temporary medical condition or injury, see Temporary Injuries guidelines under the Quick Links at the Disability Services website and discuss your needs with your professor.

Religious Holidays
Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, the instructor should be notified within the first two weeks of the course of any potential conflicts, and I will be happy to make reasonable and appropriate accommodations. See full details at http://www.colorado.edu/policies/fac_relig.html. See the campus policy regarding religious observances for full details.

Classroom Behavior
Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the student code.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation
The University of Colorado Boulder (CU Boulder) is committed to maintaining a positive learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CU's Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU Boulder's Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at the OIEC website.

Honor Code
All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the academic integrity policy of the institution. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code Council as well as academic sanctions from the faculty member. Additional information regarding the academic integrity policy can be found at honorcode.colorado.edu.