Course Description
Analysis and design of physical and chemical processes typically used for treatment of U.S. public water supply. Water quality requirements; rate processes and reactor design; particulate removal; disinfection; removal of dissolved organic contaminants; treatment process combinations; cost analysis. Emphasis on applications to water supply.

Course Objectives
During this semester, students should learn:
• how the quality of our municipal drinking water affects public health;
• the physical, chemical, and biological conditions and standards required for “safe” public water supply;
• which physical and chemical processes are commonly used to treat municipal drinking water to acceptable quality;
• the scientific bases and engineering principles that govern the effectiveness of common drinking-water treatment processes; and
• the nature of some of the most important challenges currently facing public drinking-water utilities.

Learning Outcomes
The work completed by students in this course should help those students to attain:
• an ability to apply physical and chemical principles of environmental engineering;
• an ability to design physical and chemical processes for large-scale centralized treatment of municipal drinking water;
• an ability to function on teams;
• an ability to identify, formulate, and solve environmental engineering problems; and
• an ability to communicate effectively.
ENV 6438: Physical & Chemical Processes for Drinking Water Treatment
Department of Civil & Environmental Engineering
University of South Florida

Cunningham

Lectures: Tuesdays and Thursdays, 3:30–4:45 PM, room NES 102

Credit: 3 units, letter grade

Instructor: Professor J A Cunningham ENC (Engineering Bldg III), room 3215
cunning@usf.edu (813) 974-9540

Office hours: About 2–3 hrs/wk will be allocated for ENV 6438 office hours.
Times will be announced during the first or second week of class.

(If you already have the 2nd edition, you might get away with it, but I will
principally use the 3rd edition, so that one is recommended.)

Pre-requisites: If you have already taken ENV 6002, and/or if you have a bachelor’s degree in
chemical engineering, you will probably be better prepared that students who
have neither of these. If you have neither of these, but you have taken at least 1
rigorous class in Environmental Engineering and you are willing to work hard,
you will likely be fine. If you have none of these qualifications, I do not
recommend ENV 6438 for you at this time.

E-mail: Outside of class, I will use e-mail to disseminate information. This will be
done through the Canvas program so I can reach all students at once. Make
sure that Canvas delivers to an active e-mail account.

Grading: 25% homework, 16.7% midterm exam, 25% project, 33.3% final exam

Web site: Course documents – including homework assignments – will be posted on
Canvas. I will also attempt to maintain a course web site:
http://www.eng.usf.edu/~cunning/ENV6438-DrinkingWater/ENV6438-DrinkingWater.htm

Reserves: As the semester goes along, I might place on course reserve some books and
articles that I think will be helpful to you. If you have suggestions, please let
me know.

Syllabus 11 January 2016
Course Schedule
The course schedule below should be pretty accurate, but there may be some slight variations, depending on how quickly we progress. Please consider the schedule below to be my best guess at how the semester will proceed. In the unlikely event that exam dates need to change, students will be given plenty of advance warning.

<table>
<thead>
<tr>
<th>Week #</th>
<th>Dates</th>
<th>Topics Covered</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>January 12</td>
<td>Course introduction</td>
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<tr>
<td></td>
<td>January 14</td>
<td>Water quality and public health</td>
<td></td>
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<tr>
<td>Week 2</td>
<td>January 19</td>
<td>Chemical reactions</td>
<td>Homework 1 due</td>
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<tr>
<td></td>
<td>January 21</td>
<td>Reactor theory: ideal reactors</td>
<td></td>
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<tr>
<td>Week 3</td>
<td>January 26</td>
<td>Reactor theory: residence time distribution</td>
<td>Project stage 1 due</td>
</tr>
<tr>
<td></td>
<td>January 28</td>
<td>Reactor theory: residence time distribution</td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td>February 2</td>
<td>Particulates in water</td>
<td>Homework 2 due</td>
</tr>
<tr>
<td></td>
<td>February 4</td>
<td>Particles, coagulation, &amp; flocculation</td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td>February 9</td>
<td>Coagulation &amp; flocculation</td>
<td>Homework 3 due</td>
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<tr>
<td></td>
<td>February 11</td>
<td>Coagulation &amp; flocculation</td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td>February 16</td>
<td>Sedimentation</td>
<td>Project stage 2 due</td>
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<tr>
<td></td>
<td>February 18</td>
<td>Sedimentation</td>
<td></td>
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<tr>
<td>Week 7</td>
<td>February 23</td>
<td>Granular filtration</td>
<td>Homework 4 due</td>
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<tr>
<td></td>
<td>February 25</td>
<td>Granular filtration</td>
<td></td>
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<tr>
<td>Week 8</td>
<td>March 1</td>
<td>guest lecture or field trip</td>
<td>Homework 5 due</td>
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<tr>
<td></td>
<td>March 3</td>
<td>Granular filtration</td>
<td></td>
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<tr>
<td>Week 9</td>
<td>March 8</td>
<td>Midterm examination</td>
<td>Midterm exam</td>
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<td></td>
<td>March 10</td>
<td>Disinfection</td>
<td></td>
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<tr>
<td>Week 10</td>
<td>March 15</td>
<td>spring break</td>
<td></td>
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<td></td>
<td>March 17</td>
<td></td>
<td></td>
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<tr>
<td>Week 11</td>
<td>March 22</td>
<td>Disinfection</td>
<td>Project stage 3 due</td>
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<tr>
<td></td>
<td>March 24</td>
<td>Disinfection</td>
<td></td>
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<tr>
<td>Week 12</td>
<td>March 29</td>
<td>Advanced topic (softening?)</td>
<td>Homework 6 due</td>
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<td></td>
<td>March 31</td>
<td>Advanced topic (ion exchange?)</td>
<td></td>
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<tr>
<td>Week 13</td>
<td>April 5</td>
<td>Advanced topic (membranes?)</td>
<td>Project stage 4 due</td>
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<tr>
<td></td>
<td>April 7</td>
<td>Advanced topic (other topic?)</td>
<td></td>
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<tr>
<td>Week 14</td>
<td>April 12</td>
<td>Treatment process combinations</td>
<td>Homework 7 due</td>
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<td></td>
<td>April 14</td>
<td>Economics of drinking water treatment</td>
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<tr>
<td>Week 15</td>
<td>April 19</td>
<td>Course wrap-up and course evaluation</td>
<td>Project stage 5 due</td>
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<td></td>
<td>April 21</td>
<td>Student presentations</td>
<td></td>
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<tr>
<td>Week 16</td>
<td>April 26</td>
<td>Student presentations</td>
<td>Homework 8 due</td>
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<td></td>
<td>April 28</td>
<td>reading day – no class</td>
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<tr>
<td>Week 17</td>
<td>May 3</td>
<td>Final exam, Thursday, May 5, 12:30-2:30</td>
<td>Project reports due</td>
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<tr>
<td></td>
<td>May 5</td>
<td>Final exam</td>
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</tbody>
</table>
Class Policies: 1, Homework Policy

- There will be about 8 homework sets to be performed during the semester.
- Depending on how many students are enrolled in the class, I might require assignments to be completed in groups. All students in the group will receive the same score on the assignment. We will decide about group size during the first week of class, once the enrollment is set.
- Even if assignments are completed by a group, it is recommended that all students work industriously to complete the homework assignments to maximize their mastery of the material covered this semester. If you do a good job on the homework assignments, you are likely to perform well on the exams. If you don’t spend the time on the homework, then you are likely to have difficulty on the exams.
- I will be available at least one hour each week, and probably more, to assist with homework problems. (Most likely about 2–3 hours per week.)
- Students may discuss the homework with each other. However, whatever work is submitted by a group should represent work actually completed by that group. You must conduct the actual computations and write up your own work without referring to the solutions of people outside your group. Copying the work of others (including text, computations, figures, tables, sections of computer programs, spreadsheets, or sections of lab reports) will be considered cheating.
- You may not refer to a previous year’s solution sets when completing the homework. That constitutes referral to somebody else’s work and is therefore considered cheating.
- Assignments are due in class on their due date unless otherwise noted. Occasionally, assignments will be due on a non-class day. In those cases, I will provide instructions on how to submit the completed work.
- Homework solutions will be provided to students, usually after the next class following the due date.
- Each group is allowed one late homework submittal during the semester -- no questions asked. Late assignments must be submitted by the beginning of the next class after the original due date. After one late submittal, no late homework will be accepted from that group regardless of reason or excuse. You get one “freebie,” and then that is it!
- Homework should be neat and legible, on standard 8.5-by-11-inch or A4 paper, stapled.
- Report numerical answers to a reasonable number of significant digits. The point of this is that you should consider the level of uncertainty associated with your reported answer.
- Your homework solutions must include at least enough detail that I can follow your reasoning and calculations. An answer provided without this level of detail will be considered insufficient.
- Helpful hint: when performing calculations, be careful of your units. You will catch about 90% of your mistakes (yes, really) if you take proper care of your units.
Class Policies: 2, Exam Policy

- There will be a midterm exam given in class and a final exam given at the time set by the registrar.
- The midterm exam will probably be on Tuesday, March 8, but the date could be changed if there is a good reason. I will announce a firm date in plenty of time for you to prepare.
- The final exam will be on Thursday, May 5, from 12:30-2:30 PM, as determined by the registrar.
- Exam questions will be primarily quantitative (problem-solving), but there may be qualitative (definition, discussion) questions as well.
- Exams will be closed-book, but students are permitted to use a personal note sheet: one double-sided 8.5-by-11-inch sheet for the midterm, two for the final. On these sheets students may write whatever they like. Sheets must be hand-written – no laser printing, scanning, photocopying, etc. Retrieval of information by other means during the examination will be considered cheating.
- Students who will not be available for an exam should inform me far enough before the exam to make alternate arrangements.
- Students who miss the exam unexpectedly (e.g., due to sudden illness, family emergency, or other unforeseen circumstances) must provide documentation or evidence of the reason for missing the exam. It will then be up to my discretion whether a “make-up” exam will be offered.
- My intention is to design exam questions such that students who have attended the class and who have diligently completed the homework assignments will be familiar with all the material needed to answer the questions. It will not be my intention to surprise you, only to challenge you.
- Generally, exam questions are intended to test the most important concepts of the class. A good exam should require the students to demonstrate their mastery of the material by synthesizing and applying the most important concepts of the course. Exam questions are not likely to test students on their recall of minutiae.
- Helpful hint: when performing calculations, be careful of your units!! You will catch about 90% of your mistakes (yes, really) if you take proper care of your units.

Class Policies: 3, USF Statement on Academic Accommodations for a Disability

Students in need of academic accommodations for a disability may consult with the Office of Students with Disabilities Services to arrange appropriate accommodations. Students are required to give reasonable notice prior to requesting an accommodation.

(Instructor’s note: The Americans with Disabilities Act is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Office of Services for Students with Disabilities at 974-4309 as soon as possible.)
Class Policies: 4, Project

- A major component of the course this semester will be the completion of a project.
- Information about the semester project will be made available to students as early as possible – hopefully in the first or second week of the semester – so that you can think about the project as the semester progresses.
- The general idea of the project is to pose, research, and answer a question related to drinking-water treatment.
- Depending on how many students are enrolled in the class, it may be necessary to complete the projects in groups. Once we know how many students are taking the class, I can decide if projects will be completed individually or in groups.
- At or near the end of the semester, each person or group will submit a written report, and will also make a brief presentation to the class about his/her/their project. Requirements for the report and the presentation will be given in more detail later in the semester. Presentations to the class will probably be about 20 minutes in duration, depending on how many students/groups we have.
- Please try to attend class on the days in which students deliver their presentations. The presentations can be fun (yes, really), and you want to support your classmates.
- Students will be graded on the quality of their written reports (both technical soundness and quality of the writing) and on the quality of their presentations. Additional details about grading of the projects will be provided later.
- If projects are completed by groups, then all members within a group will by default earn the same grade on the project. However, students will have some input into the grades of their group-mates. I will ask each group member to indicate (privately) how much each of their group-mates contributed to the project. Students who obviously contributed very little to the project will be marked down appropriately. Students who “went an extra mile” for their groups will be marked up appropriately.
- Additional details about the project will be given throughout the semester.
Class Policies: 5, Copyrights and Academic Honesty
- Any handouts used in this course are copyrighted. “Handouts” means all materials generated for this class, which include, but are not limited to: syllabi, notes, quizzes, exams, in-class materials, review sheets, and additional problem sets. This includes materials that are posted on the web as well as materials distributed in class. Because these materials are copyrighted, you do not have the right to copy the handouts unless the instructor (or other copyright holder) expressly grants permission.
- Students may audio tape lectures for their own private, personal use, or for a classmate who is registered in the class during this semester. Audio tapes may not be sold or distributed to anybody who is not registered in the class this semester.
- No form of scholastic dishonesty (cheating, plagiarism, etc.) will be tolerated. As commonly defined, plagiarism consists of passing off as one’s own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have permission of that person. This includes copying material from books, reports, journals, pamphlets, handouts, other publications, web sites, etc., without giving appropriate credit for those ideas and/or without identifying material as quotations when taken directly from another source.
- Cheating on homework and exams will not be tolerated. Cheating will be dealt with according to university policy.
- You may discuss homework assignments with students who are not in your homework group. However, when you perform your computations and/or write-ups, you must do so without referring to the work of students who are not in your group. Copying homework from a student outside your group is considered plagiarism. See Class Policy 1, above.
- You may not copy homework solutions from a previous year’s solution set. That will be considered plagiarism because you are copying somebody else’s work.
- Violation of these rules can result in disciplinary action including a grade penalty, up to and including an F or FF in the course, suspension, dismissal, and expulsion from USF. If you have any questions regarding plagiarism or other forms of scholastic dishonesty, please consult the relevant sections of the USF student catalogs, and/or ask the instructor.

Class Policies: 6, USF Statement on Emergencies
In the event of an emergency (e.g., hurricane, outbreak of contagious disease), it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include but are not limited to: Blackboard, Elluminate, Skype, e-mail messaging, and/or an alternate schedule. It’s the responsibility of the student to monitor the Blackboard site for each class for course specific communication, and the main USF, College, and department websites, e-mails, and MoBull messages for important general information.
Class Policies: 7, Attendance

- Attendance in class lectures is recommended but not required. It is likely that diligent attendance in class lectures will improve your understanding of the course material, and, hence, improve your semester grade.
- Attendance in class does not factor into your semester grade other than helping you to perform well on assignments and exams (i.e., there are no “class attendance points” awarded).
- If you miss class, there is no need to inform me or to provide me with documentation for your absence. (I don’t take it personally, really.) However, I do recommend that you acquire the lecture notes from a classmate.
- If you choose to attend class, I require that you do not engage in behavior that distracts me or that disrupts the class for others in attendance:
  - Please make sure mobile phones are turned off. **NO TEXTING DURING CLASS!**
  - Laptop computers should be used only for taking notes, not for e-mail, web browsing, or any other activity that might distract your classmates or your instructor.
  - Please do not chat with your classmates, read the newspaper, work on homework for other courses, or engage in any other behavior that is distracting to your classmates or to your instructor.
  - If you need to do something other than participate in the class lectures, then please do so outside the classroom.
  - Students who are engaged in such activities in class will be asked to leave.

Class Policies: 8, Field Trips

I would love for our class to take a field trip to a drinking-water treatment plant (or maybe more than one) some time during the semester. So far, I don’t have any firm plans for this, but I will likely be able to arrange it pretty early in the semester. The field trip(s) will be optional (not required), but highly recommended to complement class lectures and the assignments that you complete.