

Environmental Engineering Laboratory

UNIVERSITY OF CONNECTICUT
DEPT OF CIVIL AND ENVIRONMENTAL ENGINEERING

ENVE 3200 / CE 3300
SPRING 2010

Lecture: *Tuesday, 11:00-1:00 (CAST 201)* **Lab** *Thursday 11:00-2:00 (CAST 111)*

Instructor: Joseph T. Bushey, CAST 311, x6-3941, joseph.bushey@uconn.edu

Office Hours: Tuesdays 1-2 pm ... or by appointment

*** (Please check course website on HuskyCT and use discussion board) ***

Teaching Assistants:

Xiang Li (technical questions), BRON 322, xiang.li@uconn.edu (W 3:30-4:30; by appointment)

Matt Quaranta (writing), BRON 320, mlq05001@enr.uconn.edu (M 1:30-2:30; by appointment)

Course Texts

Mandatory

1. Experimental Research Notebook for Scientists and Engineers (1998) Jones and Bartlett Publishers.
2. ENVE 3200 Laboratory Manual (2010) (*handed out in class*)
3. Sawyer, C.N., P.L. McCarty, G.F. Parkin (2003) Chemistry for Environmental Engineering and Science. 5th Edition, McGraw-Hill, 752 pp. [**Sawyer**]
4. Robinson, M.S., Stoller, F.L., Costanza-Robinson, M.S., Jones, J.K. (2008) Write Like a Chemist. Oxford, New York. [**Robinson**]

Recommended Supplementary Texts (At Babbidge Library or ENVE main office)

5. Skoog, D. A.; West, D. M.; Holler, F. J. Fundamentals of Analytical Chemistry; 7 ed.; Saunders College Publishing: New York, NY, 1996, pp 870. (Excellent book on experimental data analysis; inorganic/aquatic analytical chemistry; various instrumental analytical techniques)
6. Reynolds, T. D.; Richards, P. A. Unit Operations and Processes in Environmental Engineering; 2 ed.; PWS Publishing Co.: Boston, MA, 1996, pp 798.
7. Jenkins, D.; Snoeyink, V. L.; Ferguson, J. F.; Leckie, J. O. Water Chemistry, Laboratory Manual; 3 ed.; John Wiley & Sons: New York, NY, 1980. (Several exercises were developed from this manual)
8. Snoeyink, V. L.; Jenkins, D. Water Chemistry; 1 ed.; John Wiley & Sons: New York, NY, 1980, pp 463.
9. Droste, R. L. Theory and Practice of Water and Wastewater Treatment; John Wiley & Sons, Inc.: New York, NY, 1997, pp 800.

10. American Water Works Association. Water Quality and Treatment; 4 ed.; Mc-Graw-Hill, Inc.: New York, NY, 1999, pp 1194.
11. Grady, C. P. L. Jr, Daigger, G. T.; Lim, H. C. Biological Wastewater Treatment; 2 ed.; Marcel Dekker: New York, NY, 1999, pp 1076.
12. Standard Methods for the Examination of Water and Wastewater; 19 ed.; Eaton, A. D.; Clesceri, L. S.; Greenberg, A. E., Ed.; American Public Health Association: Washington, DC, 1995.
13. Huckin, T. N. and L. A. Olsen. 1991. Technical writing and professional communication. McGraw-Hill, Inc., New York, NY.
14. Kanare, H.M. (1985) Writing the Laboratory Notebook. American Chemical Society, Washington, D.C. *especially Ch. 5 & 6.*

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| Grading: | <u>Formal</u> Lab Reports: Individual (2) | 20% |
| | <u>Informal</u> Lab Reports: Individual (9) | 35% |
| | Final Project (Group Design/Experiment/Report/Presentation) | 20% |
| | Lab Notebooks (includes Pre-lab)/Quizzes/Homework | 20% |
| | Participation (From group evaluations, instructor evaluation) | 5% |

Lab Reports and Lab Notebook pages (pre-labs) are due at the BEGINNING of lab session
Penalty for late reports: 20% per day.

Lab Notebooks: The laboratory notebook is an essential document for any experimental work, used to record methodology/procedure in addition to data. Notes should be clear, concise, and ***neatly recorded*** (see Kanare (1985), *Writing the Laboratory Notebook* (ACS), as a guide). A significant part of the laboratory write-up should occur ***before the lab period*** – including the title, purpose, materials and methods (see *Report Guide* handout). You ***must*** construct a flow diagram of your experimental approach in your lab notebook. *The flow diagram should convey your understanding of what activities you will perform during the lab period.* Lab notebooks will be inspected prior to each laboratory and the notebook page copies will be submitted for informal report evaluation. Your name must be on every page of your notebook!

Lab Reports: The report-writing efforts will involve a buildup to complete formal laboratory reports. We will begin with informal reports focusing on individual sections and ultimately get to the synthesis of a complete report by combining these individual sections into a well-written, flowing report with all sections linked together smoothly. Long formal laboratory reports are required for select experiments, including the Final Project. All reports are due at the beginning of the laboratory period one week after the completion of the laboratory experiment as specified in the table below. The formal lab report should cover: Abstract (summary of experiment and results), Introduction (Relevant Theory with Objectives stated), Methodology, Results, Discussion, Summary, References, Tables/Figures and necessary Appendices as

described in more detail in the *Report Guide* handout. Reports will be graded on both technical content and editorial quality. Reports are subject to a late submission penalty of 20% per day after the due date, up to a maximum of 60% grade reduction for that report.

Long formal lab reports should be concise and well written (10-15 pages, double-spaced, font size = 12). *Tables and figures should be placed **AT THE END** of the report (after references, before appendices).* Two labs, *BOD* and *Chlorination*, will be **individual** formal report efforts. The **remaining** long formal lab report for the *Project* will be a **team effort** with shared writing responsibility. A team-grade will be assigned to the total report. Each formal report may be edited and re-submitted for a re-grade. Re-writes are mandatory for grades < B and are due within a week of receiving the initial graded lab report. Final grade will be averaged between the initial and re-written report grades. Students must pass the writing component of the course to receive a passing grade.

The remaining laboratory reports will be informal reports. Informal reports will emphasize one aspect of formal report writing: One section of the informal report specified by the instructor will be composed as required for a formal report, whereas other sections can be completed by reference to the laboratory manual, or in bullet form. A FULL laboratory data analysis and presentation must be performed! A portion of the informal lab report grade will be assigned for **high-quality** data presentation and overall report organization. Re-writes will not be granted for informal reports as feedback from these reports will contribute to student skills in writing formal reports.

Overall Course Objectives

At the completion of this course you will be able to:

1. Apply fundamental and quantitative knowledge about environmental chemistry to interpret and solve water, soil and air quality engineering problems.
2. Apply basic statistical techniques to analyze and interpret experimental data.
3. Design, conduct, analyze and interpret lab- and pilot-scale experiments to estimate kinetic and stoichiometric information for water quality engineering unit processes.
4. Summarize, interpret, and present experimental information in formal reports and via oral presentations.
5. Critique technical writing and provide feedback to others.
6. Work effectively as a team member and team leader to solve water quality engineering tasks.

Spring 2010 ENVE 3200 / CE 3300

Course Calendar

| LECTURE | TOPIC SHADED = CAST 111 | READING: <i>SAWYER</i> (Chapter or sections unless noted) | READING: <i>ROBINSON</i> (Chapters or sections unless noted) | LAB | READING: <i>LAB MANUAL</i> | LABORATORY EXPERIMENT | DUE |
|---------------|--|---|--|---------------|-------------------------------|--|----------------------------------|
| Jan 19 | Introduction, Overview; Review <i>Report: Data Presentation</i> | 1, 9, 10 | 1, 16 | Jan 21 | Lab 0 | Lab Familiarization/ Safety/ Excel "Paper" Lab 0 – statistics | |
| Jan 26 | Data Analysis; Review <i>Report: Overview; Language</i> | 1, 2, 9, 10, 11.2, 11.3;11.4 | 2, p. 583, pp. 601-658 | Jan 28 | Lab 1 | Gravimetric Data (Lab 1) | Lab 0 <i>Data</i> |
| Feb 2 | Water Quality Parameters <i>Report: Methods</i> | 13, 26, 34 | 3 | Feb 4 | Lab 2 | Total/Dissolved Solids (Lab 2) | Lab 1 <i>Data</i> |
| Feb 9 | Alkalinity; titration; Coagulation/flocc'n <i>Report: Results</i> | 4.12.3, 16, 18, 15.1, 7 | 4 | Feb 11 | Lab 3 OR Lab 4 | Alkalinity/Titration (Lab 3) OR Coagulation and Flocculation (Lab 4) | Lab 2 <i>Methods</i> |
| Feb 16 | Adsorption Isotherms Spectrophotometry <i>Report: Discussion</i> | 3.12, 12.2 pp.294-296 | 5 | Feb 18 | Lab 3 OR Lab 4 | Alkalinity/Titration (Lab 3) OR Coagulation and Flocculation (Lab 4) | Lab 3 OR Lab 4 <i>Results</i> |

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|---------------|---|--|----------|---------------|--------------|--|------------------------------|
| Feb 23 | Adsorption: Set-Up (Lab 5) <u>CAST 111</u> | Lab 5 | | Feb 25 | | Adsorption: Analysis (Lab 5) | Lab 3 OR Lab 4 Discussion |
| Mar 2 | Breakthrough curves; Chromatography Report: <i>Introduction</i> | p.25-26, 3.8, 5.34,12.4, 33.4 | 6 | Mar 4 | Lab 6 | Gas Chromatography (Lab 6 – “Paper”) NO CLASS | Lab 5 Discussion |

SPRING BREAK MARCH 6-14

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|---------------|---|-------------------------------|-----------|---------------|--------------|------------------------------|--|
| Mar 16 | Biological Treatment; Project Hypothesis Report: <i>Finalizing Written Work</i> | 23, 22 | 18 | Mar 18 | Lab 7 | BOD (Lab 7) | Lab 6 <i>Introduction</i> |
| Mar 23 | <u>PROJECT DESIGN</u> (analysis of BOD ₅) <u>CAST 111</u> | | | Mar 25 | | <u>PROJECT DESIGN</u> | Lab 7 FULL: Individ. DUE 3/30 |
| Mar 30 | Chlorination LAB 7 DUE <i>Lab 7 Critique</i> | 2.7, 3.10, 4.8, 20 | | Apr 1 | Lab 8 | Chlorination (Lab 8) | <u>PROJECT DESIGN</u> (INDIVID.) |

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| Apr 6 | <u>FINAL PROJECT:</u> Experiment CAST 111 | | | Apr 8 | | <u>FINAL PROJECT:</u> Experiment | Lab 8 FULL: Individ. |
| Apr 13 | <i>Presentation: Know Your Audience</i> Then... <u>FINAL PROJECT:</u> Experiment | | pp. 584-600 | Apr 15 | | <u>FINAL PROJECT:</u> Experiment | Lab 8 Critique |
| Apr 20 | <u>FINAL PROJECT:</u> Experiment | | | Apr 22 | | PROJECT PRESENTATIONS UTEB 150 | <u>First Draft – Project Report: APRIL 27th</u> |
| Apr 27 | Air Pollution/ Atmos. Nitrogen First Draft – Final Report DUE <i>Report: Abstract</i> | 25.2 | 7 | Apr 29 | Lab 9 | NO _x in Car Exhaust (Lab 9) | |
| May 4 | | | | May 6 | | FINAL PROJECT REPORTS Lab 9 Abstract | FINAL PROJECT REPORTS Lab 9 Abstract |

* Required readings in *Sawyer* for lecture of current week; **bold** = required
Assignments: bold = formal, otherwise – informal