ENCE 411

Sections 0101, 0102

ENVIRONMENTAL ENGINEERING SCIENCE

Alba Torrents

Department of Civil and Environmental Engineering

University of Maryland

College Park, MD

SYLLABUS

Fall Semester, 2010

Lecture:	**Tu, Th:**	**11:00 am – 11:50 am**	**EGR Rm. 0110**
Lab, 0101:	**Fri:**	**10:00 am – 1:00 pm**	**EGR Rm. 1138**
Lab, 0102:	**Fri:**	**1:00 pm – 4:00 pm**	**EGR Rm. 1138**

Instructor:

Alba Torrents

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Office hours:

T, Th., 9:30-10:15 am; and 12:15-1:00 pm;

Wed., 11:00 am-12:00 pm;

Or by appointment

Teaching Assistant:

Natasha Andrade

Rm.

Office phone:

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Office hours: To be announced

Course Description:

The basic physical, chemical and biological processes that occur in engineered and natural environmental systems will be discussed. Included will be presentation of parameters used to describe the quality of water, air and land. Measurement techniques will be discussed. A weekly lab will provide hands-on experience with environmental quality measurements and treatment techniques. Labs will focus on practical and sustainability issues.

Prerequisites: ENCE 310 and permission of department.

Course Objectives and Learning Outcomes:

By the end of the course, students should be able to:

1. *Fundamental Principles.* Understand and apply the fundamental physical, chemical, and biological principles that govern key phenomena in engineered and natural environmental systems. This may include evaluating whether a theory adequately describes a physical event and establishing or validating a relationship between measured data and underlying fundamental principles.

2. *Data Analysis.* Demonstrate the ability to collect, analyze and interpret the results from laboratory tests, and to form and support conclusions; use measurement unit systems and conversions, and appropriate statistical treatment of data.

3. *Design.* Design experiments that evaluate the performance of unit operations and processes in environmental engineering or the quality of natural environmental systems.

4. *Learn from Failure.* Identify unsuccessful outcomes due to faulty equipment or procedures and then propose effective solutions.

5. *Psychomotor.* Demonstrate competence in performing a wide range of laboratory analyses to assess water and wastewater quality and performance of environmental engineering unit operations and processes.

6. *Safety.* Describe and apply safe laboratory practices.

7. *Communication.* Communicate effectively about laboratory work with a specific audience, both orally and in writing.

8. *Teamwork.* Work effectively in teams, including structure individual and joint accountability; assign roles, responsibilities, and tasks; meet deadlines; and integrate individual contributions into a final deliverable.

9. Sustainability. Students should be able to understand how sustainability issues are connected to our everyday life and should be able to understand the impact of our actions as engineering on the environment.

Course Requirements and Grading Policy:

The work to be required in this course and the percentage of your grade it represents are as follows:

Two mid-term exams (15% each)	30 %
Final Exam	20 %
Laboratory Reports	40 %
Oral Presentations	10 %
TOTAL	100 %

Mid-Term Exams:

Mid-term exams are announced in advance and held during normally scheduled class periods. Details on exam formats will be provided later.

Final Exam:

The final exam will be a "lab practical" that will be completed in teams. Details provided later.

Laboratory Reports:

Laboratory reports have to be turned in one week after completion of the laboratory work. Unexcused late reports will have grades reduced 20% per day. All reports must be typed. Use a spreadsheet program to enter raw data, to perform calculations and to prepare the required graphs and tables for the reports. Details on the laboratory report requirements are provided in a separate handout. Pre-lab questions are due the day of the laboratory.

Unless otherwise instructed, laboratory reports will be submitted in groups of two or three. All group members will share the same grade for a given laboratory report, except for the pre-lab questions, which will be graded individually. You are encouraged to discuss your experimental results with your classmates prior to preparing reports.

Laboratory reports will be graded on the following:

- Clarity (organization, grammar, spelling, punctuation, sentence structure)
- Correctness of calculations and answers to questions.
- Completeness
- Conciseness.

Oral Presentations:

One week during the semester, instead of having a laboratory session, each team will give a detailed oral presentation to the class on one of the laboratories performed up to that point. Each team will collect the data for the selected laboratory from all of the other teams and interpret and compare the results. In addition, suggestions for improvements to the laboratory exercise should be made.

Text (Available at Maryland Book Exchange):

Sawyer, C.N., P.L. McCarty, and G.F. Parkin. 2003. Chemistry for Environmental Engineering and Science, 5th ed.. McGraw-Hill, Inc., New York, NY.

Supplemental Reference Texts (Provided in the laboratory):

Standard Methods for the Examination of Water and Wastewater, 18th ed., APHA, United Book Press, Baltimore, MD (1992).

Blackboard for Engineering Courses*:*

https://bb.eng.umd.edu

The class web site on Blackboard will be used for making announcements, providing course information, sharing course documents, etc. Please follow the instructions below to log on.

After going to https://bb.eng.umd.edu, a dialog box will appear, asking you to log in. Your University Directory ID and password are required to log in. If you do not have this information, follow the link for "Student: Login Instructions" under "Getting Started" where instructions are provided for how you can find your University Directory ID and how to set or change your password.

Once you have your Maryland Directory ID and password, you are ready to go back to the log in page.

Once you log in, you will be taken to another page for you that will list, among other things, the courses you are taking. Follow the link for ENCE 411, which will take you to a page where you will be able (eventually) to find a variety of materials relevant to this course.

Personal Protective Equipment:

- Students will be required to provide their own goggles or side shield safety glasses for eye protection.
- Appropriate gloves will be provided as needed.
- Laboratory coats are optional.
- Wear long pants (no shorts are allowed).
- Wear sturdy shoes that cover your feet (no sandals or open-toed shoes).
- Note: many experts believe that contact lenses can trap dangerous vapors or liquids in your eyes.

Reminders on Key Campus Policies:

Academic Integrity

"The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit

http://www.shc.umd.edu.

To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all examinations and assignments:

"I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or assignment)."

Accommodations for Students With Disabilities:

The University is required to provide appropriate accommodations for students with disabilities. Students with disabilities should inform me of their needs at the beginning of the semester so that I can contact the appropriate individuals who will work to determine and implement appropriate academic accommodations.

Attendance Guidelines:

"University policy excuses the absences of students for illness (self or dependent), religious observances, participation in University activities at the request of University authorities,

and compelling circumstances beyond the student's control." However, "students must request the excuse in writing and supply appropriate documentation." Students with written, excused absences are entitled to a makeup exam/quiz at a time mutually convenient for the instructor and student.

Inclement Weather:

Class will be held unless there is an official schedule adjustment (closings and delays) due to inclement weather or campus emergencies. Official closures and delays are announced on the campus website (www.umd.edu) and snow phone line (301- 405- SNOW) as well as local radio and TV stations.

Policy on Religious Holidays:

The University System of Maryland policy on religious observances provides that "students should not be penalized because of observances of their religious beliefs; students shall be given an opportunity, whenever feasible, to make within a reasonable time any academic assignment that is missed due to individual participation in religious observances." However, "it is the student's responsibility to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible but no later than the end of the schedule adjustment period." Prior notification is especially important with respect to the final exam.

ENVIRONMENTAL ENGINEERING SCIENCE

TENTATIVE COURSE OUTLINE AND SCHEDULE

Week	Lecture		Laboratory		Reading
	Date	Topic	Date	Topic	
1	Sept. 1	Course Introduction	Sept. 4	Blue Plains Tour;	Ch. 1, 9
	Sept. 3	Statistical Analysis of Analytical Data		1. Statistics/Data Analysis Laboratory to be conducted independently	Ch. 10
2	Sept. 8	Solids; Gravimetric Analysis	Sept. 11	2. Solids & Turbidity Laboratory; Laboratory Safety	Ch. 26, 11.2, 11.3
	Sept. 10	Turbidity; Turbidimetry and Nephelometry			Ch. 13, 14, 11.5, 11.6, 12.2
3	Sept. 15	Settling	Sept. 18	3. Sedimentation Laboratory	Handouts
	Sept. 17	Settling, cont.			Handouts
4	Sept. 22	Microbiology of Activated Sludge; Microscopy	Sept. 25	4. Microscopic Analysis/Staining and Batch Growth Curve Laboratory	Handouts
	Sept. 24	Microbial Growth; Cultural Methods			Handouts
5	Sept. 29	DO; Winkler and Electrical Methods	Oct. 2	5. DO and BOD Laboratory	Ch. 22, 12.3
	Oct. 1	BOD			Ch. 23
6	Oct. 6	Gas Transfer; Aeration	Oct. 9	6. Aeration Laboratory	Handouts
	Oct. 8	Gas Transfer, cont.			Handouts
7	Oct. 13	**EXAM 1**	Oct. 16	Washington Aqueduct	None

	Oct. 15	Chemistry Background Fundamentals		Tour; 7. The use of the Internet as a source of information; Gathering data and graphing; Homework to be conducted independently	Ch. 2.1-2.6; 4.1-4.4
8	Oct. 20	pH: Acid-Base Equilibrium	Oct. 23	**Reports/presentation**	Ch. 2 (p. 24-27); Ch. 3 (p. 90); Ch. 5 (p. 289-292)
	Oct. 22	pH: Acid-Base Equilibrium, cont.			
9	Oct. 27	Equilibrium Chemistry: Acid-Base Titrations	Oct. 30	8. Standardization of a base and titrations to determine pKa's and acid content of unknown samples	p. 147-158; p. 462-463
	Oct. 29	Equilibrium Chemistry: Acid-Base Titrations, cont.			
10	Nov. 3	Acidity and Alkalinity	Nov. 6	9. Alkalinity and Hardness Determinations	Ch. 17, 18; Ch. 19
	Nov. 5	Hardness			

Week	Lecture		Laboratory		Reading
	Date	Topic	Date	Topic	
11	Nov. 10	Spectrophotometric Analysis	Nov. 13	10. Adsorption onto	Ch. 11.5; 12.2

	Nov. 12	Sorption and Activated Carbon		Activated Carbon	Ch. 3.12; p. 187-190; p. 294-295
12	Nov. 17	Disinfection	Nov. 20	11. Residual Chlorine and Chlorine demand	Ch. 20, 21
	Nov. 19	Disinfection			
13	Nov. 24	Pathogens; Indicator Organisms	Nov. 27	*Nov. 26-29* *Thanksgiving Recess--No Class*	Ch. 5
	Nov. 26	*Nov. 26-29 Thanksgiving Recess--No Class*			
14	Dec. 1	Trace Contaminants and their Analysis	Dec. 4	12. Gas Chroma-tography and Atomic Absorption	Handout, Ch. 12, 34
	Dec. 3	Lecture			
15	Dec. 8	**EXAM 2**	Dec. 11	**Lab Practical**	
	Dec. 10	Lecture			
	Dec. 14	**FINAL EXAM** **Lab Practical Reports Due 10:00 am**			

Specific Lab modifications to include sustainability aspects into the classroom:

Lab 1: Stat Analysis
We want to make this the lab where we bring them to the USDA, show them the research performed there and give them some of our raw data for them to analyze at home. We can also include the GCMS and the LCMS here instead of in lab 12. We would have two big problems for them to solve (one for each of the most important projects we are working on right now) rather than 6 problems like in the original lab.

Lab 2: Solids/Turbidity
We want to completely change this lab. We'd like to build a few "field" models using different soil types (clay, gravelly soil, top soil) to show runoff, stream pollution, and erosion. We'd pour some water amended with N, P, and food coloring to show how soil captures these pollutants (or not) and what runoff looks like when there are no mitigation structures being used. This might wind up being a 2-part lab to also include sedimentation (Lab 3), that can be done for 2 weeks. Homework question would be related to the importance of mitigation (presence and different types) and stream pollution using the internet to get some of the answers we are looking for.

Lab 3: Sedimentation
Look at clay settling vs. other soils (from model in Lab 2) → why clay is so hard to settle; importance of silt screens, grass seeds, and other construction site strategies. These two labs would tackle urban, agricultural, and construction site problems and how to protect surface water/watershed quality.

Lab 4: Microscopy and Lab Growth
No changes; looks good.

Lab 5: BOD
No changes; looks good.

Lab 6: Gas Transfer/Aeration
Modify take-home questions to relate to Potomac/Anacostia river problems with DO (NPR broadcast just discussed how DO levels are lower in Potomac now than 5 years ago), how waste water effluent affects river health.

Lab 7: Internet Resources Lab
Ok. We are reframing the questions to include more sustainability issues, although many of the questions are already focused on sustainability and Chesapeake Bay water quality.

Lab 8: Titration
Ok.

Lab 9: Alkalinity/Hardness
Ok.

Lab 10: Activated Carbon
Ok.

Lab 11: Chlorine
Ok.

Lab 12: GC and AA Spectrometry will be turned into Microbial Energy
Incorporate these concepts when students visit USDA in the beginning (Lab 1). This lab will be turned on a lab where we will have some microbial cells that we will incubate for a week and harvest energy from the microbial population when it is mature. The questions will then be linked to how this influences our new political tendency to shift towards “clean” energy sources.