

## ChEE 400L/500L Environmental Engineering Laboratory (1 unit)

Fall 2016

**Instructors:** Bob Arnold and Reyes Sierra

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**Meeting time:** Monday, 2pm to finish

**Location:** Harshbarger basement; for lecture only—Harshbarger 118B

**Course Website on D2L:** <http://www.d2l.arizona.edu>

**Teaching Assistant:** none; the class will be assisted by Dr. Vasiliki Karanikola

### **Office hours:**

TBD. Office hours will be set during the initial class meeting based on student availability. The idea is to select hours so that each student can attend at least one hour per week. Meetings outside office hours are acceptable but should be by appointment.

### **Textbook and other course materials:**

No primary text required. The instructor(s) will provide laboratory handouts as well as supporting lecture material, as necessary, in areas to be covered. D2L will be the primary means of distributing class material.

### **Course description**

This laboratory experience focuses on unit operations and processes commonly applied in environmental engineering and supports fundamental concepts developed in required courses for Environmental Engineering majors. Individual and group reports and oral presentations will serve as vehicles for the development of technical communications skills. The anticipated student time commitment is as follows: two and a half hours of laboratory per week for 5 weeks, plus attendance at periodic 50-minute lectures (on Mondays, @ 2:00-2:50, when scheduled) that are designed to support the laboratory efforts.

### **Course objectives, learning outcomes:**

The objectives of this course are to provide: (1) hands-on experience with unit operations and processes commonly applied in modern environmental engineering research and practice; and (2) opportunities to apply and improve student technical writing and oral presentation skills. The course covers reactor design and operation, physical-chemical processes, and biological processes.

Student learner outcomes:

By the end of the course the student should have demonstrated the ability to:

1. Design and conduct experiments as well as to analyze and interpret data (ABET outcome b).
2. Use the techniques, skills, and modern scientific and technical tools necessary for environmental engineering practice. (ABET outcome k).
3. Communicate effectively (ABET outcome g), or communicate effectively about laboratory work with a specific audience, both orally and in writing.
4. Describe and apply safe laboratory practices.
5. Function on multi-disciplinary teams.

**Course program:**

This course consists of the following elements.

Introduction

Laboratory Safety

Lab I- Reactor Operation and Modeling: CSTR in series

Lab II- Physicochemical Processes: Reverse osmosis

Lab III- Biological Processes: Enzyme kinetics

Laboratory assignments will be conducted in small (3 to 5 person) groups.

**Laboratory Reports:**

Laboratory reports must be turned in one week after completion of the laboratory exercise. Reports are due on the due date at the BEGINNING of class. Unexcused late reports will have grades reduced:

- One day or less: 30% off
- 2 to 3 days: 50% off.
- More than 3 days: no credit.

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.

Unless otherwise instructed, laboratory reports will be submitted in groups. All group members will share the same grade for a given laboratory report, except for the pre-lab questions, which will be graded individually. Grading of the lab reports will be based on the quality and clarity (English grade - 35%) of your writing as well as the content (Technical content - 65 %).

**Oral and Journal Presentations (Only graduate students)**

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. Each team will collect the data for the selected laboratory from all of the other teams and interpret and compare the results. Suggestions for improvements to the laboratory exercise should be made. In addition, each team will prepare and submit a journal article written in "Environmental Science and Technology" style summarizing and discussing the results of the selected laboratory.

## Homework Policy

There is no homework for this course. However, you are expected to spend at least 25 hours on your literature review, experimental planning, data analysis, and other laboratory-related activities. This is in addition to the time spent in the lab conducting the experiments.

**Grading scale and policy:** Grades will be based on the following algorithm—

	400-level	500-level
Pre-lab assignments	15%	15%
Lab reports	45%	40%
Oral presentation & graduate paper	----	20%
Course participation	5%	5%
Notebook	10%	5%
Final exam	25%	15%

The grade scale follows:

≥ 90	A
80 - < 90	B
70 - < 80	C
65 - < 70	D
< 65	E

## Course prerequisites:

400A students: ChEE 370R (OR CHEE 478 OR CHEE 476A OR CHEE 476B).

500A students: None

Students must meet the course prerequisites or otherwise satisfy the instructor of their preparation to take the course. Prerequisites can be waived only at the discretion of the instructor.

## Graduate-level requirements:

Graduate-level requirements include a course paper, an oral presentation, and additional exam questions.

## Laboratory safety

All students will be required to complete successfully the University of Arizona Chemical Safety Laboratory (online).

### Personal Protective Equipment:

- Students will be required to provide their own goggles or side shield safety glasses for eye protection.
- Laboratory coats are required. Coats will be available at the lab location.
- Appropriate gloves will be provided as needed.

- Wear sturdy shoes that cover your feet (no sandals or open-toed shoes allowed).
- When in doubt, ask.

### **Additional Policies, Warranties and Disclaimers:**

1. **Required attendance policy:** Attendance at lectures is mandatory. Please do not arrive late to the lab. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored. Absences due to medical or family emergencies will also be excused.

For examinations: All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion.

2. **Policies regarding expected classroom behavior:** There will be no use of cell phones or mobile devices during class.

3. **Policies against plagiarism follow the Student Code of Academic Integrity:**

<http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>.

4. **Policies against threatening behavior by**

**students:** <http://policy.web.arizona.edu/threateningbehavior-students>.

5. **Policies against discrimination and**

**harassment:** <http://policy.arizona.edu/humanresources/nondiscrimination-and-anti-harassment-policy>.

6. **Required extracurricular activities:** none

7. **Special materials required for the class:** none

8. **Accommodations for students with disabilities:** It is the University's goal that learning experiences be as accessible as possible. Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: [uadrc@email.arizona.edu](mailto:uadrc@email.arizona.edu), <http://drc.arizona.edu/>. You must register and request that the Center or DRC send me official notification of your accommodations needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. *The need for accommodations must be documented by the appropriate office.*

10. **Confidentiality of Student Records**

<http://www.registrar.arizona.edu/ferpa/default.htm>

11. **Final Exam**

**Regulations:** <http://www.registrar.arizona.edu/schedule101/exams/examrules.htm>.

12. **Subject to Change Statement:** Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.