

ENCH 437: Chemical Engineering Laboratory

**Department of Chemical and Biomolecular Engineering
University of Maryland, College Park, Maryland**

Instructors:

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Office Hours: 10:00-11:00 am, Tuesday and Thursday

Teaching Assistant:

Mr. Alex Langrock

Location: 4128, Chemistry Building

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Office Hour: Wednesday 11:00 AM – 12:30 PM

Class Schedule:

Tuesday (Session 0201) and Thursday (0101)

Discussion: 11:00am-12:15pm, J.M. Patterson Building (083), 2202

Laboratory: 1:00pm-5:00pm Chemical and Nuclear Engineering Building (090), 1145

Prerequisites:

ENCH 424; ENCH 426; ENCH 440; and ENCH 442

Textbook:

The following books are recommended for reading but not required.

1. R.H. Perry and D.W. Green. Chemical Engineers' Handbook. (any edition) New York: McGraw Hill.
2. J.R. Welty, C.E. Wicks, R.E. Wilson. Fundamentals of Momentum, Heat, and Mass Transfer. (any edition) New York: John Wiley & Sons.
3. R.W. Fox, A.T. McDonald. Introduction to Fluid Mechanics. (any edition) New York: John Wiley & Sons.
4. H.S. Fogler. Elements of Chemical Reaction Engineering. (any edition) Upper Saddle River, NJ: Prentice Hall.
5. W.L. McCabe, J.C. Smith, P. Harriott. Unit Operations of Chemical Engineering. New York: McGraw-Hill.

Course Website

Blackboard Academic Suite/ELMS, <https://bb.eng.umd.edu>. Course material, announcements, and grades will be posted there

Course Objective:

ENCH437 focuses on the application of chemical engineering principles (unit operation and processes) in small-scale semi-commercial equipment. Experimental data will be used to evaluate the performance/efficiency of the investigated equipment. Emphasis is placed on correct presentation of the results in report form.

Assignments:

Students will design and operate experiments using small scale semi-commercial equipment based on previous acquired chemical engineering process and unit operation principles. Students will collect experimental data to develop scientifically sound conclusions to evaluate performance and efficiency of operations in written report. Both oral and written presentations of experimental studies are required. The following knowledge and skills are expected upon completing the course:

- An understanding of safe laboratory practice.
- Development of critical thinking and proficient communication through experiment design, data collection, and result interpretation.
- Experience working in a team.
- Experience in preparing technical reports and making presentations.

1. Work Plan

The group will receive the experimental objectives and then submit a one or two page experimental plan to the instructor.

2. Revised Work Plan

After meeting with the instructor and discussing the original work plan, the work plan must be improved. The revised work plan must be submitted before conducting the assigned experiment. The group will not be allowed to perform an experiment without submission and approval of their revised work plan.

3. Final Written Report

After each experiment, a detailed technical report must be prepared as a group effort. The content and format of the report can refer to the Final Report Outline. The final report must cover but is not limited by the outline.

Please see the Lecture and Laboratory Schedule for the due day of each assignment.

Presentations:

Each group has to give a half-hour presentation in the Lab after finishing the first experiment. The presentation includes (1) experiment design, (2) operation of equipment, and (3) conclusions. At the end of this semester, every group will present one experiment that they performed. The group can choose which experiment they want to present.

Presentation time will be limited to 15 minutes and the group will answer questions from the audience for up to 5 minutes.

Grading:

Every written assignment, presentation will be graded in a scale from 0 to 10. The final grade will be weighted as follows:

- Lab 1: 20% (Work Plan: 20%, report: 80%)
- Lab 2: 25% (Work Plan: 20%, report: 80%)
- Lab 3: 25% (Work Plan: 20%, report: 80%)
- The first Presentation: 5%
- Final Presentation : 25%

Late assignment submission will result in 10% deduction each day.

Laboratory Materials: A laboratory notebook is required. Safety glasses, gloves, and lab coats will be provided

Course Policy:

1. The semester is divided into 3 experiment cycles. Each group will be assigned three experiments, one per cycle. Students will work in groups of 3 or 4, and be the report writer in rotation. While all group members are fully responsible for performing the assigned experiments (literature searching, designing work plan, operating equipment, collecting and analyzing data), the report writer is responsible for writing the work plan and assembling the final report with input from all group members.
2. All students are expected to be present on all scheduled class days. Excused absences will be granted for serious reasons with official proof. If an emergency arises, **YOU MUST INFORM THE INSTRUCTOR OR TEACHING ASSISTANT BEFORE CLASS** and arrangements will be made for the whole group to perform the experimental work at another time. Unexcused absence may result in failing the course.
3. The group will not be allowed to leave the laboratory until their experimental setup has been cleaned and restored. Any equipment breakdowns should be reported to the instructor or the teaching assistant immediately.
4. Safety goggles will be provided to the students, and will be kept by individual students till completing all experiments. Students will not be able to complete the course with a final score without returning their safety goggles. No marking on the goggle is allowed (will be considered as damaged) and damaged goggles must be replaced by the student in possession.

Safety Rules for the Unit Operations Laboratory:

THE FOLLOWING PROCEDURES AND REQUIREMENTS MUST BE STRICTLY FOLLOWED:

1. Before entering the laboratory for orientation or operation of equipment, groups are expected to be aware of the safe operation of the equipment and the chemistry of the process being performed.
2. Report all injuries, however slight, to instructor. Call 911 for all emergencies
3. Find and memorize the location of all safety & first aid equipment.
4. Find, read, and understand MSDS sheets on all chemicals. Use gloves when handling corrosive, reactive, or poisonous chemicals.
5. No open toed shoes are allowed in the lab. Students are required to wear long pants and a lab coat.
6. Safety goggles should be worn at all times in the lab (contacts are strongly discouraged).
7. No necktie is allowed. Long hair must be kept under control.
8. Pick up all trash and other materials and dispose of properly.
9. Food and beverages are prohibited in the lab.
10. All equipment and the surrounding area must be left in Bristol fashion at the end of the course.

Disabled students:

Students with any sort of limitation or disability should discuss its consequences with instructor prior to the start of the course.

Honor Code:

Students are expected to be aware of and understand the limitations imposed by the University's Code of Academic Integrity and the consequences for violations thereof.

Class Schedule:

Tuesday (Thursday)

Date	Schedule
Sept. 1 (Sept 6)	Startup lecture (form groups, assign experiments) 11AM-12:15PM; 1-2PM; Lab tour
September 8 (13)	Lecture on fuel cell-I; 11AM-12:15PM; Study Project #1 at lab 1-5PM. Submit a work plan for project #1 to TA's mail box by 2:00pm the day before the class
September 15 (20)	Lecture on fuel cell-II at 11AM-12:15PM; Discussion with instructor on work plans at lab 1-5PM, Submit a revised work plan for project #1 to TA's mail box by 2:00pm the day before the class
September 22 (27)	Discussion on format of work plan.11AM-12:15PM; Start project #1 1-5PM
Sept. 29 (Oct. 4)	Finish project #1 1-5PM
October 6 (11)	1 PM Submit final report on project #1; First presentation (1:00-3:00PM) in Lab; Study project #2 at lab 1-5PM. Submit a work plan for project #2 to TA's mail box by 2:00pm the day before the class
October 13 (18)	General discussion on format of project report at 11AM-12:15PM; Discussion with instructor on work plans at lab 1-5PM, Submit a revised work plan for project #2 to TA's mail box by 2:00pm the day before the class
October 20 (25)	Discussion 11AM-12:15PM; Start project #2 1-5PM
Oct. 27 (Nov. 1)	Finish project #2 1-5PM
November 3 (8)	1 PM Submit final report on project #2; Study project #3 at lab 1-5PM Submit a work plan for project #2 to TA's mail box by 2:00pm the day before the class
November 10 (15)	General discussion 11AM-12:15PM; Discussion with instructor on work plans at lab 1-5PM, Submit a revised work plan for project #2 to TA's mail box by 2:00pm the day before the class
November 17 (22)	Discussion 11AM-12:15PM; Start project #3 1-5PM
Nov. 29 (Dec. 1)	Finish project #3 1-5PM
December 6 (8)	11 AM submit final report on project #3; preparation of presentation
December 13 (15)	Oral presentation 11AM-12:15PM

Final Report Outline

Cover sheet---Title

Name and position of the contributors

Date of report

Abstract--- Stands alone; does not refer to any other section; describes very briefly the whole body of work usually one page or less, never more than two.

Introduction—background to work you did

Discussion of comparable work in literature

Reason for doing the work

Procedure—general description, i.e. not a detailed list of steps

Results --- can often be tabulated

Section needs few words: at total reflux $x=$; $y=$;

Correlation and graphs

Discussion---what you learned

What the data mean

Error analysis

Source of errors (“more heat loss than expected”)

Conclusions—summarize the things you learned (“Process works efficiently”)

Recommendations---what you suggest be done as a result of your work

Literature Cited---

Appendix—the place you put useful support information

MSDS sheets for your raw materials

Vapor pressure curves

Derivation of equation you used

Sample calculation

Anything else that supports the work you have done.