

Chemical Engineering 475
Unit Operations Laboratory I
217 CB
Fall 2015



Prerequisites: 376 & 391, Engl 316. Stat 201 is recommended. Please see the instructor if you have not completed all four of these classes.

Description: Experimental verification of unit operations design principles; data collection and reduction; report preparation.

Instructors:

Michael Beliveau; 223 CB; 422-3921; beliveau@byu.edu (Lab Manager)
Tommy Knotts; 350J CB; 422-9158; thomas.knotts@byu.edu (Section 1, MW 2:00-4:50 pm)
Tom Fletcher; 350E CB; 422-6236; tom_fletcher@byu.edu (Section 2, TTh noon-2:50 pm)
Stan Harding; 210A FB; 801-560-8595; n.stanley.harding@gmail.com (Section 3, TTh 4:00-6:50 pm)

Teaching Assistants:

Section 1: Curt Lockhart, curtdgr8@gmail.com, cell: 714-417-3922
Section 2: Jeremy Passey, jeremy.w.passey@gmail.com, cell: 801-678-6512, 343 CB
Section 3: Alex Josephson, josephson.alex@gmail.com, cell: 509-338-5749, 208A FB

Objectives of Class

1. Perform experiments that reinforce concepts learned in the Chemical Engineering curricula. This semester focuses on fluid dynamics, heat transfer, and thermodynamics.
2. Experience more open-ended problem statements to simulate more of an industrial experience.
3. Improve skills in safety, group work, statistics, writing, and presentations.

Lab Format

We will try to simulate a professional engineering environment in the lab. You will be divided into teams of three students and will be given three projects in the form of memos from your supervisor (instructor). The projects will intentionally be somewhat open-ended, and your team will respond to each project by conducting experiments, performing analyses, drawing conclusions, and making recommendations. Most of the projects are not merely cookbook experiments, and because of the intermediate size may not work perfectly (which happens frequently in industry).

During the course of the class both written and oral reports will be used according to the schedule below. An electronic lab notebook will be used by the team for each project.

For the individual assignments, all graphs, figures, and tables must be your own work. You may not use figures from a team member for an individual report. For all projects, you will be required to maintain professional standards of attendance, teamwork, and safety practices throughout the semester.

Attendance

In keeping with the goal of simulating the professional environment, you must be in attendance (“at work”) for the entire lab period on each day of the lab. Each unexcused class missed will result in a 5 point deduction from your grade unless you receive permission from your instructor and make up work that is agreeable with your group. Each unexcused tardy will result in a 2 point deduction. For emergencies or other pressing circumstances, please communicate with Mike Beliveau or your instructor just as you would with an employer. If you focus on this class and analyze your data as you collect data, you should be able to perform all required work in the three-hour lab period.

Teamwork

You will be assigned to a different team for each project. It is expected that you will work cooperatively, sharing a fair portion of the work-load. At the conclusion of each project, the other members of your team will be required to evaluate how well you performed as a team member (attendance, abilities, contributions, demeanor, etc).

Safety

The following safety precautions are required by all (these are not optional):

1. No food is allowed in the laboratory or in the computer area. You may take a short break after the initial lecture time to eat lunch or dinner, but not in the lab or computer area.
2. All personnel in the laboratory area are required to wear safety glasses, long pants, and covered shoes (no shorts, skirts, sandals, or flip-flops). You will lose points for preparation if you are not dressed properly on lab days.
3. All students are required to complete ChEn 311 before taking ChEn 475; the ChEn 311 course includes the HAZCOM training course.
4. Experimental work should be completed during the regular class periods. If additional time is needed in the laboratory, you must clear it with your instructor and make an appointment for the use of the laboratory with Mike Beliveau. At least two students must be present during those additional hours (no one is permitted to work in the lab alone).

Resources

Written Materials: No official text is used for this course. Some textbooks and engineering handbooks are kept in the laboratory for your use, but please do not remove them from the room, and please return them to the bookshelf at the end of each period. A significant amount of information is also available on the course website at <http://www.et.byu.edu/groups/uolab/>. Of course, your textbooks from previous courses will also be helpful. **YOU MAY NOT USE OR LOOK AT PREVIOUS REPORTS** except those provided by the instructor.

Hardware: Instruments, supplies, manuals, etc., may be checked out from the Laboratory Supervisors, Mike Beliveau and John Sowa, or from the T.A. All materials checked out during the laboratory must be returned to the stockroom at the end of the laboratory period.

Lectures: Brief lectures will be given in 217 CB at the start of class in order to provide guidance about report writing, data analysis, etc. We hope that these will be helpful, and we welcome your feedback on these lectures, as well as suggestions for additional topics.

Honesty

The honor code at BYU must be followed at all times. As previously stated, you must do your own work for the individual assignments. You may discuss data reduction, experimental results, etc. with your team (not previous teams unless given permission by the instructors) but you must write your own report and prepare your own graphs and figures for presenting your results. **YOU MAY NOT USE OR LOOK AT PREVIOUS REPORTS** except those provided by the instructor. Plagiarism and cheating is not tolerated in any profession, including chemical engineering. Plagiarism includes copying your partners work or copying reference material without proper references. If you need to include information in your report that is not your own, you should paraphrase the information and provide a reference. Academic dishonesty will result in a grade of E for the course.

Projects: Three projects will be given during the semester. The following outline gives some guidelines for the required reports. Additional details are provided in the supplemental handouts entitled “Experiments and Communication” and “Report Guidelines.”

Item	#	Who?	Details
Safety Sheets	3	Team	Submit by the end of the second lab period for <u>each project</u> . You must have the form approved by an Instructor or TA prior to starting any experiments. You will hand-write the startup and shutdown procedures on the back of this form before it is approved.
Proposals	3	Team	Before any experimental work can begin, each team must submit a proposal outlining steps that will be followed to solve the problem.
Quizzes	3	Individual	A project-specific multiple choice quiz will be given at the conclusion of every project. These quizzes test basic understanding and should be easy to pass if the lab has been completed and each team member understands the equipment and

			analysis procedure.
Progress Reports	3	Individual	A 1-paragraph progress report and an accompanying 1-page powerpoint file describing intermediate results are required in the middle of the time for experiments on each project.
Complete Report	1	Team	A complete report is required for the 1 st project, but limited to 4-5 pages.
Memo Report	1	Individual	A memo report is required for the 2 nd project, limited to 2-3 pages.
Grading critiques	2	Individual	At the end of the 1 st and 2 nd projects, you will be required to critique reports from two peers that are not on your team.
Oral Presentation	1	Team	Your team will be assigned to present an oral presentation for the 3 rd project.
Leadership Report	3	Individual	At the end of each lab, you will provide feedback to the members of your team about their performance as a teammate and leader.
Lab book	3	Team	The lab notebook will be electronic this year, using OneNote in Microsoft Office. This must be completed each day.

Grading

		Points
1. In-class safety/lab assignment	Team	P/F
2. Labview Assignment*	Team	P/F
3. Leadership Report #1-3 (5 pts each)		15
4. Progress Reports (10 pts each)		30
5. Project #1 Team Complete Report [†]	Team	100
6. Project #2 Individual Memo Report [†]		100
7. Critiquing of Reports (4, 5 pts each)		20
8. Project #1-3 Quizzes (30 pts each)		90
9. Statistics Assignment*		20
10. Statistics Quiz		20
11. Projects #1-3 Team Proposals (30 pts each) [†]	Team	90
12. Projects #1-3 Team Notebooks (10 pts for each project)	Team	30
13. Project #3 Team Oral Presentation [†]	Team	100
14. Attendance		‡
15. Attitude**		25
TOTAL POINTS		640

* This is an in-class assignment. Attendance and participation during the entire lab period is required since this exercise is part of the lab period. If you have to miss this class, please contact the instructor prior to the class to make arrangements for making up the assignment.

† Successful completion of these assignments is required to pass the class. An E grade will be given if one or more assignments is not submitted, or if a grade of 60% or less is given on any of these deliverables.

‡ Attendance is required. For each unexcused absence, 5 points will be deducted from the grade. For each tardy, 2 pts will be deducted from the grade.

**In the work place your attitude will play a large role in your evaluation by your supervisor. These points will be awarded by the instructor for maintaining a positive attitude in the class. Positive suggestions for improving the class are welcomed.

Grading will be on a curve, but the lowest grade given if a person attends class and completes all of the work is usually a B. If everyone works hard the average GPA should be around an A-.

Due Dates. All assignments must be turned in at the beginning of class to receive possible full credit. If late:

- 75% if turned in within 24 hrs (but class is not missed and report is not worked on in class)
- 60% if turned in within 24 hrs (but class is missed or report is worked on in class)
- 50% if turned in between 24 and 48 hrs
- 0% if turned in after 48 hrs.

Competencies

1. Students will gain hands on experience with chemical processes, units, and corresponding equipment through lab experiments
2. Students will understand and be able to describe the physical significance of key dimensionless quantities including Re .
3. Students will understand qualitatively conduction, forced and free convection, and radiation and have experience with one or more modes during experiments.
4. Students will be able to analyze systems containing multiple resistances to heat transfer during laboratory experiments.
5. Students will understand convective heat transfer and be able to use heat transfer coefficients as they relate to the UO Laboratory experiments.
6. Students will demonstrate familiarity and experience with the measurement of process variables (e.g., P , T , flow rate, conc.) using manual and/or electronic devices and computers.
7. Students will demonstrate knowledge of basic laboratory techniques.
8. Students will be able to use the scientific method and problem solving strategies, as well as statistical methods, to design, carry out, and analyze experiments in order to solve engineering problems.
9. Students will use a process control system.
10. Students will demonstrate familiarity and experience with chemical process equipment.
11. Students will demonstrate an understanding of basic engineering statistics in their laboratory reports
12. Students will demonstrate effective interpretation of graphical data.
13. Students will demonstrate an ability to solve engineering problems.
14. Students will be able to integrate topics from various Chemical Engineering courses to solve realistic problems in the areas of heat transfer, fluid flow, and thermodynamics.
15. Students will exhibit critical and creative thinking skills for analysis and evaluation of problems and cause-effect relationships.
16. Students will be able to obtain and evaluate appropriate input information/data from databases, handbooks, correlations, experiments, literature, etc.
17. Students will be able to rationalize units, make order of magnitude estimates, assess reasonableness of solutions, and select appropriate levels of solution sophistication.
18. Students will understand and practice safe laboratory and chemicals-handling principles.
19. Students will be able to give effective, well organized oral presentations including the handling of questions and the use of appropriate visual aids.
20. Students will be able to write effective, well organized technical reports, including formal engineering reports and short letter reports.
21. Students will practice good teamwork principles.
22. Students will be able to do performance calculations on heat exchangers from experimental data and demonstrate abilities or understanding in one or more of the following aspects: heat exchanger sizing, heat exchanger design, fouling, utilization of overall heat transfer coefficients, types of heat exchangers, and materials of construction.
23. Students will be able to design or analyze flow systems involving one or more of the following aspects: pipes, valves, fittings, pumps, flow meters, Newtonian fluids, non-Newtonian fluids, laminar flow, and turbulent flow.
24. Students will demonstrate effective reading of technical material.