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**Unit Operations Laboratory I**

**217 CB**

**Spring 2019**

**Location and Time** 217 CB, TTh 12:00‐5:50 p.m.

**Instructor** Stella Nickerson, 330M EB, 801‐422‐3173, stelladn@byu.ed

**Lab Manager** Michael Beliveau, 223 CB, 801‐422‐3921, beliveau@byu.edu

**Course Overview**

The Unit Operations Lab presents the opportunity to perform hands-on experiments related to concepts learned in previous courses. You will work with real equipment and analyze real data. You will tackle problems which may be more open-ended, more ambiguous, and more plain-confusing than the back-of-the-book problems you are by now so familiar with. You will also practice and improve skills including working in teams, writing technical reports, giving oral presentations, and performing statistical data analysis. If approached with the right spirit, UO Lab can be an invaluable experience integral to becoming a confident, competent professional engineer.

**Attendance**

This class aims to simulate a professional engineering environment to the extent possible. In keeping with this goal, you must be in attendance (“at work”) for the *entire* lab period on each day of the lab. Each class missed will result in a 10‐point deduction from your grade unless you receive permission from your instructor and make up work in a manner that is agreeable with your group. Each tardy will result in a 5‐point deduction. Leaving class early will result in a 5‐point deduction for each instance. For emergencies or other pressing circumstances, please communicate with Mike Beliveau or your instructor just as you would with an employer. All the experimental work will be done in class, and you should also try to do most data analysis and report writing in class.

**Teamwork**

## Projects will be conducted in teams of 3-4. 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).

When a written report is required, each team member must prepare their own report. It is permissible to share graphs, figures, and tables generated from the data collected as a team; however, because writing styles and analysis methods may differ among members of the team, it could be suboptimal to use the same graph as your teammates. The data you provide in the document must support what is written. Be smart about it, people.

You are *not* permitted to ask other groups or students who took the class another semester how they are doing (or did) a particular project. You are not permitted to use and should not even view materials, data, or reports from previous semesters.

**Safety**

All students are required to follow the following safety rules. (T*hese are mandatory.*)

1. No food or drink is allowed in the laboratory or in the computer area. You may take a short break during non‐ lecture times to eat lunch or dinner but do *not* do so 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 sandals or flip‐flops). Long pants and covered shoes are required each class day—even if you are not planning on being in the lab.
3. All students are required to complete ChEn 311 (where HAZCOM training takes place).
4. No labs/equipment may be run/started before the specific lab safety training has been done and the specific lab safety sheet has been passed off with either the instructor or Michael Beliveau.
5. 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).
6. At least one student from each team must be in the lab itself (not the computer area) when running experiments to monitor the experiment and enact emergency procedures if problems occur.
7. Students who operate *any* equipment in *any* unsafe manner or in a manner that damages the equipment or results in a user‐preventable accident will incur a *significant* grade penalty. This includes not knowing how to run the equipment or shut it down. *All team members should know how to safely run the equipment.*

**Resources**

***Written Materials***

This course has no official text. 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 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. Remember, you may not use or look at previous reports.

***Hardware***

Instruments, supplies, manuals, etc., may be checked out from the Laboratory Supervisor (Michael Beliveau). All materials checked out during the laboratory must be returned to the stockroom at the end of the laboratory period. Most of the information you will need has been placed on the UO Lab webpage for each individual experiment.

**Grading and Due Dates**

Unless otherwise noted, all assignments must be turned in *at the beginning of class* to receive possible full credit. See the class schedule for the due dates for each item. For each late assignment, you may obtain up to the following maximum credit:

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

**Honor Code**

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. The university's expectation, and my own expectation in class, are that each student will abide by all Honor Code standards. Please contact the Honor Code Office at 422‐2847 if you have questions about those standards.

**Lab‐Specific Honesty**

Remember, you must do your own work for the individual assignments. You may discuss data reduction, experimental results, etc. with your current team (not previous teams unless given permission by the instructors) and use the same main graphs generated during the data analysis, but you must write all the text of your own report, alter the team graphs to fit the flow of your individual report, and generate any new graphs that may be needed to support your arguments. YOU MAY NOT USE OR LOOK AT PREVIOUS REPORTS. 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.

**Sexual Harassment**

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education and pertains to admissions, academic and athletic programs, and university‐ sponsored activities. Title IX also prohibits sexual harassment of students by university employees, other students, and visitors to campus. If you encounter sexual harassment or gender‐based discrimination, please talk to your professor or contact one of the following: the Title IX Coordinator at 801‐422‐2130; the Honor Code Office at 801‐422‐2847; the Equal Employment Office at 801‐422‐5895; or Ethics Point at [http://www.ethicspoint.com,](%20http%3A//www.ethicspoint.com%2C) or 1‐888‐238‐1062 (24‐hours).

**Student Disability**

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422‐2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422‐5895, D‐285 ASB.

Course Competencies

1. Students will gain hands on experience with chemical processes, units, and corresponding equipment through lab experiments.
2. Students will demonstrate an understanding of basic engineering statistics.
3. Students will understand and be able to describe the physical significance of key dimensionless quantities.
4. Students will understand qualitatively conduction, forced and free convection, and radiation and have experience with one or more modes during experiments.
5. Students will be able to analyze systems containing multiple resistances to heat transfer during laboratory experiments.
6. Students will understand convective heat transfer and be able to use heat transfer coefficients as they relate to the UO Laboratory experiments.
7. 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.
8. Students will demonstrate knowledge of basic laboratory techniques.
9. Students will be able to use the scientific method and problem solving strategies, as well as statistical methods, to design and carry out experiments in order to solve engineering problems.
10. Students will use a process control system.
11. Students will demonstrate familiarity and experience with chemical process equipment.
12. Students will demonstrate an ability to solve engineering problems.
13. 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.
14. Students will exhibit critical and creative thinking skills for analysis and evaluation of problems and cause‐ effect relationships.
15. Students will be able to obtain and evaluate appropriate input information/data from databases, handbooks, correlations, experiments, literature, etc.
16. Students will be able to rationalize units, make order of magnitude estimates, assess reasonableness of solutions, and select appropriate levels of solution sophistication.
17. Students will understand and practice safe laboratory and chemicals‐handling principles.
18. Students will be able to give effective, well‐organized oral presentations including the handling of questions and the use of appropriate visual aids.
19. Students will be able to write effective, well‐organized technical reports, including formal engineering reports and short letter reports.
20. Students will demonstrate effective reading of technical material.
21. Students will demonstrate effective interpretation of graphical data.
22. Students will practice good teamwork principles.
23. 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.
24. 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.