**CHEN 4905- Section 2 Unit Operations Laboratory**

### Meets:

**Lecture:** **T, H -** 12:55 - 1:45, WEB L122

**Laboratory:** **T, H -** 2:00 - 5:00, MEB 3520

Instructor: Terry RingOFFICE HOURS: T, H 1-5 PM or BY APPOINTMENT

Course Webpage: <http://www.che.utah.edu/~ring/>

TA:Nathan Yonkee

### ****Laboratory Manager and CLEAR Staff****

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| **Bob Cox** | **Amy Bingham** | **Stacey Overholt** |
| Lab Manager | CLEAR Specialist - Writing | CLEAR Specialist-Teams & Oral Communications |
| rec6@utah.edu | amylinb@gmail.com | stacey.overholt@utah.edu |
| 3520B MEB, 581-7846 | 1706 WEB | 1706 WEB |

Pre-requisites:  C- or better in CH EN 3553, 3603, & 4903. Major standing.

Co-requisites: CH EN 4203.

Catalogue Description: Continuation of 4903: Provides the opportunity to analyze and optimize processes and products by several means: experimentation, simulation, instrumentation, and control. Hands-on experience with real systems is emphasized as are communication skills and teamwork.

### Text, Materials, Fees:

There is a special laboratory fee of $100. The text for the course is available from the copy center and online, <http://www.che.utah.edu/projects_lab/handbook>.  You must also keep an approved laboratory notebook (available in the bookstore). It is recommended that you have access to **Perry's Chemical Engineers Handbook, 8th ed,** and ***Writing Style and Standards in Undergraduate Reports, Second Edition*** by Jeter and Donnel (ISBN 978-1-932780-06-2)**.**

Hard hats, lab coats, and safety glasses will be supplied by the department. Proper use of safety equipment, maintenance of your laboratory workspace and proper record keeping in the lab book will have bearing on each report grade.  Handouts for the course and the lab handbook from the copy center are available.

### Other Online Materials:

The projects lab has a dedicated site with which you should become familiar, <http://www.che.utah.edu/projects_lab>. On this site you may find equipment manuals, SOPs, the lab handbook, and more.

Rigorous and statistically sound analysis of data is a key component of this course. This information can be found within the CHEN 4903 course materials given last semester and can be found at <http://www.che.utah.edu/~ring/>.

Overview of the Course: The course unrolls in 4 phases. The CLEAR writing specialist will be available for one-on-one consultations and group conferences to help you with the written assignments throughout the semester.

**Deadlines for the Phases:**

Phase 1 - January 17, 2014: Single page individual proposals and single concept slide due.

Phase 1 - January 23, 2014: Three minute individual proposal pitch.

 January 28, 2014: Funding and Team Decisions Made by Faculty

Phase 2 - February 14, 2014: Full (team) proposals due.

Phase 3 - April 11, 2014: Team Project reports due.

Phase 4 – Technical Oral Presentations Scheduled from March 25 to April 10, 2014 during lecture.

**Phase 1:** Phase 1 is performed and graded individually. Each student will write a single page proposal, and create a single concept slide for a project meant to:

1. Improve the capabilities of the Projects Laboratory, or
2. Perform a short research program for a faculty member.

Each student will then pitch their ideal to a panel of professors and approximately a third of the proposals will be supported and teams of two or three interested students will be created around the winning proposals. Students will give a 3 minute "elevator pitch" regarding their proposal, with the aim of persuading, in a concise manner, a board of instructors that the student's proposed work is sound, feasible, and important. Each individual student must make their own unique pitch.

The Phase 1 deliverables that will be graded include:

1. A one page written proposal
2. A single slide that gives the concept for the proposed project
3. An oral presentation to a faculty panel pitching your proposal. This is a short, 3 minute “elevator pitch”

Students are required to meet with the CLEAR writing specialist before the final drafts of the proposals are handed in. Students are also required to meet with the CLEAR oral communications specialist before their oral “elevator pitch” presentation.

Students will listen to the oral elevator pitches and develop a list of 5 projects in the order of their preference to be a member of the team.

Before beginning Phase 2 and 3, each team must arrange to meet with the professor for a 30 minute preliminary laboratory conference regarding the project’s planning, pertinent theory, and safety issues.

**Phase 2:** Phase 2 is performed and graded as a team. This phase is intended to familiarize the students in the team with the equipment they are to use in their final proposed work. Preliminary data will be generated during this phase of work and used in the writing of a formal proposal. Students are required to meet as a team with the CLEAR writing specialist before the final drafts of the formal proposals are handed in. The Phase 2 deliverables that will be graded include:

1. Group-written formal proposal with budget for work including a procurement delivery schedule that meets the demands for time associated with the semester. The budget is negotiable with the faculty member in charge and possibly with the Department Laboratory Committee. For the proposal, the drafts of the Technical Background and Objectives sections must be handed in prior to the report's due date (see the class calendar for due dates). Each report must be turned in as pdf's via emails; one to the professor and the other to the CLEAR specialist on or before the due date and time. One copy will be graded by the CLEAR specialist and the other by the ChE professor.

Students are required to meet as a team with the CLEAR writing specialist before the final drafts of the proposal is handed in. The CLEAR writing specialist will also be available for one-on-one consultations, group conferences, and by appointment to help you with other written assignments throughout the semester.

**Phase 3:** Phase 3 is performed and graded as a team. In phase 3 laboratory work demonstrating the value and utility of the proposal’s work are to be done and reported out in a group-written formal report. The Phase 3 deliverables that will be graded include:

1. Group-written formal report. For the formal report, two hard copies of a draft of the Introduction and Theory sections must be handed in prior to the report's due date (see the class calendar for due dates). Each report must be turned in as pdf's via emails; one to the professor and the other to the CLEAR specialist on or before the due date and time. One copy will be graded by the CLEAR specialist and the other by the ChE professor.

Students are required to meet as a team with the CLEAR writing specialist before the final drafts of the formal report is handed in. The CLEAR writing specialist will also be available for one-on-one consultations, group conferences, and by appointment to help you with other written assignments throughout the semester.

*Students interested in graduate school may wish to substitute a formal report with a journal article. If so, the interested student (or team upon a unanimous decision) should consult with the professor at the beginning of the project period to discuss the appropriateness of a journal article format for their topic. Also, note that the grading rubric for the journal article is different from that for the formal report.*

Try to conduct all your experiments during scheduled class time. However, if more lab time is needed, contact the professor or lab manager to obtain their approval. **NO ONE MAY WORK IN THE LAB ALONE AND LABORATORY STAFF MUST BE NOTIFIED BEFORE ANY LAB WORK BEGINS OUTSIDE OF DESIGNATED LAB PERIODS**.

**Phase 4:** Phase 4 is performed and graded as an individual. Near the end of the semester each student will give a 10 minute technical presentation to the class (note that these are not group presentations).  The topic of their presentation must be related to chemical engineering and based on research or laboratory work personally conducted by the student in 4903, 4905, or in their workplace.  Each student's topic must be approved by the instructor.

### Grading:

The grading breakdown for 4905 is shown in the bar graph below. Assignments handed in late will receive a penalty of 10% of the total number of points available for the first day late (or fraction thereof), and an additional 2% penalty for each subsequent day.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 10% | 10% | 10% | 20% | 20% | 15% | 10% | 5% |  |
| One Page Proposal | Pitch | Final Formal Report (Group) | Project Success (Group) |  |
|  | Concept Slide | Formal Proposal (Group) | Technical Presentation | Professionalism |

In addition to the reports, proposals, and the presentations, notice that there is a 5% "professionalism" score and a 10% project success score. The project success is evaluated on the technical success of the Phase 3 project. You will be required to arrange meetings with the CLEAR specialists outside of class time to help prepare for your oral presentations and edit your reports. One factor that will affect the professionalism score is your preparedness for and attendance at these meetings (60% of the professionalism score, determined by CLEAR). The other factor that will affect your professionalism score is your attendance at the presentations of your peers and submission of your peer evaluations (40% of the professionalism score). This score will be calculated by the percentage of presentations and evaluations completed, after allowing for six unexcused missed presentations.

*Team Work Score*: Because the proposal and final report will be team efforts, each student's team working, as evaluated by team members and CLEAR specialists, will affect the student's score on these reports. See Canvas for the team working grading sheet. The score for group reports will be calculated according to the following:

c =  ymax – y;
if c > 20% then x = ( c - 20% ) / 80%, else x=0;
P = P0 ( 1 - x / 4);
where P=final score, P0 = initial score, y = your team working score out of 100%,   ymax = maximum team working score in your group.

*Translation: As long as you’re within 20% of the max, your score is unaffected. Below that, up to 25% of team project points could be lost.*

**Learning Objectives for the Course:**

1. Apply concepts from heat transfer, fluid mechanics, mass transfer, process control and thermodynamics to model and analyze the performance of unit operations equipment.
2. Apply concepts from mathematics to model and analyze the performance of unit operations equipment.
3. Compute description statistics (e.g. sample mean, sample standard deviation) and apply methods of statistical inference (e.g. hypothesis test, confidence intervals) to analyze experimental data sets.
4. Develop specific experimental objectives to meet overall experimental goals.
5. Design and conduct experiments to collect data relevant to experimental objectives.
6. Analyze experimental data to obtain parameters and correlations describing unit operations equipment performance.
7. Evaluate the quality of experimental results by comparison with accepted correlations and theories and develop valid conclusions about deviations from expected equipment performance.
8. Demonstrate effective team skills including goal-setting, consensus-building, listening, role-setting, and time management.
9. Demonstrate effective leadership skills including facilitating team discussions and decisions, calling team meetings, and insuring team achieves all required tasks on schedule.
10. Produce professional-quality written reports that present, analyze, and interpret experimental results logically and which are well organized and easy to read.
11. Produce a professional-quality oral presentation that presents, analyzes, and interprets experimental results logically and which are well organized and delivered.
12. Apply concepts of professional ethics to design and conducting experiments and analyzing and interpreting experimental data.
13. Demonstrate knowledge of laboratory and process equipment and instrumentation and their capabilities and limitations.
14. Demonstrate the ability to design an experiment to meet desired needs within realistic constraints such as environmental, economic, health and safety.

### Nondiscrimination and Disability Access Statement:

The University of Utah is fully committed to affirmative action and to its policies of nondiscrimination and equal opportunity in all programs, activities, and employment with regard to race, color, national origin, sex, age, status as a person with a disability, religion, sexual orientation, and status as a veteran or disabled veteran. The University seeks to provide equal access to its programs, services and activities for people with disabilities. Reasonable prior notice is needed to arrange accommodations. Evidence of practices not consistent with these policies should be reported to the Office of Equal Opportunity and Affirmative Action, (801) 581-8365 (V/TDD).

Upon request, this information is available in alternative formats, such as cassette, Braille, or large print.