# CHEMICAL ENGINEERING 4903-1, PROJECTS LABORATORY-I
## Fall Semester, 2009


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**CLEAR Specialists:**

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W 2:00-3:00, R 1:45-3:45
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Clair Canfield, Teams & Oral Communication
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Office Hours:
T, Th: 10-12PM
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**PREREQUISITES:** CH EN 3553, 3603, 5503. Major standing; CoReq: CH EN 4203.
**SCHEDULE:** M, W 12:55-5:00 p.m., ROOMS 102 WEB & 3520 MEB

Class will usually meet Mondays and Wednesdays at 12:55 p.m. in room 102 WEB for lectures, general announcements and informational items unless notified otherwise. Students will be randomly assigned to work in groups of three. Each group will be assigned three projects over the course of the semester. Before beginning each project, groups will arrange to meet with the instructor for a preliminary oral examination regarding the project's planning, pertinent theory, and safety issues. Experiments on unassigned days are discouraged; try to conduct your experiments during scheduled class time.

Towards the end of the semester each student will give a 10 to 12 minute oral report to the class between 12:55 and 1:45PM in 102 WEB. The topic for your oral report must be related to a social issue. Attached is a list of possible topics. You may select a topic off the list or select your own. However, each student's topic must be unique and approved by the instructor.

Oral and Written report guidelines are provided in the text for this course, and are available on Prof. Geoff Silcox's website (www.che.utah.edu/~geoff/writing/index.html). Lectures and other miscellaneous course material may be found at the instructor's web site (http://www.che.utah.edu/~tony/chen4903/). In addition, you will receive several lectures throughout the semester to assist you in your report writing and presentation efforts. As part of your assignments, you are required to arrange a meeting with Clair Canfield, the oral and teamwork specialist for Chemical Engineering, outside class time to help prepare for your oral presentations. Your presentations will also be videotaped to be used at a later date for additional assignments. Joshua Lenart, the technical writing specialist, will be available to help you with your written reports.

**REPORTS:** For the first project each student of each group will write a formal report. For the remaining two projects, each student must write one formal report and one memo report. The order of the formal and memo report is at the student's discretion, as long as at least one student in each group writes a formal report for each project. Reports must be submitted in order to pass the course and will serve as the primary basis for the course grade. Reports, both partial and final, handed in after the deadlines are subject to penalties. For the first formal report, four copies are requested. The instructor will receive the original report and an electronic copy (through email). A hard copy of the full report will be given to Joshua Lenart and an electronic copy will be provided for the CLEAR staff (www.coe.utah.edu/clear - click submit homework). If your file is too large for University email, >50MB, then contact the instructor and CLEAR to see how they can receive your electronic report. All hard copies must be submitted to the department secretary on or before the due date. Only two copies of the second and third report will be requested: the original report and an electronic copy for the instructor. Eleven days prior to each report's due date, a copy of each formal report's theory section must be submitted to the instructor and the CLEAR staff.

**Grading:**

| Item | Points |
|---|---|
| Homework, Mapping | 20 |
| 2 - Formal Reports and 1 - Memo Report | 300 |
| Oral Report | 100 |

**TEXT, MATERIALS, FEES:** The text for the course is available from the copy center. The recommended text is ***Perry's Chemical Engineers Handbook, 7th ed.*** You must keep an approved laboratory notebook (available in the bookstore). A 10 inch screwdriver, a 10 inch crescent wrench and work gloves and clothes may be useful. Hard hats and safety goggles will be supplied by the department. Proper use of safety equipment, maintenance of your laboratory workspace and proper record keeping in the student's lab book will have bearing on each report grade. There is a special laboratory fee of $100. Various handouts for the course and the lab handbook from the copy center are also available on the web, www.che.utah.edu/~geoff/writing/index.html.

*The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.*

## CHEN 4903 Projects Laboratory I, Section 1

**Catalog Description:** Experiments and theoretical solution of realistic problems in heat transfer, fluid flow, mass transfer, chemical-reaction kinetics, and process control by use of semi-industrial-scale and bench-scale equipment.

**LEARNING OBJECTIVES:**

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

# Possible Topics for the Persuasive Oral Report

**Ch En 4903-1**

For your persuasive oral report you may choose from the list of suggested topics below, or select a topic that better suits your interests. Each student, however, must choose a unique topic and have his or her topic approved by the instructor.

| | |
|---|---|
| 1. Genetically modified foods | 22. Clean coal technology |
| 2. Stem cell research | 23. K-12 Science and math education |
| 3. COX-II inhibitors (Vioxx, Celebrex) | 24. Wind energy |
| 4. Biological warfare agents | 25. Solar energy |
| 5. Gene delivery to treat human disease | 26. Nuclear energy |
| 6. FDA regulation of pharmaceuticals | 27. Nuclear waste storage in Utah |
| 7. Low cost medical tech for the 3rd world | 28. Nuclear reactor security at the U of U |
| 8. Agricultural use of antibiotics. | 29. Acid mine drainage in Utah |
| 9. Agro-chemicals vs. Organic foods | 30. Recycling at the U of U |
| 10. Global climate change | 31. Nuclear weapons testing |
| 11. Mercury pollution | 32. Sustainable transportation |
| 12. Air pollution in Utah | 33. H1N1 (swine flu) pandemic |
| 13. Perchlorate pollution in Utah | 34. Nanomaterials, environmental concerns |
| 14. Arctic National Wildlife Refuge drilling | 35. Chemical Engineering in a "flat" world, globalization's effect on our industry. |
| 15. Paper vs Plastic Grocery Bags | 36. Research using human-animal hybrids |
| 16. Cloth vs. Disposable diapers | 37. Space program, Moon vs. Mars |
| 17. Hybrid cars | 38. Childhood vaccinations |
| 18. Diesel vs. Gasoline | 39. Cognitive enhancing pharmaceuticals |
| 19. Fuel cells | 40. Corn Ethanol |
| 20. Oil shale | 41. Gulf of Mexico's "Dead Zone" |
| 21. Tar sands | 42. Risks of Synthetic Biology |

# Chemical Engineering 4903
# Proposed Lecture and Assignment Schedule
# Fall Semester 2009

(Subject to change, revised 7/22/09)

| Day | Date | Lecture / Laboratory Topics | Due Dates |
|---|---|---|---|
| M | 8/24 | Organizational Meeting, Form Groups, Schedules & Procedures, Maintaining a Lab Book, HW1 Given Out | |
| W | 8/26 | Lab Safety Lecture, Lab I Assignment Given Out | |
| M | 8/31 | Physical Measurements | |
| M | 9/2 | Teamwork Lecture I | **HW-1 Due** |
| M | 9/7 | *Labor Day Holiday* | |
| W | 9/9 | Teamwork Lecture II | Lab I Prelim. Conference |
| M | 9/14 | Data Analysis | |
| W | 9/16 | Mapping Assignment, Data Analysis | |
| M | 9/21 | Formal Report Writing | |
| W | 9/23 | Writing Style | |
| M | 9/28 | **Theory section of Lab Report 1 due in Dept Office, 1pm** | **Theory I Due** |
| W | 9/30 | | |
| M | 10/5 | | |
| W | 10/7 | Lab II Assignment Given Out | |
| **F** | **10/9** | **Lab Report I Due in Dept Office, 1 pm** | **Lab Report I Due** |
| M/W | 10/12-10/17 | *Fall Break* | |
| M | 10/19 | Review of Lab Report I | Lab II Prelim. Conference |
| W | 10/21 | Team Work Follow-up | |
| M | 10/26 | Technical Letter/Memo Report Writing | |
| W | 10/28 | Persuasive Oral Presentation Guidelines – I | |
| M | 11/2 | Persuasive Oral Presentation Guidelines – II, **Theory section of Lab Report 2 due in Dept Office, 1pm** | **Theory II Due** |
| W | 11/4 | Oral Presentation Lecture | |
| M | 11/9 | | |

| Day | Date | Lecture / Laboratory Topics | Due Dates |
|---|---|---|---|
| W | 11/11 | Lab III Assignment Given Out, | |
| **F** | **11/13** | **Lab Report II Due in Dept Office, 1 pm** | **Lab Report II Due** |
| M | 11/16 | Review of Lab Report 2 | Lab III Prelim. Conference |
| W | 11/18 | 3 Oral Reports | |
| M | 11/23 | 3 Oral Reports | |
| W | 11/25 | 3 Oral Reports | |
| M | 11/30 | 3 Oral Reports, **Theory section of Lab Report 3 due in Dept Office, 1pm** | **Theory III Due** |
| W | 12/2 | 3 Oral Reports | |
| M | 12/7 | Review of Oral Reports | |
| W | 12/9 | | |
| **F** | **12/11** | **Lab Report III Due in Dept Office, 1 pm** | **Lab Report III Due** |
| M-F | 12/14-12/18 | **Final Exam Week** | |

*Oral Presentations (10 to 12 min + 5 min. discussion) on a social issue. All students are required to attend.

# CHEMICAL ENGINEERING 4903-1
## Fall Semester 2009

Short Assignment –Mapping (Due by 5 PM, September 2, 2009)
Submit your work to Chemical Engineering Office, 3290 MEB

Draw a floor plan of the Chemical Engineering Laboratory (3520 MEB). Include principal pieces of process equipment, analytical equipment, and the location of all safety equipment. Confine your plans (sketches) to areas used in the senior project laboratory course; do not consider graduate research offices or research laboratories.

Additional Notes:
(1) Your sketches should be included in your laboratory notebook as well as submitted to us.

(2) Though not necessarily made to scale, your sketches and captions should be prepared with care and neatness.

(3) As with conventional plans and maps, north should be labeled at the top of each sheet.

(4) Safety equipment which must be identified includes:

a. Fire extinguishers
b. Fire alarms
c. Fire blankets
d. Safety showers*
e. Eye wash fountains
f. First-Aid kits

***Do not test-pull a safety shower chain**; the safety showers will not shut off until an embarrassing amount of water has been discharged. Operate the safety showers only in the case of a real emergency.

(5) The principal pieces of laboratory equipment include the following:

a. Distillation column
b. Batch distillation column
c. Extruder
d. Gas absorber columns
e. High pressure glass lined reactor
f. Vacuum drying oven
g. Spray drier
h. Fluidized bed apparatus
i. Double-pipe heat exchanger
j. Shell-and-tube heat exchanger
k. Gas flow circuit
l. Liquid flow circuit
m. CSTR/Tubular reactor
n. pH Control System
o. Liquid level control system
p. Multivariable control system
q. Catalytic reactor
r. Fermentor/Bioreactor
s. Heat control experiment
t. Liquid level flow control
u. Spray dryer
v. Heat conduction system
w. Fuel cell system
x. Matlab level control system
y. Matlab crane control system
z. Dialysis apparatus
aa. Ultrafiltration apparatus
bb. DI $H_2O$ Source
cc. Any other major equipment

(6) The principal pieces of analytical equipment include the following:

a. HPLC
b. Densitometer
c. Refractometer
d. Viscometers
e. Flame AA
f. UV/VIS
g. FTIR
h. GC
i. Laboratory barometer
j. Any other major equipment

Submit your assignment in the form of a memorandum. Your written response to this assignment will be graded, and will be worth 20 points (≈5%) in your overall class grade.