CHEG 4137W & 4139W
Fall ’08 & Spring ’09

COURSE INFORMATION

Instructors: Eric Anderson, EII, Room 208, x2490, ewanders@engr.uconn.edu
Fall 2008
Professor Montgomery Shaw, IMS, Room 211A, x3980, montgomery.shaw@uconn.edu
Spring 2009
TBD
Lab Manager: Mr. Richard Kozel
Consultant: Professor G.M. Howard, EII, Room 210, x2479, howard@engr.uconn.edu
Teaching Assistants: Sujan Shrestha, Room 214, x6-6095, sujanster@gmail.com
Zineng Zhang, Room 214, x6-6095, zhangzineng@gmail.com
Office hours: M,W 10:00 am to 1 pm.

Class Periods: Tuesday and Thursday, 1 - 5 PM
Classroom: (when needed for lecture and/or oral presentations) CAST Room 204
Laboratory: EII, Room 114, and EIII (Bromwell) Room 316

BE SURE TO CHECK YOUR EMAIL and THE BULLETIN BOARDS (above the mailboxes and in the Lab) for announcements of class meetings and course information.

Course website: http://www.engr.uconn.edu/~ewanders/237W.htm

Course Content:
1. 5 experiments for Fall ’08 and 4 experiments for Spring ’09
2. Preliminary report and Hazard Analysis Form before each experiment.
3. Lab Safety Check Sheet to the T.A. at the end of each experiment.
4. One Major group report, one Minor written report with one Rewrite, one Major report; and one Minor (10 min) and one Major (20 min) Oral Reports

Grading:
One Major group written report 15%
One Major individual written report 20%
One minor written report 10% + rewrite 10%
One 10-minute oral report* 15%
One 20-minute oral report* 20%
Team & Laboratory Performance** 10% (includes evaluations by Instructors and TAs)

Total 100%

This is a W course; all written reports must be satisfactory in order to pass the course.

* For the oral report, a written abstract and copies of the slides used must be turned in at the time of the talk. If any of these items are missing, points will be deducted from the oral report score.
** A component of the lab-performance grade will be derived from auto-rating scores for each experiment.

Due Dates:
Written reports are due by the beginning (1:30 pm) of the 2nd class period following the last scheduled period of your experiment. There will be a 4% penalty per weekday or weekend for late submissions (e.g., Saturday + Sunday = 4%). No reports will be accepted after December 9, 2008. When hard-copy reports are submitted, the time and date of submission must be entered by an instructor, TA or a secretary. Reports may be submitted electronically as a single PDF file.
EXPERIMENT CODE

Experiment | Subject | Instructor | T.A. |
-----------|---------|------------|------|
1          | Draining Tank | Anderson/Shaw | (All) |
2          | Distillation   | Anderson     | Zhang |
3          | Digital Control| Anderson     | Zhang |
4          | Kinetics A     | Shaw         | Zhang |
5          | Heat Exchange  | TBD          | Zhang |
6          | (open)         |             |      |
7          | Evaporator     | Shaw         | Sujan |
8          | Pump & Pipes   | Anderson     | Sujan |
9          | Kinetics B     | TBD          | Sujan |
10         | Gas Absorption | Shaw         | Sujan |
11         | (open)         |             |      |

Note: Each student will run five (Fall 07) or four (Spring 08) experiments. In the fall, the first will be written up as a group report, the next two as either a minor individual written or oral report, the fourth as a major individual written report, and the last as a major oral report (there is no written report for the final experiment). In the spring, the first two are either minor individual written or oral report, the fourth as a major individual written report, and the last as a major oral report. There will be no final exam either semester.

References:  
Chemical Hygiene Plan for the CHEG Laboratories (available in the laboratory)  
School of Engineering Safety Manual (available in the laboratory)  

Other Writing Help: The Writing Center at UConn: www.writingcenter.uconn.edu  
Scientific abbreviations: http://www.cas.org/ONLINE/standards.html#listinga  
Safety Information: UConn Environmental Health and Safety, http://www.ehs.uconn.edu
Course Objectives
After completing this course, successful students will:

1. Integrate knowledge and skills acquired in earlier courses;
2. Solve open-ended problems by applying theory, planning and executing an experimental program, and analyzing and interpreting results;
3. Work effectively in teams;
4. Demonstrate laboratory safety and knowledge of equipment operation;
5. Communicate findings and interpretations clearly and effectively.

Organization
Prior to beginning actual experiments, the class will receive instructions concerning general laboratory safety practices and procedures. There will be lectures on the statistical treatment of data, preparation of written and oral reports, and the salient features of the experiments. Other formal classes will be scheduled as announced.

All experiments will be carried out in groups. One member of each group will be designated Foreman for the experiment. It will be the Foreman’s responsibility to organize the work of the group, to prepare the preliminary report (for presentation at the pre-lab conference), and to provide effective leadership.

The remaining members will assume (by group decision) the roles of Safety Inspector and Technician. The Safety Inspector must complete an Experiment Hazard Analysis Form for presentation at the pre-lab conference (see form at end of document) and complete the Lab Safety Check Sheet, which must be submitted to the T.A. at the conclusion of the experiment (i.e. the last scheduled day of the experiment). It is suggested that the Safety Inspector keep a copy of the original Experimental Hazard Analysis Form for updating or editing during the actual experiments. A discussion of safety issues must be included in the written report.

A Technician should also be appointed. He/she will be responsible for recording experimental notes and data in lab notebook(s), having the notebook(s) signed at the end of each lab period by the T.A. or Instructor, and distributing the data to group members. During the experiment, the group's Technician is also encouraged to enter all relevant data from the lab notebook into a spread sheet. Again, these spread sheets must be forwarded to all members of the group at the end of each day. You may not use any other group’s data (an exception may be made for the kinetics experiments. For groups of more or fewer than three, the roles of Safety Inspector and Technician may be rotated or shared, respectively.

At least one day prior to the beginning of each experiment a pre-laboratory conference between squad members and the T.A. assigned to that experiment should be arranged. The purpose of the meeting is to allow the group to present a summary of its plans for the upcoming experiment (preliminary report) and to go over the Experiment Hazard Analysis Form. Advance preparation by all squad members is essential before this conference. Scheduling of this
conference is the students’ responsibility. Both the preliminary report and the Experiment Hazard Analysis Form must be turned in to the T.A. at the conclusion of this conference.

All reports must follow the minor or major report formats, as appropriate, explained in the handout *Preparation of Laboratory Reports*.

After the first (Draining Tank) experiment, all reports are individual reports. Each student, working alone, must analyze the raw data, formulate the tables, draw the figures and write the text. Details of the presentation of the results (e.g., number and type of figures and tables) are up to the individual student. To save on routine manual labor, it is suggested that raw data be entered on spread sheets for distribution.

All groups will rate the members of teams larger than two using the Autorating method. This procedure is explained on separate handouts. The autorating scores will also be a factor in the grade “Team and Laboratory Performance” part of the course grade (see p. 1).

"Freeloading" (i.e., shirking one’s fair share of the work) is an unacceptable abuse of the team concept, as it undermines team effectiveness in a disproportionate manner. While teams are expected to reasonably accommodate the strengths, weaknesses, and schedules of their members, they are NOT expected to give someone a free ride. For obvious safety reasons, individuals may not operate the experimental equipment alone or after hours. If someone on your team is not contributing, you are obligated to reflect this in the Autorating evaluation for that individual.

The reports must follow the format prescribed and must be submitted on time. Late reports will be penalized 4% per weekday or weekend (Saturday + Sunday). No report will be accepted after December 9th.

Unlike previous semesters, we are scheduling one rewriting of the minor individual report. It is due one week after the graded report is returned. Any other report may also be returned by the Instructor to the Student for a rewrite if it is not an acceptable exposition of the experiment, but this is at the sole discretion of the Instructor (i.e., students may not "choose" to do a rewrite). If a report is returned, the student is obligated to redo the report to reflect the comments of the Instructor who graded the report. One week is allowed for revisions, after which the usual penalty schedule will be applied.

Two oral presentations with visual aids have been assigned for this semester. Location, scheduling, and details concerning this talk will be discussed prior to the designated talk date. Attendance of all scheduled speakers is required for the entire day of the presentations. Credit will be given for student participation in the questioning of the speaker.
In the Laboratory

**Laboratory Safety**

Laboratory safety is an important element of experimental work. It will be each student's responsibility to read and understand the "Chemical Engineering Safety Manual" and apply these rules in lab. Penalties for careless, childish, or dangerous behavior may include expulsion from the laboratory and will influence heavily the student's Team & Laboratory Performance grade. When a safety hazard is observed, your group will be asked to stop work until the situation is corrected to the Instructor's or T.A.'s satisfaction. **THE FOLLOWING LABORATORY PRACTICES WILL BE STRICTLY ENFORCED:**

- Maintain a safe work area. Clean up and properly store your equipment and supplies.
- Know the location of all fire extinguishers, safety showers, eyewashes, fire blankets and the first aid kit, and know how to use them.
- Consider safety when planning and executing your experiments. Obtain MSDS sheets for chemicals you are using. Know the key information concerning hazards, toxicity, and spills.
- Handle all noxious or hazardous chemicals in the hood. Use rubber gloves when handling corrosive chemicals or glass items.
- Gas cylinders should be chained or clamped at all times. After using cylinder gas, close the tank valve and release pressure from the regulator. Replace floor gratings if they are removed.
- Identify tasks that involve risk of personal injury. Be cautious of steam lines.
- At least two people are required at any operating equipment. Never leave running equipment unattended. Students will be permitted to work in the laboratories at times other than the scheduled period only with the specific permission of the Instructor and Mr. Anderson.
- Be familiar with equipment before you operate it. Report malfunctions promptly to Mr. Anderson.
- Address spills or accidents immediately and report them to Mr. Anderson.
- Wear proper attire to laboratory. Proper attire includes shirts that cover the shoulders, and midriff, long pants, socks, and closed-toe shoes. Common items that are specifically prohibited include sandals, high-heeled shoes, cloth shoes, neck ties, scarves, and dangling jewelry. Long hair must be tied back or otherwise confined.
- Wear safety glasses or prescription glasses at all times. Wear safety goggles when mixing or pouring chemicals.
- Wear a hard hat in the high bay area (near distillation column and evaporator). Hats can be obtained from the stockroom at the beginning of each lab.
- Consumption of food and beverages should be limited to the student lounge area.
- Performing experiments while your judgment or reactions are impaired is dangerous. Schedule your all-nighters and celebrations accordingly.

**Laboratory Notebooks**

*Each student is required to have a bound laboratory notebook* with pre-numbered pages. All experimental data, literature references, basic equations, start-up and shut-down procedures, observations, etc. are to be neatly recorded directly in these notebooks. This activity is aimed at
developing the record keeping practices that are commonly required by most industrial concerns as supporting evidence for patenting. Do not record data on loose sheets of paper, paper towels, laptops, etc. At the end of the lab period, the Instructor or T.A. will initial and date the pages of data taken in the laboratory. In addition, all notebooks used by the group must be given to the Technician immediately following each lab period. The technician will be responsible for having the notebooks signed and for making copies for all the group members. A clear, unaltered copy of all data from all notebooks used for the experiment must be included as an appendix to the completed lab report. Your Instructor may inspect your notebooks any time.

Other practices that should be followed:

- Write only in dark, waterproof ink, leaving at least a one-inch margin on all sides.
- Title and date each page on the top line.
- Record all raw data (with units) directly and immediately into the notebook. Writing must be legible. Do not process data before recording, as mistakes are easy to make and cannot be corrected. Process all data latter.
- Measurements, calibrations, observations, notes, sketches and sources of this information should be included.
- Permanently fasten (tape, staple, glue) into the notebook all attachments, including calibration curves, chart recordings, copies of literature data, etc. Record sources of all attachments.
- Data that is incorrectly measured or recorded should be marked through with a single line, and the correct value written above or to the right. Do not obscure the original. Record explanations for bad data.
- "Z-line" the unused portion of any page.
- A T.A. or Instructor must initial and date each page 1/2-in. below the last line of data.
- Do not remove pages; do not skip pages.

Attendance and Academic Honesty
You must attend all scheduled laboratory periods, group pre-lab conferences and your assigned oral report sessions. Absences will be excused according to the guidelines in the Student Handbook. You must have a written excuse that can be verified. It is the student's responsibility to document such absences, and to advise the Instructor in advance when possible. Penalties for unexcused absences will be reflected in the Autoratings and in the Team & Laboratory Performance part of the course grade.

Engineering is a profession; professional behavior is expected of you. You may not use reports or data produced by other students as a substitute for your own work. Possession of other students' work (including, but not limited to previous years' unit operations lab reports) will be considered academic dishonesty. Published work, course notes, and discussions with colleagues and Instructors are acceptable sources of information; however, you must give credit when you use the ideas or efforts of others. Take pride in this practice as an indication of your professional training and stature. For more details, please refer to the section on plagiarism in the handout entitled Preparation of Laboratory Reports.
Preliminary Report and Experiment Hazard Analysis Form

Prior to each experiment, there will be a pre-laboratory conference between all group members and the T.A. in charge of that experiment. It is the Foreman's responsibility to schedule this meeting. The group must meet before this conference, inspect the apparatus, plan the experiment, and prepare the preliminary report and the Experiment Hazard Analysis Form, both to be handed in at the conference.

The preliminary report explains what you intend to determine experimentally and how you will do it. You must demonstrate that you know how to operate the equipment, you understand the engineering principles involved, you are aware of potential hazards and errors, and you have a well-conceived experimental plan. The preliminary report should consist of a diagram of the apparatus plus a short (1-page maximum) summary of plans for the experiment, i.e., what data will be taken and how that data will be analyzed. The experimental plan should be discussed jointly by the whole group.

The Experiment Hazard Analysis Form is attached at the end of this document. It is to be filled out by the group's Safety Inspector. On the form, the Safety Inspector must identify potential hazards associated with the various proposed experimental steps, the recommended procedures to avoid the potential accident and actions in case an accident occurs. It is suggested that the Safety Inspector keep a copy of the original form for updating during the actual experiments. A discussion of safety must be included in the "Safety Considerations" section of the written report.

At the conference, the Foreman and Safety Inspector will give oral summaries of the Pre-laboratory Report and Hazard form (5 minutes each (max), with no visual aids except the report or form and blackboard). Following the presentations, all squad members will be questioned by the T.A. about various aspects of the upcoming experiment. For example, be prepared to answer questions such as 'What parameters are critical?', 'What key plots do you plan to make?', 'What range of variables will be sufficient to accomplish your goal?', 'How do you plan to analyze experimental error?', and 'What are the expected outcomes?'

Laboratory Reports

Proficiency and ease in report writing are skills required by every engineer. Many industrial executives state that the greatest weakness of young chemical engineers is their inability to report clearly the important results and conclusions of their work. This failing frequently results from a combination of poor grammar, excessive words, lack of organization, and/or weak logic, hazy thinking, and carelessness.

To strengthen these skills, each student will be required to write two major reports and two minor reports. The ultimate goal of a report is leave the busy reader with knowledge and understanding of your findings and ideas in as little time as possible. This is best accomplished by presenting the information in an organized, concise, and factual manner. Effective writers have their conclusions and recommendations in mind before they begin writing and organize their report to substantiate these points to an unenlightened and possibly skeptical reader. Therefore, it is helpful to make a detailed outline before beginning any writing. The mere taking and reporting of data are insufficient; intelligent interpretation must be included. (Refer to “Preparation of Laboratory Reports” handout for more details.)
A detailed description of the recommended major report format and writing tips are contained in
the handout titled “Preparation of Laboratory Reports”. The major report format outlined in this
handout should be followed for all reports, although modifications may be appropriate depending
upon the nature and emphasis of the experiment.

The reports will be due at the beginning of the second laboratory period (1:30 pm) following the
scheduled completion of the experiment. Reports are to be logged in by the T.A. or by a
Department secretary and then placed in the Instructor’s mailbox. Late reports will not be
tolerated and any tardiness in submitting reports will result in lowered grades. The penalty for
late submission will be 4% for every weekday or weekend or fraction of a day late
(excluding recess days). Extenuating circumstances beyond the student’s control may mitigate
the late penalty and should be discussed with the Instructor beforehand.

If you choose to submit electronically, send a single PDF file directly to the cognizant Instructor.
To limit the file size, scanned material (e.g., notebook pages) should be scanned at ~150 lines/in
resolution and using the “line art” setting, or equivalent. Limit the use of half-tone B&W and
color photos or scans. If you include such, trim the image electronically and “discard” the
trimmed-off material. After trimming, the files must be reduced in size to “print” quality, or
equivalent. Enter graphs into the document as images (not object files), again with lowered
resolution. All other rules and guidelines are the same as for hard-copy reports, including page
numbering and margins.

All reports should be produced using standard word-processing software and printed clearly
using 12-pt type or larger. The text should be double-spaced. All text and inserts should be on
one side of the paper only, with suitable margins (see handout). Pages should be numbered
either throughout or by section. There is no excuse for misspelled words or bad grammar. Use
the tools on your word-processor to check for errors, but never rely totally on the computer. A
final reading of a printed copy is always worthwhile.

The data and sample calculations presented in appendices may be done neatly by hand.
Drawings and graphs should be computer generated if possible, but may be done very neatly by
hand. The required report title page is shown on the next page. All reports should be submitted
securely fastened inside a report folder, or electronically as a single PDF file.

Written Laboratory Reports: Details
All written reports must be securely fastened in a report folder with a clear, windowed or solid
cover. If windowed, the report title, author and date must show through the window. If the
cover has no window, this information must be on a label pasted to the cover. The title page
format shown here will be required on all written reports and for submission of the Abstract and
slides accompanying the oral reports. Oral report materials do not need a cover, but should be
stapled securely.
Note that all report folders should have a positive fastener for the left side so that report pages can not fall out or become separated. Also, margins should be wide enough so that all material on a page can be seen without having to remove the fasteners. Mount landscape format with top in the binding, again leaving plenty of margin.

Include with your report, but unfastened, the completed Autorating forms. This confidential form may also be given directly to an Instructor. The latter is the only option for electronic submission.

**Oral Reports**

Verbal as well as written communication skills are essential to the successful engineer. Ease with the preparation and presentation of an effective talk is attained primarily through practice and experience. Therefore, two oral reports will be required in this course. The first talk will be seven minutes in length and will cover the experiment completed just prior to the scheduled talk date. The second oral report (20 min) will be given near the end of the semester. The material covered in this talk will be the last experiment completed by the student. A few minutes for questions and comments or suggestions will follow each individual talk. All students scheduled on a given day are required to attend all talks given that day and will be encouraged to participate in these discussions. Students will also be asked to provide written comments concerning their peers' performances during the oral reports. These anonymous comments will be assembled and distributed to the speakers.

The following is a brief set of suggestions to help you in preparing for your oral reports. A more detailed description of these points may be found in the handout “Advice for Speakers.”

1. Do not talk longer than the topic requires. Rigorously remove empty phrases and limit repetition to key ideas.
2. **DO NOT READ** your presentation. It should not be necessary to use a manuscript or other notes during the talk. You should be very proficient with the subject matter.
3. Speak clearly, simply, and loudly. Look at your audience! Make sure all can view your slides.
4. ORGANIZE! An orderly talk is important for you and your audience.
5. Use mathematical notations and equations sparingly. If you do not plan to use or discuss material, remove it from the slide.

6. Make economical use of your slides. A slide should never contain large amounts of text or a big table but should give pertinent information clearly and legibly, with print large enough to be read at the back of the room (24 pt. or larger.) Data and results should be presented in the clearest format possible, usually as diagrams or graphs. Limit the use of tables and rigorously delete parts that are not relevant to your discussion. Limit the number of slides you use; plan on spending approximately one to 1-1/2 min per slide.

One suggested sequence for slide or viewgraph presentation is:

I. Title Page (supply your name, topic, etc.)
II. Introduction, including your objective(s)
III. Schematic of Experimental Apparatus
IV. Graphs of Important Results
V. Conclusions/Earth Shattering Discoveries

V. Team & Laboratory Performance

The team & laboratory performance evaluation is designed to reflect a student’s contribution to the experiment and his or her group and to encourage students to carry their part of the load. The performance grade will be based on student attendance, safety practices and knowledge of equipment operation, in-lab teamwork skills, preparedness for the pre-laboratory conference, and other factors. The Instructors, with input from the T.A.'s, will assign the laboratory performance grade. The basis for the grade will also include the evaluations on Autorating forms for the experiments.
Instructions for the Autorating System  
(Developed by Prof. Brown at MIT)

1. Please use the following ordinal ratings:

   **Excellent**: contributed much more than required and expected; a true leader
   **Very good**: strong contributor
   **Satisfactory**: pulled his/her weight
   **Ordinary**: showed up and helped when asked
   **Marginal**: some effort was required by the others to get this person going
   **Deficient**: really little contribution here in spite of requests/warnings
   **Unsatisfactory**: poor understanding of material; no effort; a mere passenger
   **Superficial**: showed up occasionally, but didn’t know what was going on. Preferred to discuss other subjects; disruptive attitude
   **No show**: no presence, no contribution

2. After careful consideration, give each team member **including yourself** a grade, and submit these to the Instructor on a separate and unbound sheet when your report is due. These will be processed by an algorithm suggested by Prof. Brown to arrive at a **component** of your Laboratory Performance grade.

   **Project Name:** __________________________

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<th>Names of Team Members</th>
<th>Rating</th>
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# CHEG 237W and 239W

## Experiment Hazard Analysis Form
(to be turned into the T.A. with the preliminary report at the pre-lab conference)

**Experiment:**  
**Safety Inspector:**  
**Date:**  
**Group members:**

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<tr>
<th>Experimental Steps</th>
<th>Potential Hazards</th>
<th>Recommended Procedure to Avoid Accident</th>
<th>Recommended Action in case Accident Occurs</th>
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