Chemical Engineering Laboratory

CHEN 3810, Spring 2009
Mon and Wed 1:00pm-5:00pm
282 Mudd Building

Instructors:

Scott Banta sbanta@cheme.columbia.edu
820 Mudd (212) 854-7531

Mark Borden mb2910@columbia.edu
809 Mudd (212) 854-6955

Jordan Spencer spencer@columbia.edu
807 Mudd

Teaching Assistants:

Nkechi Anako na2323@columbia.edu

Min Kuo mk3028@columbia.edu

Cherry Chen ccc2136@columbia.edu

Edward Swanson ejs2163@columbia.edu

Course Description:
This course emphasizes active, experiment-based resolution of open-ended problems involving use, design, and optimization of equipment, products, or materials. Under faculty guidance students formulate, carry out, validate, and refine experimental procedures, and present results in oral and written form. The course develops analytical, communications, and cooperative problem-solving skills in the context of problems that span from traditional, large scale separations and processing operations to molecular level design of materials or products. Sample projects include: scale up of apparatus, process control, chemical separations, microfluidics, surface engineering, molecular sensing, and alternative energy sources. Safety awareness is integrated throughout the course.

Course Objectives:

1. Develop skills in formulating experimentally based solutions to achieve specified objectives.
2. Enhance ability to creatively synthesize classroom knowledge for solving open-ended problems.
3. Teach critical analysis and evaluation of data – including iterative optimization of experimental design that integrates preliminary results.
4. Improve written and oral communication skills.
5. Teach cooperative and teamwork based approaches to problem resolution.
6. Validate engineering concepts and principles from prior coursework.
7. Familiarize students with assembly and use of laboratory apparatus.
8. Educate students in safe laboratory practices.

Textbook:
Required: Beer, D., and McMurrey, D. A Guide to Writing as an Engineer 2nd Ed., Wiley

Safety and Ethics:
Mandatory safety, ethics and professionalism presentations will be given on January 23rd.

Lab Write-ups:
The write-ups for each laboratory experiment can be found on the Courseworks site.

Grading:	5 Lab Group Assignments	75%
	Comprehensive Final exam	25%

Approximate weekly schedule:

Week	Topic	Assignments
1 1/23	Ethics and Professionalism Presentation Introduction to Course	
2 1/26 1/28	First Rotation, 1st Week Experiments	
3 2/2 2/4	First Rotation, 2nd Week Experiments	
4 2/9 2/11	Second Rotation, 1st Week Experiments	Written Group Comprehensive Data Analysis of First Rotation
5 2/16 2/18	Second Rotation, 2nd Week Experiments	
6 2/23 2/25		Full Oral Group Presentations of Second Rotation
7 3/2 3/4	Third Rotation, 1st Week Experiments	
8 3/9 3/11	Third Rotation, 2nd Week Experiments	
3/16 3/18	Spring Break	
9 3/23 3/25	Fourth Rotation, 1st Week Experiments	Full Written Group Report of Third Rotation
10 3/30 4/1	Fourth Rotation, 2nd Week Experiments	
11 4/6 4/8		Individual Oral Presentations of Fourth Rotation
12 4/13 4/15	Fifth Rotation, 1st Week Experiments	
13 4/20 4/22	Fifth Rotation, 2nd Week Experiments	
14 4/27 4/29	Comprehensive Final Exam – Time TBA	Individual Executive Summary of Fifth Rotation

Group Assignments:

	Group A	Group B	Group C	Group D	Group E
Monday	Hobgood Reed Sundelacruz	Chu Moreno Nicholas	Colbrourne Ho Svokos	Espinal Liu Stone Zeng	Cornell Lee Seltzer Vyner

	Group A	Group B	Group C	Group D	Group E
Wednesday	Rispoli Srinivas Wilner	Feliciano Fu Kwan	Bisso Jiang Yu	Arnold Chan Monteverde	Dash Lin Mackay Wong

Rotation Assignments:

	Rotation 1	Rotation 2	Rotation 3	Rotation 4	Rotation 5
Group A	Ammonia Absorber	Agitation	Electrophoresis	Dye Mixing	Rotating Electrode
Group B	Rotating Electrode	Electrophoresis	Dye Mixing	Ammonia Absorber	Agitation
Group C	Agitation	Dye Mixing	Ammonia Absorber	Rotating Electrode	Electrophoresis
Group D	Electrophoresis	Ammonia Absorber	Rotating Electrode	Agitation	Dye Mixing
Group E	Dye Mixing	Rotating Electrode	Agitation	Electrophoresis	Ammonia Absorber

Assignments:

Effective technical communication skills are essential for any professional career, including the engineering profession. It is crucial to be able to accurately and clearly disseminate information in both oral and written formats. At times, this may mean a complete written paper or report about an experiment, process, or product that is geared towards a non-engineering audience. At other times, this may require a brief and efficient technical summary that is aimed at a well-informed peer or supervisor. Oral presentations can also range from a brief update to a colleague, to a short talk at a seminar, to a full oral presentation as a part of a job interview. All of these examples require an ability to critically understand the material that is to be presented, a mastery of the modality of the presentation, and knowledge of audience that is to receive the presentation. Therefore, this semester the lab groups will be required to produce several different written and oral presentations of the research conducted during the laboratory rotations. The required textbook A Guide to Writing as an Engineer 2nd Ed. by Beer and McMurrey will be a valuable resource for the different written and oral presentations.

Report Formats:

All written communications must be written in a professional engineering format. This means that all written documents will have a cover sheet that includes the title of the experiment, the date of submission, who the report is submitted to, who the report is from.

Rotation 1 – Each group will present a **written comprehensive analysis of the data** that was collected during the rotation. The group can assume that the audience for the presentation is already very familiar with the background of the experiment and the experimental methods. Therefore, the report will just focus on the critical analysis of the data presented, and the meaning of the analyzed data. This will essentially be a Results and a partial Discussion section of a traditional lab report. Since other sections are not required, the groups will be graded on the collection, presentation, analysis, and understanding of their experimental data.

Rotation 2 – After the completion of the second research rotation, each group will give a **complete oral presentation of their work**. The presentations will be approximately 15 minutes long (not including questions), and each member of the group must participate. The presentation

must provide the background, materials and methods, significant results, and overall conclusions of the experiment. The presentations will not only be graded for scientific content, but they will also be graded for the professionalism of the delivery, and the overall impact of the presentation. Presentations will be graded according to Beer and McMurrey, Figure 9-11.

Rotation 3 – The third research rotation will require **a full written report**. The lab report will follow the format of an engineering report, as outlined in Chapter 6 of Beer and McMurrey. The report will contain a Letter of Transmittal, an Executive Summary, and an Introduction. The body of the report will contain a Materials and Methods section, a Results section, and a Discussion section. The report will end with a Conclusion section, references, and appendices if necessary. The most important section of a manuscript is always the Discussion section. This is where the authors have the opportunity to summarize their main findings, to place their findings in the context of other work that has been done in the field, to honestly evaluate the strengths and weaknesses of the presented work, and to explain the overall significance of the work. This manuscript will be graded on both its scientific merit and its written format.

Rotation 4 – Sometimes the members of a group must give individual presentations about the work of the entire group. And, sometimes the presentations are informal. After the fourth research rotation all group members will meet one on one with the instructors to give an **oral presentation of the technical results of the experiment using an informal format**. Each student will then be asked questions about the project and the students will be graded on their understanding of the experimental details and the effectiveness of their oral presentation skills.

Rotation 5 – The final presentation will be an **individual executive summary** from each member of the group. An example of an executive summary can be found in Figure 6-2 of Beer and McMurrey. It can be assumed that the audience for the summary is well-informed about the project, and this summary must be a well-written statement of the most important findings of the experimental rotation. It must be written accurately and concisely, and it must be exactly 1 page long. The summaries will be graded for their impact and their ability to convey the main findings of the research rotation.

The comprehensive final exam will include material from all of the experimental rotations throughout the semester. Material on safety, ethics, and professionalism will also be included on the exam. The exam will be closed book, and it will be given during the last week of the semester. The exact time and location will be announced later in the semester.