CHEE 4361 (Required)
Chemical Engineering Practices

Catalog Data: Cr. 3. (1.5-5). Prerequisites: CHEE 3462, 3369, 3367, and credit for or concurrent enrollment in CHEE 4367. Design and execution of experiments with emphasis on heat and mass transport, unit operations, process control, and reactors. Written reports.


Prerequisites by Topic:
1. Unit operations with emphasis on distillation, absorption, extraction, and fluid-solid systems.
2. Mass transfer in single and multiphase systems and combined heat and mass transfer. Selected topics in heat and mass transfer, and in heat and momentum transfer.
3. Modeling techniques of chemical engineering problems with emphasis on process control.
4. Chemical reaction kinetics, mechanisms, and reactor design in static and flow systems; introduction to heterogeneous catalytic reactions in flow systems.

Course requirements:
Each student is required to carry out four (4) projects during the semester. A (library) Research Project will be carried out individually, and will be different for each individual. Three Experimental Projects will be carried out each group of three individuals. The entire class will be divided into groups of three for purposes of execution of the Experimental Projects. The assignment of Group Leader will rotate, thereby giving each student an opportunity to act as Group Leader for one Experimental Project.

Topics: (each class is 90 minutes, two classes per week for 4 weeks + each lab day is 8 hours, there are 12 / semester + 3 presentation days / semester, each is 3.5 hours long.)

1. Laboratory safety + hazardous material handling (1 class)
2. Introduction to LabView software and Advantech hardware (1 class)
3. Introduction to Statistical Design of Experiments (3 classes)
4. Introduction to report writing. (1 class)
5. Presentation skills (1 class)
6. Library instruction – finding scientific information, data, etc. (1 class)
7. Actual experimental design and implementation (12, 8 hour, class days)
8. Oral presentations (3, 3.5 hour class days)

Projects: Each group of 3 students will perform 3 experiments from the list below.
1. Packed-column Absorption Unit\textsuperscript{A,B}
2. York-Scheibel Extraction Column\textsuperscript{B}
3. Gas Lift – Gas absorption/stripping in Circulation Water\textsuperscript{A,B}
4. Packed Distillation Column\textsuperscript{A,B}
5. Tubular reactor - Armfield\textsuperscript{A,B}
6. CSTR – Armfield\textsuperscript{A,B}
7. Air-Water Tray Hydraulics Simulator\textsuperscript{B}
8. Packed Extraction Column\textsuperscript{B}
9. Tunnel-drying Apparatus\textsuperscript{A,B}
10. Leaf Filtration Apparatus\textsuperscript{A,B}
11. Plexiglass CSTR – Gas Absorption/Stripping\textsuperscript{B}
12. 20 Tray lab-scale distillation column\textsuperscript{A,B}
13. CSTR Control Unit – Conductivity\textsuperscript{A,B}
14. Adsorption – Gas – Low Pressure or Pressure Swing\textsuperscript{A,B}
15. Glucose Isomerase – Glucose to fructose\textsuperscript{A,B}
16. Single Pellet Reaction Kinetics\textsuperscript{B}
17. Fuel Cell Experiment under construction

A Computer control experiment
B Computer data-acquisition

**Expected Student Outcomes:**

Demonstrate technical knowledge by formulating solutions to experimental problems and analyzing experimental data. (a)\textsuperscript{3}
Demonstrate the ability to design and run experiments and analyze and interpret experimental results. (b)
Demonstrate the ability to design / scale up equipment from laboratory data. (c)
Demonstrate the ability to identify, formulate, and solve engineering problems. (e)
Demonstrate an understanding of ethical and professional responsibility of engineers. (f)
Demonstrate the ability to communicate effectively, both orally and in written reports. (g)
Demonstrate knowledge of how engineers impact society. (h)
Demonstrate the ability to engage in life-long learning. (i)
Demonstrate the ability to use process control and statistical software packages. (k)

The A, B, C below is the letter assigned to the group members. The reports required and the contribution of each project to your final grade is as follows:

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Report</th>
<th>Student</th>
<th>% of Grade</th>
<th>Notes</th>
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<tbody>
<tr>
<td>1 Library Project</td>
<td>Research Project</td>
<td>Oral Presentation</td>
<td>All</td>
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\textsuperscript{3} Lowercase letters in parentheses refer to ABET outcomes under Criterion 3 (see Appendix).
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<thead>
<tr>
<th></th>
<th>Experimental Project # 1</th>
<th>Preliminary Report 1</th>
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<td>B</td>
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<td>Conduct of Exper 2</td>
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<th>Appendix</th>
<th>Program-Specific Outcomes</th>
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| ABET Outcome, Criterion 3 | Use chemistry and physics concepts to set up and solve chemical engineering problems  
Use mathematical tools to solve chemical engineering problems |
| (a) an ability to apply knowledge of mathematics, science and engineering. | Select appropriate experimental equipment and techniques necessary to solve a given problem  
Evaluate and interpret experimental results using statistical tools and chemical engineering concepts |
| (b) an ability to design and conduct experiments as well as to analyze and interpret data. | Apply material and energy balance concepts to design a unit operation  
Define objectives and perform the design of an integrated chemical process under realistic constraints |
| (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health & safety, manufacturability, and sustainability. | Define roles and responsibilities to align with capabilities of team members and fulfill project requirements  
Develop and carry out a project plan through team work |
| (d) an ability to function on multi-disciplinary teams. | Translate an engineering problem into a mathematical model or other suitable abstraction  
Use mathematical model or other suitable abstraction to solve an engineering problem and interpret results |
| (e) an ability to identify, formulate and solve engineering problems. | Demonstrate knowledge of professional code of ethics.  
Identify ethical issues and make decisions for a chemical engineering problem. |
| (f) an understanding of professional and ethical responsibility. | Make presentations that are factual and tailored to the audience  
Can communicate in writing to non-technical and technical audiences |
| (g) an ability to communicate effectively. | Understand the impact of chemical engineering solutions in a global, economic, environmental, and societal context. |
| (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. | Recognize the importance of advanced education and development opportunities  
Identify, retrieve, and organize information necessary to solve open-ended problems |
| (i) a recognition of the need for and an ability to engage in life-long learning. | Know the interplay between current technical and societal issues  
Know the recent history, current status, and future trends of chemical engineering |
| (j) a knowledge of contemporary issues. | Use modern software to solve chemical engineering problems  
Understand how to operate equipment relevant to chemical engineering systems |
| (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. |  |