CHEN 414
Unit Operations Laboratory I
COURSE SYLLABUS

Instructors: Dr. Yue Kuo Mr. Jerry L. Bradshaw
Office: 235 Brown 36B Zachry
Phone: (979) 845-9807 (979) 845-0610
yuekuo@tamu.edu j-bradshaw@tamu.edu

Prerequisites: CHEN 304 and 323; ENGL 210 or 301

Textbook Required: Chemical Engineering Unit Operations Laboratory I. This laboratory manual is written by the laboratory instructor and is sold to the students at the TEES Copy Center. The manual includes laboratory safety rules, course syllabus, and a discussion of each experiment including some theory. Units Operations Laboratory Report Preparation Guidelines. This manual includes information on communication (oral and written), suggested report format and a sample report. The Guidelines have evolved over a number of years with input from CHEN Faculty, Tech Writing Faculty and Graduate Students. Other references are standard textbooks on grammar, technical writing, unit operations and Perry’s Handbook.

Attendance Policy: Attendance is mandatory and is included in the class grade.

Course Description: In CHEN 414, engineering problem solving is taught through hands on experience with pilot-plant scale equipment in the atmosphere of a technical task group. In the course, skills for accurate data collection, analysis and communication are developed. Students learn to operate equipment and modern instrumentation with precision. They thoroughly analyze their data and present a formal written report on each of the four experiments. Laboratory safety rules are strictly enforced, and a review of a current safety article (from trade literature) is required in each report. Grammar and technical writing are considered to be as important as technical content, and the report grading and rewriting plus oral presentations over the first three reports emphasize the importance of communication.

Learning Objectives: At the end of this course, students will be able to:

1. Apply fluid flow and heat transfer principles in the operation of pilot-plant scale equipment.
2. Apply classroom learned principles related to orifice and Venturi coefficients, Fanning friction factors, pipe roughness, relative roughness, and Reynolds numbers in a laboratory.
3. Determine experimentally overall and film heat transfer coefficients in both laminar and turbulent flow regions, and compare the results with empirically calculated coefficients.
4. Determine experimentally simultaneous heat and mass transfer coefficients in the drying of a solid.
5. Determine experimentally the compressibility factors, 2nd virial coefficients, and bubble point/dew point of gases, and compare the results to literature values.
6. Analyze experimental data and present formal written reports on each of the experiments.
7. Develop and give formal oral presentations over the experiments and results using PowerPoint or its equivalent.
Topics and Hours

Topics

1. Introduction, Laboratory Safety Rules, Report Writing (1.5 hours)
2. Familiarization with Experiments (1.5 hours)
3. Compressibility Factors of Carbon Dioxide and Helium (6 hours)
4. Studies in Fluid Flow (6 hours)
5. Drying (6 hours)
6. The Study of Heat Exchanges (6 hours)
7. Student PowerPoint Presentations on Experiments (9 hours)
8. Exam on Report Writing (2 hours)
9. Last day lecture (2 hours)

Total: 40 hours

Class Policies and Procedures

• Each group conducts four experiments. Each study requires a single written report. The COURSE SCHEDULE gives details.

• Obtain the following supplies:
  
  For each student:
  • Eye protection

  For each group:
  • Four folders with transparent covers
  • Four report cover sheets - provided by the Instructor

• Check out at the end of each day of the experiment by having the laboratory instructor sign the data sheet.

• Submit the reports in the folders, with cover sheet visible, bound with ACCO type fasteners.

• Turn in reports at the beginning of the appropriate laboratory session! There is penalty for late reports.

• Rotate responsibility for the final form of the various sections of the report among the group members. Although the writer is graded on the quality of expression, the entire group is graded on the content of every section. Remember: Every member of the group is responsible for the accuracy of the calculations.

• Put your initials on the pages you write.

• Each report receives a letter grade based on the following criteria:
  • The accuracy of the data and results.
  • The understanding and thought shown in analyzing the experiment.
  • The effectiveness of communication.

• A report may be returned for complete rewriting and/or reworking if the laboratory instructor determines it is inadequate. All reports must be submitted in satisfactory form to receive a passing grade in the course.

• One week after the reports are returned to the students, recommendations from the graders are to be incorporated in a revised version of the report. Revised pages are to be inserted in front of the original pages and returned with the original pages. The revised version will be inspected to determine if the revisions were incorporated.
The assignment of group leader rotates. The duties include the following:

1. Notifying the laboratory instructor that he/she is the group leader.
2. Organizing and directing the preparation and execution of the experiment.
3. Ensuring that all equipment is in place before the group leaves the laboratory.
4. Coordinating the preparation of the report and checking for overall unity and coherence.
5. Preparing and submitting the Confidential Group Leader’s Report in a sealed envelope attached to the report.

The Confidential Group Leader’s Report must include letter grades for the other team members and a brief statement evaluating the performance of each. The evaluation should be over the total job (the work in the laboratory and the preparation of the report). Include in the Group Leader’s Report, the following statement: "On my honor as an Aggie, this group has neither given nor received unauthorized aid on this academic work." The group leader should sign the report.

After group members examine the comments and correct the reports, they should return them to the Laboratory Instructor within one week.

The distribution used to determine the final grades will be as follows:

1. Laboratory Performance 15%
2. Group Leaders’ Evaluations 10%
3. Oral Presentations 20%
4. Written Reports 50%
5. Exam- Report Writing 5%

"Laboratory Performance” includes

1. Preparation before class
2. Prompt attendance
3. Effectiveness as a group leader
4. Contribution as a team member
5. Neatness (in the laboratory and on the data sheets)
6. Care and accuracy in operating the equipment and gathering data
7. Proper use of safety equipment
8. Strict adherence to safety guidelines
9. Effort and Effectiveness in correcting the reports

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”

For additional information please visit: http://www.tamu.edu/aggiehonor
Copyrights
The handouts used in this course are copyrighted. By “handouts” we mean all materials generated for this class, which include but are not limited to syllabi, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless the author expressly grants permission.

### Relationship to Program Outcomes:

<table>
<thead>
<tr>
<th>Course Objectives</th>
<th>Assessment Method</th>
<th>ChE Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply fluid flow and heat transfer principles in the operation of pilot-plant scale equipment.</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>1, 2, 4, 5, 6, 11</td>
</tr>
<tr>
<td>Apply classroom learned principles related to orifice and venturi coefficients, Fanning friction factors, pipe roughness, relative roughness, and Reynolds numbers in a laboratory.</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>1, 2, 4, 5, 6, 11</td>
</tr>
<tr>
<td>Determine experimentally overall and film heat transfer coefficients in both laminar and turbulent flow regions, and compare the results with empirically calculated coefficients.</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>1, 2, 4, 5, 6, 11</td>
</tr>
<tr>
<td>Determine experimentally simultaneous heat and mass transfer coefficients in the drying of a solid.</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>1, 2, 4, 5, 6, 11</td>
</tr>
<tr>
<td>Determine experimentally the compressibility factors, 2nd virial coefficients, and bubble point/dew point of gases, and compare the results to literature values</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>1, 2, 4, 5, 6, 11</td>
</tr>
<tr>
<td>Analyze experimental data and present formal written reports on each of the experiments.</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>4, 7, 11</td>
</tr>
<tr>
<td>Develop and give formal oral presentations over the experiments and results using PowerPoint or its equivalent.</td>
<td>Laboratory Work, Report Writing, Oral Presentation, Final Exam</td>
<td>4, 7, 11</td>
</tr>
</tbody>
</table>