

ChE 338
Separation Processes
Spring 2009
Syllabus

This is an introduction to the analysis and design of equilibrium-limited separation processes. Topics include binary distillation, multi-component distillation, separation of azeotropic mixtures via extractive distillation and other schemes, absorption, solvent extraction, and crystallization. The use of computer applications for both analysis and design will be emphasized throughout.

Objectives: As a result of this course, you should:

1. Understand the physical and chemical basis for distillation and similar staged separations.
2. Understand the use and limitations of mathematical and computer-aided design model models for the design and analysis of separations.
3. Understand the economics of the separation technologies studied especially the costs and decisions involved in process design.
4. Be able to design a separation process to meet a desired objective, such as product purity or production rate.
5. Be able to use phase diagrams for the design of separation equipment such as crystallizers.
6. Have an improved understanding of and ability to apply results from physical chemistry, thermodynamics, material and energy balances, mathematics and some economics to real chemical engineering problems.
7. Understand the general approach to the design and analysis of separation processes.
8. Be prepared to use the principles and tools learned in this course to solve problems not covered in detail as part of this course and to continue learning related materials as needed in the future.

Instructor

Prof. Neil S. Forbes
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Teaching assistants

Bhushan Toley
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The TAs' duties are to grade papers, to place solutions online, to discuss the solutions with you after you have read them, to proctor exams, to discuss any other questions related to the class with you, or to refer questions to the instructors as needed.

Logistics

Tuesdays and Thursdays, 9:30 - 10:45 pm
Separations computer lab, Mondays 3:35 - 4:25 pm
201 Lederle Graduate Research Tower (Alumni Classroom)

This classroom and the Pulaski computer classroom in Goessmann are accessible in the evenings.

Textbook

M. F. Doherty and M. F. Malone. *Conceptual Design of Distillation Systems*. McGraw-Hill, NY. 2001.

Additional reading materials may be provided as a course package or will be distributed as handouts.

Computer Resources

Excel, MathCAD, and Distil will be used. Contact Dr. Forbes with questions about your computer account or these tools. The web site for the course is located at: <http://www.ecs.umass.edu/che/che338/>. Grades will be available online using SPARK.

Grades

The course grade will be based on:

| | |
|------------|-----|
| Homework | 15% |
| Exam 1 | 25% |
| Exam 2 | 25% |
| Final exam | 35% |

Partial credit will be given. Many questions will be open-ended and more than one answer may be correct. The homework will be graded by the teaching assistants under the instructors' supervision and approval, and you can discuss questions with them after reviewing the posted solutions. The instructors will resolve any questions that remain concerning the homework after your discussion with the teaching assistant.

Homework

Homework will be assigned on Tuesdays (mostly) and due the following week. You should submit written solutions and be prepared to discuss the results in class. Late homework assignments will not be accepted without approval from the instructor *prior* to the due date.

It is essential that your solutions be neat, concise and grammatically correct. For each problem include as appropriate:

1. *Problem Statement.* Describe your interpretation of the question, often with a sketch.
2. *Basis.* State any assumption you will need to make to solve the problem. For example, which equation of state do you plan to implement?
3. *Strategy.* State your plan for a solution. Also describe the algorithm you will use to solve the problem. Describing the algorithm is essential for simulation-based exercises where the thinking process is not demonstrated in the computational output.
4. *Results.* The major results and discussion.
5. *Summary.* A few sentences highlighting the major points and questions that remain unresolved, if any.

Not every assignment will require each of these sections and you can simply omit as appropriate. Note that you may be called on in class to discuss your solution. Presentation, as well as content, will be evaluated in grading. Illegible or unclear solutions will be considered incorrect. Note: This means that if you use MathCAD or a similar tool, it is important that you organize the solution so that it is easily understood. For example, indicate clearly what you have specified or assumed the location and source of data, etc.

Working together to get a homework solution is okay. However, not working out your own solution, not understanding your own solution, or not submitting your own solution is cheating which also ruins the learning value of the assignment. Copying assignments will greatly affect your ability on exams. Copying will result in a grade of zero for that assignment. Repeated copying will result in a failing grade for the course.

A discussion of concepts and approaches for homework assignments with your classmates is useful. However, it is essential that you submit your own independent solutions for grading on individual assignments. It is particularly important in group

study or discussions that everyone contributes. If you are uncertain about how much cooperation is healthy or permissible, err on the side of less and discuss the situation with Prof. Forbes.

Other suggestions:

- Working in a study group on problem sets and class preparations is a great approach, but keep it to 2 to 4 people.
- Take notes not only from the chalkboard, but also on what is said and discussed in class.
- Budget your time wisely, beginning from the start of the semester.
- Read the provided material carefully. You have to do the reading to understand the material, and you will benefit by searching out your own sources in the library and on the Web as well as making use of the textbooks from your chemistry courses. Finding information not in the provided textbook is an essential aspect of this course.

Examinations

There will be two midterm examinations and one final examination. The first exam will be in class on Thursday, **March 12th**, the second exam will be on Thursday **April 9th**. The final exam date and time will be announced once it is assigned.

For all circumstances, absence from exams will only be excused with *prior* approval of the instructor. This includes medical and family emergencies. In these cases a phone call or email to the instructor (Prof. Forbes) prior to the start of the exam will suffice.

Communication

There will be times when changes in the course schedule are necessary, and these changes will be announced during class time and posted on the class web site. Additionally, you are welcome to send email to the instructors and TAs at any time.

Academic honesty

The University policy on academic honesty will be strictly enforced, and academic dishonesty will result in a failing grade for the course. The details of this policy and several examples are given in the "[Academic Regulations](#)" which are on the web site for Dean of Students Office: http://www.umass.edu/dean_students/.