**Instructor:** Dr. Richard T. Cimino, Senior Lecturer

**Office:** 321C Tiernan Hall, Phone: 973-596-5729, E-mail: cimino@njit.edu

**Class:** T/Th; 2:30-3:50 PM; Face-To-Face

**Room: KUPF 211**

**Office Hours:**

Office hours this semester are offered online M/W/F **by arrangement only -** please sign up online at https://drcimino.youcanbook.me. Office hours will take place using my personal Zoom meeting room. Additional meeting times/days/locations can be arranged as needed and pending my availability.

## Course Description and Requirements

This is the first course in separations, examines traditional methods and technologies by which chemical engineers separate and purify mixtures. Emphasis here is on strippers, absorbers, distillations, and extractions.

**Prerequisites:** CHE 342, CHE 370

**Corequisites:** None

## Course Objectives

Taking this course, a motivated student will learn to:

1. Define the concept of single and multiple stage processes and write the material balances.
2. Identify the thermodynamic equilibrium relations and diagrams used in distillation/absorption column design. Illustrate their use.
3. Define the interphase mass transfer models and illustrate their use.
4. Identify the absorption/stripping, distillation processes and various types of towers.
5. Develop and apply the graphical methods of absorption/stripping, and distillation tower design.
6. Apply the interphase mass transfer models to design packed absorption/stripping towers.
7. Define different types of efficiencies and use them to design absorption/stripping and distillation towers.

8. Identify the basic concepts of design: relations between the process efficiency and economic constraints.
9. Use ASPEN to design separation processes.

**Learning Materials**

**Textbook**

Required: Phillip C. Wankat, Separation Process Engineering: Includes Mass Transfer Analysis, 4th Ed. Prentice Hall, 2017. ISBN 13: 978-0-13-344365-3. The textbook is the main source for preparing for classes and reading the textbook before each class is necessary. Additional materials will be posted on Canvas.

**Calculator:** A graphing calculator (TI-83, TI-84 or TI-84SE) is required for solving numerical problems.

**Required Hardware:**

A working computer equipped with Windows is necessary to run ASPEN on your own computer. ***Apple and/or Linux systems are strongly discouraged for this course. If you intend to run ASPEN on your own Apple/Linux computer, you will need to dual boot or use a virtual machine with Windows. If you do not own a computer, you are welcome to utilize the computer lab in TIER-411B to complete ASPEN assignments.***

**Required Software:** MS Excel, MATLAB, AspenOne chemical process modeling software (will be introduced in class).

**Internet Access:** You must have a reliable internet connection for your device.

**Additional Materials:**

Graphing or engineering paper and a ruler/straightedge. Software for modifying images such as MS Paint, PDF Expert, etc...

**Course Outline**

| Week | Date(s) | Topic (preliminary, subject to minor changes) |
|---|---|---|
| **1** | 1/21 | **Ch.1 Introduction to Separations** |

| | | |
|---|---|---|
| **1-2** | 1/23-1/28 | **Ch. 2 Flash Distillation** |
| **2-3** | 1/30-2/4 | **Ch. 2 Flash Distillation, Lab 1** |
| **3-4** | 2/6-2/11 | **Lab 2**<br>**Ch. 3 Intro to Column Distillation** |
| **4-5** | 2/13-2/18 | **Ch. 4 Binary Column Distillation** |
| **5-6** | 2/20-2/25 | **Ch. 4 Binary Column Distillation, Exam 1 Review** |
| **6-7** | 2/27-3/4 | **Exam 1**<br>**Lab 3** |
| **7-8** | 3/6-3/11 | **Ch. 9 Batch Distillation** |
| **8** | 3/13 | **Ch. 12 Absorption & Stripping** |
| | | **Spring Break 3/16-3/23 (wooo!)** |
| **9** | 3/25-3/27 | **Ch. 12, continued**<br>**Ch. 10 Staged Column Design** |
| **10** | 4/1* | **Exam 2 Review**<br>***No Class 4/3 (Wellness Day)** |
| **11** | 4/8-4/10 | **Exam 2, Ch. 15** |
| **12** | 4/15-4/17 | **Ch. 16** |
| **13** | 4/22-4/24 | **Final Presentations** |
| **14** | 5/6 | **Final Exam Review** |

## Final Exam: TBA

**Assessment and Grading**

**Homework:** Homework assignments will be posted regularly on Canvas. Homework assignments must be submitted electronically on Canvas. No late homework will be accepted. Homework will be done in teams of no more than 3 individuals.

**Aspen Labs:** These will be due at fixed points throughout the semester. Students must work in teams on all labs and submit lab memos detailing the results of your experiments.

**Term Project:** There will be one Term Project in this course, to be completed in teams. This project is research-based and will have several deliverables throughout the semester.

**Exams:** There will be two midterm exams (80 min long) and one final exam (2.5 hours long).

**Grading:** Your final course grade will be calculated by weighted average, using the following weights:

| **Category** | **Weight** |
|---|---|
| **Homework** | **15%** |
| **Project** | **20%** |
| **Aspen Labs** | **15%** |
| **Midterms (x2)** | **30%** |
| **Final Exam** | **20%** |
| **Total** | **100%** |

**Final course grades will be assigned according to the following rubric:**

| **Lower Bound** | **Letter Grade** | **Upper Bound** |
|---|---|---|
| **90** | **A** | **100** |
| **85** | **B+** | **89** |
| **80** | **B** | **84** |

| | | |
|---|---|---|
| **75** | **C+** | **79** |
| **70** | **C** | **74** |
| **60** | **D** | **69** |
| **0** | **F** | **59** |

**Policies**

**NJIT Honor Code:** The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of the Dean of Students.

**Special Needs:** If you need accommodations due to a disability please contact OARS to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

**Lectures**

This course is a face-to-face course. This means that each lecture will take place in-person during the class hours. Failure to attend the sessions may result in a negative impact on your course grade, because there are numerous in-class activities. Additionally, the examples discussed in the class are not necessarily from the main textbook and therefore missing a class will have consequences for your preparation for exams. ***Note, if at any point the course is forced to go into a virtual modality, you will be provided with additional information on how to access the course lectures electronically.***

Students are expected to be in the classroom at the starting time of the class period. Being late to class may have consequences for your final course grade.

No audio or video recording is allowed. Detailed lecture notes for all sessions will be provided for you to review at a later date.

Cellphones should be silenced during lectures and turned off during exams.

**Course materials, office hours and correspondence**

The course Canvas page is the main platform for delivering information about the course. All relevant course materials and assignments will be posted on Canvas, so a student should check it regularly.

Students must upload a professional-looking head shot for their Canvas profile.

Students are strongly encouraged to attend Office Hours. Long questions which require derivations will be discussed only during the Office Hours and will not be answered by email. Questions regarding grades can be discussed only during the Office Hours.

E-mail and Canvas correspondence is intended only for quick questions. Questions which require a detailed discussion should be discussed in person during the Office Hours.

All correspondence should be conducted in a professional style, using formal English.

To assure a quick response to your emails, please add "CHE360" in the subject of your emails.

The instructor reserves the right not to respond to emails at his personal discretion.

**Exams, Quizzes, Homework and Grades**

A letter grade is based on the final score, calculated using Canvas in accordance with the Tables given in this syllabus. The assigned letter grade is final and cannot be negotiated.

A student can dispute the exam scores within a week after the announcement of the score. Exam scores can only be disputed during the official Office Hours, not during class time or via email.

Students will get zero for not coming to exams or any other course activity. If students miss an exam due to extreme circumstances (such as a medical problem), they need to notify the instructor via email before the beginning of the exam, and bring proof of the circumstance to the Dean of Student's office. Only in the case of official approval from the Dean of Student's office may a make-up be given at the discretion of the instructor.

A student must show full details when solving a problem during an exam. Not showing the work will cause the loss of points even if the final answer is correct.

Partial credit can be given for solving the exam and quiz problems, though no partial credit will be given if there are not enough details to follow.

The final answer should be always evaluated with respect to its reasonability. No partial credit will be given if the final answer is wrong and unreasonable if the student does not acknowledge this explicitly on the exam problem.

Student handwriting must be legible in order to receive points.