

ChEE 303
Chemical Engineering Mass Transfer
Fall 20xx
University of Arizona

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Instructor's Availability:

The instructor and teaching team will be available by appointment and students should post your questions to piazza privately or publicly and the instructor and teaching team will respond as quickly as possible.

Formal office hours will also be posted on the D2L class site.

Active Learning Environment: Day(s), Time and Location TBD

Instructional Manager: TBD

This person is who you email if you have clicker issues, if you miss the dropbox for an assignment, if there is an emergency, if you have issues outside of homework or exams. They will do a first response.

Class Preceptors:

TBD

Communicating with the Teaching Team Outside of Class:

Use the piazza discussion board to ask questions about the course or course content:
<https://piazza.com/arizona/fall2019/chee303> (subject to change, depending on semester)

The settings on Piazza allow posts to remain private to the instructor and this should be used instead of emailing the instructor directly.

Course Description:

This course will introduce you to the fundamental principles of mass transfer and separation processes. It will equip you with technical skills to design trayed and packed columns.

Textbook: *Mass Transfer Operations For the Practicing Engineer.* Louis Theodore and Francesco Ricci, ISBN 978-0-470-57758-5

CHEE 303 Course Notes, Eduardo Saez, available for download at D2L

Communicating with the Teaching Team Online:

Piazza will be used for all questions and students should obtain a free account at piazza.com and then be able to link to our class. Students who answer questions will earn up to 2% extra credit towards their final grade. Before asking a question, please check that someone has not already asked/answered the same question. Preceptors will also be monitoring the piazza discussions and commenting. You can join the discussion board here: <http://piazza.com/arizona/fall2019/chee303>. (subject to change depending on semester)

Course Objectives:

Upon completion of this course, students should:

- 1) Understand the underlying mass transfer and thermodynamics principles of separation processes;
- 2) Identify, analyze and solve equilibrium and rate-based separation problems including distillation, absorption, adsorption, and extraction processes;
- 3) Implement selection and design of separation processes for a specified feed and desired product streams.
- 4) Use modern computational tools, such as ASPEN and Excel, to analyze and design separation processes;
- 5) Function effectively in teams during classroom and homework exercises, and exams.

Absence and Class Participation Policies:

Class and supplemental attendance are not optional for this class. Unlike some classes where students passively copy notes, the activities done in class are critical to student success. Class attendance will be verified with a clicker question that appears at some point randomly in the day's activities and will be auto-recorded through that device. If you do not have a clicker, please get one as quickly as possible from the UA Bookstore or purchase a license for TurningPoint ResponseWare. Clickers will also be used to gauge understanding of reading material, support class discussions, facilitate understanding of new concepts and review previously taught material.

If you forget your clicker, please take a picture of your notes from that day, email the picture to ---@email.arizona.edu (email will change, depending on semester) and report the class and date in the subject so you can receive attendance points. If you miss class, you can watch the recording in Panopto in UA Tools on D2L and then email the same email address to earn 75% of the attendance points.

Absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

• Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.

Required Textbooks or Readings:

Mass Transfer Operations For the Practicing Engineer. Louis Theodore and Francesco Ricci, ISBN:978-0-470-57758-5

ChEE 303 Course Notes, Eduardo Saez, available for download at D2L

Course Prerequisites:

The course you must have taken before this course are ChEE 203.

Course Website: D2L website for ChEE 303

Important Dates to Keep in Mind:

All dates and deadlines regarding registration, dropping, GRO'ing, etc. can be found at <https://www.registrar.arizona.edu/courses/dates-deadlines>

Required or Special Materials:

We will be using Turning Technologies Clickers and/or responseware for class extensively for both attendance and for helping the teaching team see where students need more help in mastering the content of the course. A link here helps remind students of details on how to get registered and set up:

<https://oia.arizona.edu/content/19>

Required Examinations and Assignments:

There will be approximately 26 pre-lecture videos, 14 pre-lecture quizzes, 12 homework assignments, three midterms and one final exam. Each midterm exam will be split into a group portion and an individual conceptual and individual calculational portion. Detailed dates are provided in a schedule later.

Required Extracurricular Activities:

None

Grading Scale and Grade Policies:

This section will highlight the breakdown of major graded elements first, then detail the grading scale, and then get into details.

Course Grading Policies:

This section details the graded elements of the class, first in a big picture way and then in detail.

Big Picture View of Graded Elements

Individual	HW	Due weekly	15%
Group	HW	Due weekly	5%
Pre-Lecture Videos		Due daily	5%
Pre-Lecture Quizzes		Due daily	10%
Attendance		Due daily	10%
1 st Midterm		Exam	10%
2 nd Midterm		Exam	15%
3 rd Midterm		Exam	15%
Final Exam		End of semester	15%
Total			100%

Teamwork is required in all engineering jobs and we will start building your skills in this area by working in teams inside and outside of class. You should help your classmates master content even as you ask questions of them when you are stuck. To help your team, make sure you attend class, do the pre-quizzes, and work with them. You will find that the group homework will not be solvable by one person so certainly work with your team on those activities.

Homework: (15% of grade for individual problems + 5% for group team problems)

Homework is due at the ***beginning*** of the class on the day it is due to the dropbox for that day. Late homework will be accepted with a 10% late penalty until 11:59 pm on the day it is due. A clear scan, picture from your device, or other clear materials will be acceptable.

Group HW will typically be the one or two toughest problems from each set of concepts will be due each week and is a group mastery problem that you will solve together in your learning teams. Each person on your team should submit a full copy of the group’s solution with all names to their own dropbox. These problems will be graded for detail.

To eliminate confusion and difficulties in staying current, students will have 1 week from the date homework, quizzes, or exams are returned to discuss grading criteria and scores with the instructor or

regrader. After the 1 week time limit has passed, students will not be able to petition for changes to their grade. All regrade requests must be done through the Regrade Form posted on the d2L site.

Pre-Lecture Video on D2L (5% of grade):

The online videos developed to summarize course materials will make up 5% of the grade. Since lecture time is mainly used to develop technique skills in solving practical problems, it is very important for you to be familiar with concepts and principles behind by reading assigned materials and watching videos. In each pre-lecture video, several quiz questions are included to examine your progress. Before due date, you are allowed to have an access to a video in multiple times. The video slides will be posted at D2L later on.

Pre-Lecture Quizzes on D2L (10% of grade):

There are many elements of being ready for new topics and part of that is to do the class readings and watch pre-class videos ahead of time so you are ready for what happens in class. The online quizzes developed to help you be ready for class will make up 10 % of the grade and you will have three attempts on each quiz and your highest score will be the one recorded. These quizzes are designed so students will know the most important details from each reading section. If you want to efficiently study, open the quiz and start reading, looking for the details the questions ask you to notice, and take notes on the details. You'll quickly find out that the quizzes are randomized and if you are unhappy with your score and retake, that you get a new set of questions that cover the same content in a slightly different way. You'll be faster if you take the quiz seriously the first time.

Attendance (10% of grade):

An active learning environment involves everyone working together to help master the content. Points will be assigned for attendance for each lecture based on use of your clicker/responseware during class, but up to two missed days will be dropped for each student. If you were present on a day in class and did not have your clicker, email a scan of your notes to that day to the TA, clearly telling them which lecture number and the date, and include some portion of your notes for that date.

Midterm Exams (40% of grade):

These in-class exams are **comprehensive** and are scheduled on later pages. Unless otherwise announced, these exams will be open book. The exams will have three pieces:

A group exam that will be paper and Excel-based (30 minutes) (35%)

An individual exam (65%)

 An individual calculational exam (30 minutes) (50%): paper and Excel-based

 An individual conceptual exam in (15 minutes) (15%): D2L

Make-up midterms: There will be no make up midterms. If a student has a valid medical or emergency excuse, the missed exam grade will be replaced by the average of the other midterm grades.

Extra credit (up to 1% increase in final grade):

Students who answer other students' questions posted to the piazza discussion board can earn up to 1% extra credit towards their final course grade, at the discretion of the instructor.

Possibility of Dropping some Scores Based on Class TCE Response Rates:

If 80% of the class completes the Teacher Course Evaluation at the end of the semester, then the lowest one pre-quiz D2L grades will be dropped for every student in the class.

If 90% of the class completes the Teacher Course Evaluation at the end of the semester, then the lowest individual HW score will be dropped.

Final exam: (15% of grade)

Final exam policies are described here:
<https://registrar.arizona.edu/courses/final-examination-regulations-and-information?audience=students&cat1=10&cat2=31> and will be followed in this class.

The final exam is scheduled for December 18, 1:00 until 3:00 pm.
<https://www.registrar.arizona.edu/courses/final-examination-schedule-spring-2019>

Plagiarism: Although this course is not writing intensive, plagiarism is unacceptable. The plagiarism policies within the Student Code of Academic Integrity will be strictly followed:
<http://doc.web.arizona.edu/uapolicies>.

Threatening Behavior: The general policies against threatening behavior by students will be followed:
<http://policy.web.arizona.edu/~policy/threaten.shtml>

Inclusivity: This course supports elective gender pronoun use and self-identification; rosters indicating such choices will be updated throughout the semester, upon student request. As the course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect

Grading Rubric:
Letter grades on exams or assignments will not be determined; a final letter grade will be given at the end of the semester instead. This course will be graded on a straight scale as follows:

<u>Total percentage of points</u>	<u>earned</u>	<u>Final Grade</u>
90 – 100 %		A
80 – 89.999 %		B
70 – 79.999 %		C
60 – 69.999 %		D
< 59.999%		E

Classroom Behavior Policy

Developing your ability to effectively work in teams is an important aspect of this course, so you will regularly work in small groups in class, and you will complete weekly group homework and take group exams. You will be expected to look up information on the e-text or on websites. The teaching team will help remind you not to text or be using your devices for other reasons. You will be expected to respectfully work with all teammates and to be supportive of each other when you struggle with the content.

Threatening Behavior Policy

The general policies against threatening behavior by students will be followed:
<http://policy.web.arizona.edu/education-and-student-affairs/threatening-behavior-students>

Academic Integrity Policy

Plagiarism in any form, including copying the work of another student, will not be accepted. The plagiarism policies within the Student Code of Academic Integrity will be strictly followed:
<https://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>. Clicking in for another person is a form of academic dishonesty and will be dealt with according to the same guidelines.

Nondiscriminatory and Anti-harassment Policy

UA policies list prohibited behaviors here:

<http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Accommodations for Students with Disabilities

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Schedule of Topics and Activities

The schedule appears at the end of this document in concise form.

Standards for Homework Problems and Quizzes:

1. Briefly restate the problem using a sketch or diagram where appropriate. Label the sketch or diagram with all quantities involved.
2. Indicate the basis you select, and indicate any change of basis within the problem. State assumptions.
3. Include both the numerical value and units for all quantities involved, including intermediate results.
4. Answers should be circled or otherwise marked, and reported to an appropriate number of significant digits.
5. Values obtained from a handbook or other reference should be accompanied by a citation. For example:

CCl_4 boiling pt. $76.5\text{ }^\circ\text{C}$ (CRC, pg C-373)

6. Show how you have checked your work if appropriate.
7. Be clear and concise when writing answers to questions.

Substandard work will result in a loss of credit.

Standards for Style and Presentation of Problem Sets:

1. All assignments are to be submitted by scans with all Excel/Matlab files used with clear annotations on those materials on how answers were arrived at. Each homework should be submitted in one submission with as many files as you needed to use. Handwriting must be legible.
2. Each page must have the students' names and group number, the course number, and the page number in the upper right-hand corner.

Substandard work will result in a loss of credit.

Changes to the Syllabus: The information contained in the course syllabus, other than the absence policies may be subject to change with reasonable advanced notice as deemed appropriate by the instructor.

ChEE 303 Fall 20xx Class Schedule (subject to change - check D2L for updates)

Week	Date	Day	Lec #	Reading Assigned (Louis)	Reading Assigned (Saez)	Homework Due	Pre Class Activities	Topic
1	xxx	x	1	Ch. 1, 2, 3, 4, 5				Introduction
	xxx	x	2	Ch.6 (p. 41 – p. 61)	p. 3-1 – p. 3-7		PLV 2 PLQ 1	VLE
2	xxx	x	3		p. 1-1 – p. 1-12	HW 1	PLV 3 PLQ 2	Mass Transfer Mechanisms
	xxx	x	4	Ch.7 (p.73 – p. 80)	p. 1-12 – p. 1-19		PLV 4 PLQ 3	Equation of Continuity
3	xxx	x	5	Ch. 7 (p.80 – p.87)	p. 1-20 – p. 1-26	HW 2	PLV 5 PLQ 4	Unimolecular Diffusion
	xxx	x	6					Stefan Problem
4	xxx	x	7		p. 1-26 – p.1-31	HW 3	PLV 7 PLQ 5	Mass Transfer Coefficients
	xxx	x	8	Ch.8 (p.97 – p.117)			PLV 8 PLQ 6	Mass Transfer Operations
5	xxx	x	9	Ch.9 (p.119 – p.127)	p. 3-7 – p. 3-11		PLV 9 PLQ 7	Flash Distillation
	xxx	x	10			Test 1		
6	xxx	x	11	Ch.9 (p.127 – p.133)	p. 3-59 – p. 3-65	HW 4	PLV 10 PLQ 8	Batch Distillation
	xxx	x	12	Ch.9 (p.133 – p.142)	p. 3-12 – p. 3-17		PLV 11 PLQ 9	Multistage Distillation
7	xxx	x	13	Ch.9 (p.142 – p.149)	p. 3-18 – p. 3-25	HW 5	PLV 12 PLQ 10	McCabe-Thiele Method (1)
	xxx	x	14	Ch.9 (p.149 – p.154)	p. 3-25 – p.3-34		PLV 13 PLQ 11	McCabe-Thiele Method (2)
8	xxx	x	15	Ch.9 (p.154 – p.158)	p. 3-35 – p. 3-41	HW 6	PLV 14 PLQ 12	McCabe-Thiele Method (3)
	xxx	x	16	Ch.9 (p.161 – p.173)	p. 3-42 – p. 3-59		PLV 15 PLQ 13	Multicomponent Distillation
9	xxx	x	17			Test 2		
	xxx	x	18	Ch.10 (p.187 – p.200)	p. 2-1 – p. 2-17		PLV 16 PLQ 14	Absorption (1)

10	xxx	x	19	Ch.10 (p.227 – p.240)	p. 2-17 – p. 2-31	HW 7	PLV 17 PLQ 15	Absorption (2)
	xxx	x	20	Ch.7 (p.87 – p.93)	p. 2-31 – p. 2-37		PLV 18 PLQ 16	Overall Mass Transfer Coefficients
11	xxx	x	21	Ch.10 (p.200 – p.226)	p. 2-38 – p. 2-44	HW8	PLV 19 PLQ 17	Packed Column
	xxx	x	22		p. 2-44 – p. 2-53		PLV 20 PLQ 18	Equipment Sizing & Pressure Drop
12	xxx	x	23	Ch.10 (p.241 – p.243)	PDF file	HW 9	PLV 21 PLQ 19	Separation Techniques
	xxx	x	24	Ch. 6 (p.64 – p. 69) Ch. 12 (p.300 – 301)			PLV 22 PLQ 20	LLE, VSE&LSE
13	xxx	x	25			Test 3		
	xxx	x	26	Ch.11 (p.245 – p.250) Ch.11 (p.257 – p.264)			PLV 23 PLQ 21	Adsorption Classification & Equipment
14	xxx	x	27	Ch.11 (p.250 – p.257)		HW 10	PLV 24 PLQ 22	Adsorption Equilibria
	xxx	x		Thanksgiving Break				
15	xxx	x	28	Ch.11 (p.264 – p.282)		HW 11	PLV 25 PLQ 23	Design and Performance Equations
	xxx	x	29	Ch.12 (p.293 – p.306)			PLV 26 PLQ 24	Liquid-Liquid Extraction
16	xxx	x	30	Ch.12 (p.312 – p.318)		HW 12	PLV 27 PLQ 25	Solid-Liquid Extraction
	xxx	x	31					
17	xxx					Final Exam		

All homework is due on the days listed above unless otherwise designated on a specific problem handout. PLV: Pre-lecture Video; PLQ: Pre-lecture Quiz.