ChEE 202
Elements of Chemical Engineering II
Spring 20XX
University of Arizona

Instructors: Dr. Paul Blowers — blowers@email.arizona.edu
128 Harshbarger — 520-626-5319

Dr. Adrianna Brush — Adriannabrush@email.arizona.edu
134B Harshbarger — 520-626-5259

Lecture: Day(s) Time
Building – Room _____

Preceptors:

Instructional Managers:

The following recitation sections will be co-led by the preceptors:
D Time Location .
D Time Location
D Time Location
D Time Location
D Time Location

Instructor's Availability:
Both instructors will be available by appointment and students should post to piazza privately or publicly when they are available and the instructors will respond after communicating with each other and the teaching team.

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

Course Description:
This course will introduce you to the fundamental principles of chemical process analysis. It will equip you with problem-solving techniques and will give you experience in the application of these techniques to a wide variety of process-related problems. This course will also begin demonstrating how mathematics and spreadsheets can be a fundamental tool for solving complex engineering problems, including the solving of transient material and energy balances.

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/spring2019/chee202/home
If you have other unrelated matters to discuss, you may contact either instructor via email:
blowers@email.arizona.edu

Course Objectives:
This course will introduce you to the fundamental principles of chemical process analysis. It will equip you with problem solving techniques and will give you experience in the application of these techniques to a wide variety of process-related problems. This course will also begin demonstrating how mathematics and spreadsheets can be a fundamental tool for solving complex engineering problems, including the solving of transient material and energy balances.

Expected Learning Outcomes:
Upon completion of this course, students should be able to:

1) competently solve energy balances for both open and closed systems for pure substances and be able to apply these techniques to chemical engineering unit operations
2) perform numerical integration for analyzing chemical engineering processes as required, using both Excel and Visual Basic
3) perform curve fitting and develop empirical correlations using linear regression, polynomial regression, and non-linear regression, all in the context of solving chemical engineering problems.
4) analyze thermodynamic properties of multicomponent mixtures as applied to separations unit operations
5) perform energy balances for ideal mixture of gases and vapors, using both thermodynamic tables and psychrometric charts
6) perform energy balances for reactive mixtures
7) solve instantaneous transient material and energy balances including handling of mixtures perform energy calculations on chemical engineering processes with entropic considerations (i.e., compression and pressure drops through valves) and model simple thermodynamic cycles

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 chee2019attendance@gmail.com, 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 were 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 Texts or Readings:
Notes of Eduardo Saez, posted to D2L
Felder and Rousseau, any edition acceptable, 4th edition preferred (same book as required for ChEE 201)

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 four midterm exams, approximately 11 homework assignments, 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.

The following are the major components of the total grade in this class:

Component	Percentage
Pre-class Quizzes	10 %
Attendance	10 %
Group Homework	5 %
Individual Homework	15 %
Midterm Exams	40% total (10% each)
Final Exam	20 %

Pre-Class Quizzes (10% of grade)
Research has shown consistently that students who do preparatory work prior to a class meeting, such as learning definitions, attempting a problem, or organizing information, do substantially better than students who do not. This does not imply more work, but shifting work to being more pro-active instead of working harder after the fact to get caught up with the new content. Reading assignments to complete before class will be given, followed by a pre-lecture quiz in D2L. Students can take each quiz three times, and these quizzes cumulatively contribute 10% to the total class grade.

Class and Supplemental Attendance (10% of grade)
Attendance at all required class and discussion times is spread evenly across all meetings. Attendance will not be taken during exam times. See prior discussion of how attendance is awarded for lecture. For discussion sections, your learning assistants will input those grades each week.

Homework Assignments (20% of grade)
Homework is due to the appropriate assignment submission folder on D2L by the start of class on the day it is due. Late homework will be accepted until 11:59 pm on the day it was due but will have a 10% penalty for being late. Some homework will be done in groups and should be submitted to the group assignment submission folder for each assignment on the day it is due, and each person must submit a full copy of the team's work with everyone's full name on it to the dropbox for credit on the group homework. All assignments must be submitted electronically. Paper copies will not be accepted. Students who do not participate will not receive full credit.

Exams (four exams, 10% each, 40% of grade total)
The group in-class exams are **comprehensive,** and the scheduled dates can be found at the end of this document. Unless otherwise announced, these exams will be open book, with students allowed to write anything they want in the blank spaces in their Felder and Rousseau books. Make-up exams will not be given. The exams will have three pieces:

- A group exam (35 points) that will be paper and Excel-based (50 minutes in the main lecture on the day seheduled)
- An individual exam that has two parts
    - Calculational (50 points): this will be taken in your discussion section in the week after your group examp, and is designed to take 15-20 minutes but students will have the entire class period to complete it – this portion is open book and open note.
    - Conceptual (15 points): This portion will be taken through Examity and you will want to create an account and then schedule your version of the d2l based multiple choice/short answer portion more than 24 hours before the time you want to take you. You will be able to take this portion between Sunday at 4 pm and Monday at 11 pm the weekend/week after your group exam in lecture. This exam is designed to take 10 minutes but students will have 30 minutes. It will be closed note and closed book.

Final exam: (20% 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 Month DD, Time. https://www.registrar.arizona.edu/students/courses/final-exams

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:

Total percentage of points earned	Final Grade
90-100 %	A
80 – 89.99999 %	B
70 – 79.99999 %	C
60 – 69.99999 %	D
< 60 %	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.

Course Prerequisites:
The courses you must have taken before this course are MATH 223, ChEE 201, and ChEE 201L. If you have not completed the co- or prerequisite courses, you may be dropped from the course at the instructor's discretion as you may not succeed based on past student performance. Math 254 is a co-requisite.

Course Website: D2L website for ChEE 202.

Important Dates to Keep in Mind:
All spring registration dates are available here for 20XX: https://registrar.arizona.edu/dates-and-deadlines/view-dates?field_display_term_value=191&=Apply

Standards for Homework Problems and Exams:
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 °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.

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

Class Schedule: (note: section numbers may not match your edition of the book, but topics will)

Week		Lec. No.	Date	Day	Pre Lecture Recording	Reading Assigned for this Day from Felder and Rousseau (3rd edition)	Reading Assigned for this Day From Typed Notes	Pre Lecture Quiz	Due Dates	Topic
1		1				None	None	None		Review of ChEE 201
		2			2	Sections 7.0-7.1	None	**2**		
2					3	Martin Luther King Day	No Class	**Concept Inventory**		
		3			4	Section 7.2		**3**		Kinetic and Potential Energy, First Law of Thermo
		4			5	Section 7.3	Pg 1-12	**4**		Closed System Balances
3		5				Section 7.4		**5**	HW 1	Open System Balance and Intensive Variables
		6			6	Section 7.5		**6**		Steam Tables
		7			7	N/A	Pages 13-24 Steam Table Slides		**Test 1**	Clapeyron Equation, C_p, C_v
4		8			8	Section 8.1-8.2	Pages 33-39	8		Heat Capacities
		9			9	N/A		9	HW 2	Math: Curve Fitting
		10			10	N/A		10		Math: R^2 Values
5		11			11	NA	Pages 25-32	11		Math: Linear Regression
		12			12	Section 7.6		12	HW 3	EB: Compressors
		13			13	Section 8.3		**13**		EB: Heat Exchanger
6		14			14	Section 8.4a-c		14		EB: Adiabatic and Isothermal Tank Filling
		15			15	Section 7.7		15	HW4	Problem Solving: 7.31b, 7.35a
		16			16	Section 7.8		16	Test 2	Mechanical Energy Balances
7		17			17	Section 8.6				State Functions/Energy Pathways: 8.25
		18			18			18		H and U at Constant T
		19			19	N/A		19		Math: Numerical Integration
8		20			20		Pages 54-59	20		Heat Capacities of Mixtures

		21			21			21	HW 5	Problem Solving: 8.31
		22			22	8.4d		22		Psychrometric Chart
							Spring Break – No Class			
		23			23		Pages 68-72	23		
		24			24			24	HW6	Dehumidifiers
		25			25			25		Problem Solving: 6.28
10		26			26	Section 8.5		26		Non-Ideal Mixtures
		27			27	Section 9.1-9.2	Pages 77-88	27	HW 7	Energy Balance With Reactions
		28			28	Section 9.3-9.4		28	Test 3	
11		29			29	Section 9.5a		29		Complex Energy Balances
		30			30	Section 9.5b	Pages 89-94	30	HW 8	Thermodynamic Pathways and Reference States
		31			31	Section 9.6		31		
12		32			32	Section 9.7	Pages 94-100			Problem Solving: 9.56
		33			33	Section 10.2-10.2		33		Transient Balances Introduction
		34			34	Section 10.3		34		
13		35			35		Lecture Notes Online 34-35	35		Transient Heat Balances
		36			36			36	HW 9	3D Balances
		37			37	Section 10.4		37		Simultaneous Balances
14		38			38		Lecture Notes Online 39	38		Checking Understanding with Example
		39			39	Section 10.5		39	HW 10	More Simultaneous Balances
		40			40			40	Test 4	
15		41			41		Wrapping Up the Lectures	41		Problem Solving Examples
		42			42	Posted Notes and pdfs from other sources		42	HW 11	Thermodynamics and Entropy
		43			43			43		
16		44			44	Solve Prior Final Exam	Self-reflection and Review	44		
		45			45	Solve Prior Final Exam II	Last Day of Classes		Class Evaluation	