ChEE 202
Elements of Chemical Engineering II
Spring 2018
University of Arizona

Instructors:	Dr. Paul Blowers 128 Harshbarger	Office Hours: TBD
	Dr. Kasi Kiehlbaugh 132 Harshbarger	Office Hours: TBD
Lecture:	MWF 12:00 pm – 12:50 pm BioSciences West 301	

Preceptors:
Course preceptors: Alyssa Gutierrez, Brooke Weber, Cody Maddox, Taylor Hunter, Julie Frieb, Michael Barnes, Justin Bongco, Abdullah Abdulrahman, Mikas Zappia, and Adam Weber

The following recitation sections will be co-lead by the preceptors below in ENGR 308:

M	4 - 5 pm	Taylor Hunter and Julie Frieb
M	5 - 6 pm	Michael Barnes and Justin Bongco
M	6 – 7 pm	Michael Barnes and Justin Bongco
T	5 – 6 pm	Abdullah Abdulrahman and Alyssa Gutierrez and Mikas Zappia
T	6 – 7 pm	Alyssa Gutierrez and Adam Weber

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.

Text: *Notes of Eduardo Saez, posted to D2L*
Felder and Rousseau, any edition acceptable, 4th edition preferred (same book as required for ChEE 201)

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/spring2018/chee202
If you have other unrelated matters to discuss, you may contact either instructor via email: blowers@email.arizona.edu and kkiehlbaugh@email.arizona.edu.

Course Objectives:
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, applying finite difference methods such as Euler's method and the Runge-Kutta method, including handling of mixtures
8) perform energy calculations on chemical engineering processes with entropic considerations (i.e., compression and pressure drops through valves) and model simple thermodynamic cycles.

Course Format:
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. If you would prefer to work alone, please discuss this option with the instructors.

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:
Last day to use UAccess for adding/changing: January 18, 2018
Last day to drop a course where it will not appear on the record of enrollment: January 24, 2018
Last day to withdraw from a class online through UAccess with a "W": March 27, 2018. Students must be passing the course in order to withdraw at this time.
Last day to withdraw with a Dean's signature, for extenuating circumstances: April 17, 2018.

Course Grading Policies:
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)
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.

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 not be accepted. 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. All assignments must be submitted electronically. Paper copies will not be accepted. The submitter is responsible for reporting if any group member did not participate in a meaningful way to creating the group solution. Students who do not participate will not receive full credit. For instance, a group could report that a member helped on ¼ of the problems and didn't show up to meetings or comment by email, and that student would then receive only ¼ of the group grade.

Exams (four exams, 10% each, 40% of grade total)
These 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 (60 points) that will be paper and Excel-based (30 minutes)
- An individual exam that has two parts (20 minutes):
    - Calculational (30 points): you can earn partial credit on your individual solution
    - Conceptual (10 points): If you score below 70% on this, then this becomes a multiplier for your group exam grade, i.e., if you get a 60% on this, your group exam grade would be the score of the team times 0.6

Final exam: (20% of grade)
Comprehensive final on Wednesday, 5-9-18, during the regularly scheduled final time, which is 10:30 am until 12:30 pm in the normal classroom.

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

Other Course Policies: Mobile devices used for personal use rather than assigned class activities are strongly discouraged. Students who disrupt class or learning activities will be asked to leave the classroom.

Plagiarism and Academic Dishonesty: 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.

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

Accessibility and Accommodations:
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.

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.

Required Extracurricular Activities: none

Special Materials Required for the Class: See online course content.

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	1-10	W		None	None	None		Review of ChEE 201
	2	1-12	F	2	Sections 7.0-7.1	None	2		
2		1-15	M	Martin Luther King Day	No Class	Pg 1-12			No class-MLK
	3	1-17	W	3	Section 7.2		3		Kinetic and Potential Energy, First Law of Thermo
	4	1-19	F	4	Section 7.3		4	HW 1	Closed System Balances
3	5	1-22	M	5	Section 7.4	Pages 13-24 Steam Table Slides	5		Open System Balance and Intensive Variables
	6	1-24	W	6	Section 7.5		6		Steam Tables
	7	1-26	F	7	N/A		7	Test 1	Clapeyron Equation, C_p, C_v
4	8	1-30	M	8	Section 8.1-8.2	Pages 33-39	8		Heat Capacities
	9	2-1	W	9	N/A		9	HW 2	Math: Curve Fitting
	10	2-3	F	10	N/A		10		Math: R^2 Values
5	11	2-6	M	11	NA	Pages 25-32	11		Math: Linear Regression
	12	2-8	W	12	Section 7.6		12	HW 3	EB: Compressors
	13	2-10	F	13	Section 8.3		**13**		EB: Heat Exchanger
6	14	2-13	M	14	Section 8.4a-c		14		EB: Adiabatic and Isothermal Tank Filling
	15	2-15	W	15	Section 7.7		15	HW4	Problem Solving: 7.31b, 7.35a
	16	2-17	F	16	Section 7.8		16	Test 2	Mechanical Energy Balances
7	17	2-20	M	17	Section 8.6				State Functions/Energy Pathways: 8.25
	18	2-22	W	18			18		H and U at Constant T
	19	2-24	F	19	N/A		19		Math: Numerical Integration
8	20	2-27	M	20		Pages 54-59	20		Heat Capacities of Mixtures
	21	3-1	W	21			21	HW 5	Problem Solving: 8.31
	22	3-3	F	22	8.4d		22		Psychrometric Chart
		3-5 to 3-9				Spring Break – No Class			

	23	3-12	M	23		Pages 68-72	23		
	24	3-14	W	24			24	HW6	Dehumidifiers
	25	3-16	F	25			25		Problem Solving: 6.28
10	26	3-20	M	26	Section 8.5		26		Non-Ideal Mixtures
	27	3-22	W	27	Section 9.1-9.2	Pages 77-88	27	HW 7	Energy Balance With Reactions
	28	3-23	F	28	Section 9.3-9.4		28	Test 3	
11	29	3-26	M	29	Section 9.5a		29		Complex Energy Balances
	30	3-28	W	30	Section 9.5b	Pages 89-94	30	HW 8	Thermodynamic Pathways and Reference States
	31	3-30	F	31	Section 9.6		31		
12	32	4-2	M	32	Section 9.7	Pages 94-100			Problem Solving: 9.56
	33	4-4	W	33	Section 10.2-10.2		33		Transient Balances Introduction
	34	4-6	F	34	Section 10.3		34		
13	35	4-9	M	35		Lecture Notes Online 34-35	35		Transient Heat Balances
	36	4-11	W	36			36	HW 9	3D Balances
	37	4-13	F	37	Section 10.4		37		Simultaneous Balances
14	38	4-16	M	38		Lecture Notes Online 39	38		Checking Understanding with Example
	39	4-18	W	39	Section 10.5		39	HW 10	More Simultaneous Balances
	40	4-20	F	40			40	Test 4	
15	41	4-23	M	41		Wrapping Up the Lectures	41		Problem Solving Examples
	42	4-25	W	42	Posted Notes and pdfs from other sources		42	HW 11	Thermodynamics and Entropy
	43	4-27	F	43			43		
16	44	4-30	M	44	Solve Prior Final Exam	Self-reflection and Review	44		
	45	5-2	W	45	Solve Prior Final Exam II	Last Day of Classes		Class Evaluation	