CHEN 2120 Material & Energy Balances
Fall 2024

Course Syllabus

Instructor Information Office: **D1B16** / **https://cuboulder.zoom.us/j/92799214666**
Instructor: Ehsan Keyvani E-mail: ehsan.keyvani@colorado.edu

Instructor Office Hours
(Tue) 2:00 – 3:00 PM (In person), (Wed) 1:00 – 2:00 PM (Online)

Head TA Information	**Email**	**OFFICE HOURS**
Ava Crowley	Ava.Crowley@colorado.edu	Tue/Thu (10-11 AM | E1B25)

Teaching Assistant Information	**Email**	
Hannah Oberg	Hannah.Oberg@colorado.edu	Mon (10AM -12PM | B322)

Course Assistant Information	**Email**	
		Recitation
		Thu (1-2 PM | B331)
Arianna McCarty	Arianna.McCarty@colorado.edu	
Andrew Hickman	Andrew.Hickman@colorado.edu	Wed (5:30-7:30 PM | B322)
		Thu (4-6 PM | E225)
Sam Dey	Aditya.Dey@colorado.edu	Fri (2-4 PM | C124)

In case one of the teachers are not available for in-person office hour, they might run a virtual office hour. Please email your instructor/TA for making an appointment for virtual office hours. In-person office hours are first come first serve. You are entitled to a 15 min session per visit unless there is no other student waiting. Office hours are subject to change.

Class Times and Information
Lecture: (Section 001) T, R 11:30 AM-12:45 PM JSCBB BIOT **A115**
Course Website: https://canvas.colorado.edu/ (Canvas)
Communication: Canvas will be used for class problems, reading quizzes, and grades. You can also access screencasts from there. All the other platforms such as Gradescope and IClicker are integrated in canvas.

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Course Purpose and Goals
The overall goal of this course is to provide a foundation for solving engineering problems with an emphasis on problems related to chemical engineering processes. This course will specifically focus on identifying and defining process variables, understanding flow charts, basic unit operations, non-reactive and reactive mass and energy balances, and single and multi-phase systems. As part of this course, students will use Excel® to compute chemical and thermodynamic properties of materials, solve systems of equations, and analyze process data. An understanding of the basic principles from this course are of fundamental importance in all areas of chemical and biological engineering and, moreover, will be essential for all subsequent courses in the chemical and biological engineering curriculum.

Prerequisites
CHEN 1211 General Chemistry for Engineers and GEEN 1300 Introduction to Engineering Computing

Textbook
Elementary Principles of Chemical Processes. Fourth Edition R.M. Felder, R.W. Fousseau, L.G. Bullard. John Wiley and Sons, 2016.

Class Format
After several trial and errors throughout the last few years, we optimized our delivery method in our classroom. We utilize semi-flipped methodology. In order for you to benefit from this approach:
a) Reading assignments and screencasts will be assigned for every class. The class will be conducted with the assumption that you have read/watched them. If you really don't have time, watch the screencasts.
b) Class problems for each class will be posted online as a slide deck of the presentation. Please look through these before class so you are prepared to follow the pace. You will be provided with class problem handouts as well. If you prefer to use the digital version, you can access it pre lecture. You will be able to see these questions through your IClicker app/website.
c) Bring your calculator. You are allowed to use your computer device for following along the slides or using the textbook. However, please respect the classroom etiquette of not engaging in non-class activity on your electronics. IN addition, get used to using a normal calculator. Phone calculator is not permitted in your exams.
d) We will employ IClicker in order to conduct class quizzes/example problems. You can either use your clicker or just simply use your cellphone/computer device. Either way, you need to install IClicker Reef app (available for all devices) using your CU credentials. In the app, search for CU Boulder and Materials Balance course under the instructor name. First question will be posted on Aug 27th. Keep in mind, you also need to log in to IClicker app during every lecture to submit your attendance and respond to class problems. That being said, the use of electronic devices (phone, laptop, etc.) during the class time is only permitted for the purpose of class engagement.

Course Requirements and Grading Scheme
The breakdown of course grades is as follows:
Homework 15%
Clickers 10%
Midterm Exams 55%
Final Exam 20%

Course Policies
Homework
Homework will be assigned through **Achieve (A)** platform. We will mostly use the Achieve platform (which requires a subscription) but in rare cases (extra credit) we might post assignments on the Gradescope (G). In general, assignments will be available right after the class and the due date would be 7 days. Assignments are to be submitted individually, although you may, and are encouraged, to work with your classmates where helpful. Additionally, the problems are graded automatically (Achieve) and by TAs (Gradecope). **NO LATE HOMEWORK GRADING**. In the case of special circumstances such as illness, school-related travel, jury duty, etc. the student should inform the instructor *ahead of the due date* to make appropriate alternative arrangements. The solutions to homework assignments will be made available following the class meeting in which the assignment is due or within 15 min after the due date. All the inquiries regarding homework should be directed to

the TA who graded your work. For Achieve assignments, since everything is graded automatically, you won't be getting extension. If you have a valid reason (illness, school-related travel, jury duty, etc.) you need to obtain a temporary accommodation letter from ADA services or your supervisor and send it to your instructor. There is always some leniency at the beginning of the semester. Come talk to me. **Two assignments will be dropped.**

Clickers

All classes will include clicker questions. You receive a percentage for each day, regardless of how many questions there are for the day. You will then get an overall percentage that will count for 10 % of your grade. **Five clicker days will be dropped**. No need to reach out if you are missing a lecture due to personal reasons. Clicker questions cannot be made up, and you will not get credit if your clicker runs out of batteries, you left it at home, etc. so please don't ask. Clickers must be registered by the end of the first lecture in order to get credit. I will post clicker scores after each class. If you have all zeroes, that's a good indication that your clicker is not registered. In addition, make sure that you start your clicker app or clicker device on each class to get attendance points. Keep in mind longer clicker questions/quizzes will be given during the class time which requires your submission either through IClicker, Gradescope, Achieve (Macmillan) platforms. Since clickers results in a mandatory attendance, you can request to opt-out of clickers and add its weight to your final exam. To do so, simply fill in the clicker opt out form on logistics page on canvas. You can do this untill the end of last lecture of the semester. Personally, I wouldn't recommend it since clicker grades are in average higher than the rest of the course work.

Exams

Any student who misses a midterm exam will be dropped from the class unless they have a documented illness or similar catastrophe. If the student has an excused absence, the exam will be replaced by the final exam (i.e. the final will count as 20 % plus the percentage of the missed exam). All exams are closed book – any necessary information will be provided for you. The schedule for the quizzes/exams is posted at the beginning of the semester and will not change. All students need to be aware that a course grade of C or better is required in order to enroll in future chemical engineering courses in our department which require CHEN-2120 as a pre-requisite.

Exams may be submitted for regrading to the TAs within the week after they have been returned to you. (Papers submitted after this date will be returned without regrading.) Grades will be posted through Gradescope. If supplementary info is needed, you are responsible to bring those to the exam (Steam tables, conversion table, etc.)

Classroom

It is requested that students make every effort to arrive on-time to class such that class can be started as scheduled without interruption. Also, *any discovered incidents of academic dishonesty will be reported* to the Academic Dishonesty Committee of the Department of Chemical and Biological Engineering and to the CU Honor Code Council. Consequences may include receiving a failing grade in the course and are up to the discretion of the instructor.

Exam/Quiz Dates that you should not miss: Exam location (A115) & Accommodation qualified individuals (C124)

Exam #1: 9/9/2024 A115 & C124
Exam #2: 10/9/2024 A115 & C124
Exam #3: 11/15/2024 A115 & C124

Final Exam: 12/17/2024 **A115 & C124**

University Policies

Honor Code
All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, **clicker fraud**, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Clicker fraud in this curse means answering the questions from outside of the class.
All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: honor@colorado.edu, 303-492-5550. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Classroom Behavior
Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation, or political philosophy.

For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or required medical isolation for which you require accommodation, reach out to your instructor right away and they will walk you through needed documentation. We are dropping 3 clicker grades just to accommodate any kind of personal issue that might be stopping you from attending the class. Also see Temporary Medical Conditions on the Disability Services website.

Religious Holidays
Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. *In this class, the student must notify the instructor at least one week in advance of a missed class due to religious observance in order to*

make appropriate arrangements to turn in homework or schedule an alternative time to take an exam. See the campus policy regarding religious observances for full details.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation
CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.
Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive an outreach from OIEC about their options for addressing a concern and the support resources available. To learn more about reporting and support resources for a variety of issues, visit Don't Ignore It.

REQUIREMENTS FOR INFECTIOUS DISEASES

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all public health orders to reduce the risk of spreading infectious diseases.

The CU Boulder campus is currently mask optional. However, if masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class. Students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct & Conflict Resolution. Students who require accommodation because a disability prevents them from fulfilling safety measures related to infectious disease will be asked to follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

For those who feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the further guidance of the Public Health Office. For those who have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home.

Preferred Student Names and Pronouns
CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Mental Health and Wellness
The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.

Date	Topic	Reading Chapter	Assignments
Class 1 – 8/27	Introduction, Unit Conversion, sig figs, stats	1, 2.1-2.5	A0 & A1
Class 2 – 8/29	Dimensional Homogeneity, Linearization	2.6-2.7	A2
Class 3 – 9/3	Density, Mass, volume, chemical composition, Avg Mw	3.1-3.3	A3
Class 4 – 9/5	Pressure, manometers, Temp	3.4-3.6	A4
9/9	**Midterm 1 – A115/C124 6:30 – 8:30 PM**	N/A	
Class 5 – 9/10	Process, General balance, Flowcharts, Basis	4.1-4.2	Feedback 1
Class 6 – 9/12	DOF, Degrees of freedom analysis, Balance	4.3	A5
Class 7 – 9/17	Multiple unit balances	4.4	
Class 8 – 9/19	Recycle and bypass	4.5	A6
Class 9 – 9/24	Stoichiometry, limiting reactants, conversion, extend of reaction	4.6 a-d	
Class 10 – 9/26	Multiple reaction, Reactive species, excess air	4.6e,4.7 a-e	
Class 11 – 10/1	Recycle, pass conversion, Purge	4.7 e, f	A7
Class 12 – 10/3	Combustion	4.8	A8
Class I – 10/8	Catch up/Review	Chapter 4	
10/9	**Midterm 2 – A115/C124 6:30 – 8:30 PM**	N/A	Feedback 2
Class 13 – 10/10	Average density, Ideal gas law, real gases	5.1-5.2	A9
Class 14 – 10/15	Compressibility chart, review	5.3-5.4	A10

Class 15 – 10/17	Phase diagram, water, Single component	6.1-6.3	A11
Class 16 – 10/22	Multicomponent	6.4	
Class 17 – 10/24	Multicomponent, Solubility	6.4- 6.5 a,b	A12
Class 18 – 10/29	Ternary Phase diagram	6.6	A13
Class 19 –10/31	Catchup		
Class 20 – 11/5	Introduction to Energy, Systems	7.1-7.3	
Class 21 – 11/7	Thermodynamic tables, energy intro	7.4-7.6	A14
Class 22 – 11/12	Mechanical energy balances	7.6,7	A15
Class II – 11/14	Review	Chapters 5-7	
11/15	**Midterm 3 – A115/C124 6:30 – 8:30 PM**	N/A	Feedback 3
Class 23 – 11/19	Balances on non-reactive processes, sensible heat	8.1,3	
Class 24 – 11/21	Heat Capacity, Phase Changes	8.4	A16
11/26,11/28	**Thanksgiving Break**	N/A	N/A
Class 25 – 12/3	Phase changes, psychrometric chart	8.4 a, c, d, e	A17
Class 26 – 12/5	Heat of mixing, formation, Combustion	8.5, 9.1-5	
Class 27 – 12/10	Simultaneous Energy and Mass Balance	9.1-5	
Class III – 12/12	Final Review (Last day of Class)	Chapters 2-9	
12/17	**Final Exam – A115/C124 1:30-4:00 PM**	**Ch. 1 - 9**	