

Material and Energy Balances

ECH3023 All Sections (12436, 12437, and 12438)

Class Periods: MTWR, P1 (7:25-8:15) or P2 (8:30-9:20) or P10 (5:10-6:00)

Location: CSE E220 or FAB 0105 or CSE E221

Academic Term: Fall 2018

A quick word of advice:

Material and Energy Balances (MEB) is the first class in the curriculum of Chemical Engineering. This course will introduce you to ideas, concepts, equations, and processes that you will **repeatedly** revisit in finer detail in later ChE courses. Therefore, it is essential that you work hard to master the material, because subsequent courses will build on this material.

The people that you meet in this class will become your colleagues for the remainder of your ChE education and beyond. I suggest that you meet and interact with as many of your classmates as possible, even if you are introverted. You are encouraged to work and study in groups and help each other as much as possible (in compliance with principles of academic honesty; see below).

Instructors:

VJ Tocco (Section 12436 & 12437)

I prefer that you call me "VJ", but you may also call me "Dr. Tocco" if you are more comfortable addressing your instructors formally.

E-Mail: vjtocco@ufl.edu

E-mail is my preferred method of communication outside of class time. In order to ensure that I reply, you must use proper e-mail etiquette and put "ECH3023" in the subject line.

Office: 219A Chemical Engineering

Office Hours: Mondays 10-11 AM, Thursdays 12-1 PM, or by appointment

I have an open-door policy; if I am in my office with the door open, you are welcome to come in at any time. However, please do not disturb if the door is closed and you are coming by unannounced.

Piyush K. Jain (Section 12438)

I prefer to be addressed as "Dr. Jain" but feel free to call me "Piyush" or "Prof. Jain" as you like.

E-Mail: jainp@ufl.edu

Email is preferred mode of communication.

Office: 329A Chemical Engineering

Office Hours: Monday 2-3 PM, Friday 11 AM -12 PM, or by appointment

Teaching Assistants:

None

Course Description

(4 credits) Formulation and solution of material and energy balances utilizing physical/chemical properties of matter as applied to analyzing unit operations systems.

Course Pre-Requisites / Co-Requisites

Prerequisites

CHM 2046 (General Chemistry), MAC 2312 (Calculus 2) and PHY 2048 (Physics 1)

Co-requisites

PHY 2049 (Physics 2), MAC 2313 (Calculus 3), and MAP 2302 (Differential Eq.)

Course Objectives

Each lecture will have specific learning objectives that will be announced at the beginning of that lecture. Broadly, at the end of this course, a student should be able to do the following:

- 1) Perform basic chemical engineering calculations, including (but not limited to) unit conversions, mass/mole conversions, interpolations...
- 2) Draw and label a process flow diagram from a written description of a process.
- 3) Perform a degree-of-freedom analysis.
- 4) Derive and solve the equations needed to solve for unknown process variables.

In addition to these learning objectives, we have designed the assignments to develop the following skills, which are characteristic of real-world problems, and therefore essential for any practicing chemical engineer:

- 1) Read, interpret, and follow directions, prompts, and problem statements.
- 2) Detect and disregard superfluous given information.
- 3) Use resources to find extra information which is needed, but not given.
- 4) Brainstorm reasons for unexpected behavior (troubleshooting).

Materials and Supply Fees

None

Professional Component (ABET):

a. Specific outcomes of instruction

- The student will be able to identify the unit operations involved in a process, draw process flowcharts for single- and multiple-unit operations, identify process variables, label process streams, and develop relationships between process variables for individual process units and complex processes common to chemical engineering practice.
- The student will be able to develop mass and energy balance equations necessary to solve reactive and non-reactive steady-state and transient systems by hand.
- The student will be able to perform simple degree-of-freedom analysis to identify the number of unknowns relating total mass and energy, mass and energy flow rates, and mass composition.
- The student will be able to use fundamental thermodynamic relationships (equations of state, phase equilibria, vapor pressure) as well as empirical thermodynamics relationships (Raoult's law, Henry's law, Antoine equation), and apply these to the solution of mass and energy balance problems.
- The student will be able to report engineering calculations and problem solutions in a professional manner.

b. Student outcomes addressed by the course

Outcome (a): an ability to apply knowledge of mathematics, science, and engineering.

Outcome (d): an ability to function on multi-disciplinary teams.

Outcome (g): an ability to communicate effectively.

Required Textbooks and Software

Elementary Principles of Chemical Processes (4th Ed.) by Felder, Rousseau, and Bullard; Wiley, ISBN 13:978-0-470-61629-1

Note: I will not forbid you from using another edition of the textbook, but keep in mind that is your responsibility (and your responsibility alone!) to ensure that the assigned readings/problems match the 4th edition.

Recommended Materials

Any model of scientific calculator (except those with communication abilities) are permitted for exams and homework assignments. During exams, you may not use your cell phone as a calculator, nor may you share a calculator with a classmate.

Some software or web apps, (such as Microsoft Excel, Wolfram Alpha, or Aspen) may be useful/required for some homework assignments. Therefore, you will need access to this software, which is available on most UF machines. You will not need to use your own personal laptop for any assignments, but you might find it useful.

Course Schedule

Wk	Begins	# Hours	Reading	Assignments Due
1	08/19	2	Syllabus, Chapters 1 & 2	None
2	08/26	4	Chapter 3	None
3	09/02	3	Chapter 4.1-4.3	HW #1, Writing #1
4	09/09	4	Chapter 4.4-4.5	HW #2
5	09/16	4	Chapter 4.6	HW #3, Writing #2
6	09/23	4	Chapter 4.7-4.10	HW #4
7	09/30	4	Chapter 5	Exam #1
8	10/07	4	Chapter 6.1-6.3	HW #5
9	10/14	4	Chapter 6.4-6.8	HW #6
10	10/21	4	Chapter 7	HW #7
11	10/28	4	Chapter 8.1-8.3	HW #8
12	11/04	4	Chapter 8.4-8.6	Exam #2
13	11/11	3	Chapter 9	Class Project
14	11/18	2	Flex/Catch-Up	Writing #3
15	11/25	4	Chapter 10	HW # 9
16	12/02	3	Review/Catch-Up	HW # 10, Writing #4
17	12/09	0	Exam Week	Exam #3

Attendance Policy, Class Expectations, and Make-Up Policy

You are required to attend all lectures, but it is on the honor system and we will not monitor or record attendance. Absences will be excused if (and only if) you notify your instructor in advance of your absence via email, your reason for absence is consistent with the UF attendance policy (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>), and you provide your instructor with the appropriate documentation.

Cell phones, laptops and other electronics are allowed as educational devices only. Please do not distract others by using electronics for other purposes during class.

Excused absence work make-up

Make-up work will be considered on a case-by-case basis, commensurate with your circumstances in a manner that is fair to you and your classmates. There will be no make-up assignments for unexcused absences.

Evaluation of Grades/Course Assignments

Exams: 3 Total, 500 points; 200 (or 100) Points Each

Each exam will consist of three questions totaling 100 points, with a total time limit of two hours. The format of the questions will be similar to the homework problems, and may contain multiple parts. Exam questions are meant to assess your ability to perform engineering analysis and calculations. During the exam, you are permitted to use a calculator (any model without communication ability; you may not share), but are not permitted to refer to books or notes. The instructor will provide a “crib sheet” of common equations and needed information a few days in advance of the exam.

Your two highest exam grades (out of three) will be doubled in the final calculation of your course points. For example, if your scores are 64, 88 (176), 81 (162); your total exam points would be 402/500.

Note: Make-up exams will be considered on a case-by-case basis for documented, excused absences or emergencies. However, once you begin an exam, you may not be granted an excused absence for any reason.

Quizzes: 3 Total, 150 points; 50 Points Each

You may consider the quizzes to be “dress rehearsals” for the exams. Each quiz will occur during lecture time, and will consist of a few multiple choice, true/false, or short answer questions, totaling 50 points. During quizzes, you are not permitted to use a calculator (no complex calculations included), books, or notes.

Quiz questions will be easier (generally) and more conceptual than exam questions, and will assess your comprehension of lecture material and ensure that you keep up-to-date. Therefore, they may be announced or unannounced.

Homework: 10 Total, 150 points; 15 points Each

Homework will be assigned approximately once per week, and will consist of 4-5 problems to submit AND an additional 2-4 “practice” problems that will not be collected. The submitted problems will be graded on the following basis:

- Not attempted – 0 points
- Attempted but not completed – 1 point
- Completed but incorrect – 2 points
- Completed and correct – 3 points

You should plan to spend at least 5 hours per week on homework (if not more), and expect homework problems to be significantly more difficult than exam questions. You are permitted to discuss the problems and problem-solving strategies with your colleagues, but you may not breach the Academic Honesty Course Policy (see below).

Homework is to be completed on the assignment document (see Canvas page) in neat handwriting (without excessive erasures or cross-outs) on standard-size (8.5” x 11”) paper, without frayed edges, folds or excessive wrinkling. Write your answer(s) in the provided answer boxes.

Each problem must be accompanied by a solution (showing all work, which should begin directly beneath the answer boxes. If needed, continue your solution by attaching additional pages of your solution before the next problem. All pages must be stapled in order and contain the following information (you may use the “Extra homework page” on Canvas as a template): your name, UFID, section number, and “page X of Y”, where X is the current page, and Y is the total number of pages in the entire assignment. Begin work for each problem on a fresh page (using the back-sides of paper

is permitted). Homework that does not conform to these specifications is subject to a point deduction at the instructor's discretion.

Homework is due (in class) at the beginning of lecture on Mondays. To incentivize you to finish homework assignments early, homework submissions by noon on the Friday before the due date will receive **two automatic bonus points**. However, your total homework score may not exceed 150 points. You may also submit homework to the "homework box" outside my office or electronically via e-mail any time prior to the due date. Late homework will not be accepted without prior documentation and approval.

Team-Based Project: 100 Points

In the class project, you will work in groups of four to research an industrial chemical process of your choice. Groups will be assigned, but you will have the option to choose one of your teammates. Topics will be claimed on a first-come, first served basis, and no duplicate topics are allowed.

More details will be given when the project is assigned in October.

Reflective Writing Assignments: 4 Total, 100 Points; 25 Points Each

Writing and communication is an essential (although undervalued) skill of successful engineers. Each writing assignment will be a 500-750 word essay in response to the following writing prompts:

1. Why I chose Chemical Engineering and how I learn best (due in 2 weeks)
2. What type of career would I like? (due before career fair)
3. How do I work and interact in team settings? (due after the class project)
4. What was the most important thing I learned in MEB? (due before last day of class)

I intend for you to use these essays as a way to look at yourself introspectively and start forming career goals. These writing assignments will also allow me a chance to get to know you better.

Each writing assignment will have its own rubric, which will be distributed with the writing prompt.

Extra Credit: 20 Points Possible

You will have the opportunity to earn a maximum of 20 extra-credit points by submitting an original exam/homework questions (maximum of 10 points/question) or quiz question (multiple choice, true/false, or short answer; maximum of 2 points/question).

You must submit the question statement, an answer key, and an explanation of the concept that the question is testing.

In addition, by submitting these questions, you authorize me to use them in subsequent years (or, if the question is good enough, this year!).

The deadline to turn in extra-credit is one week prior to the last lecture (i.e. you cannot submit extra credit after you see your final exam grade)

Grading Policy

You may earn 1000 possible points in this course by completing assignments (see above). Your final letter grades will be based on your final point total only (no curve). The official thresholds to earn a given letter grade are listed below:

Point Value	Letter Grade
940-1000	A
920-939	Gray
890-919	A-
880-889	Gray
850-879	B+
840-849	Gray
810-839	B
790-809	Gray

Point Value	Letter Grade
760-789	B-
740-759	Gray
700-739	C+
670-699	Gray
620-669	C
600-619	Gray
550-599	C-
0-549	D/F (Gray)

Students in the “gray” areas may earn either the next letter grade up, or the next letter grade down based on their professionalism, participation and effort. Final decisions are based solely on the instructor’s discretion.

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Regrades:

Regrade challenges will be considered for exams and quizzes only (i.e. homework, the team project, reflective writing assignments, extra credit, etc. is not eligible for regrade challenges). There will be a two-point penalty assessed to each regrade challenge that is not overturned, and your entire assignment may be regraded as a result.

Regrade requests for simple addition mistakes or systematic grading errors may be submitted without risk of penalty or whole regrades.

To submit a regrade: On a separate sheet of paper (titled “regrade request”), briefly and clearly state the reason for your request and attach it to the front of the assignment. **DO NOT WRITE ANYTHING DIRECTLY ON ANY PAGE OF YOUR ASSIGNMENT.** You must hand-deliver your regrade request to me (in my office or after class) within one week of the date the assignment was returned to the class.

E-mail:

In order to ensure a timely response, put “ECH3023” (formatted exactly; all caps, no spaces) in the subject line. You must also use proper e-mail etiquette and professionalism.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. In most cases, the instructors are very careful to define permissible and unauthorized aids explicitly, but you are always welcome and encouraged to ask if it ever becomes unclear.

The instructors take this honor pledge very seriously. Cheating is repugnant behavior; it undermines the value of your education, and it is not fair to honest students. We will pursue any violations of the honor code to the maximum possible extent.

While the instructors encourage collaboration on homework assignments, this collaboration is limited to discussion about problem-solving strategies and approximate answers. You are not allowed to look at another student's work while completing your own assignment.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.