

CHME 2308 Conservation Principles, Summer 1 2020

1. Course number and name: **CHME 2308** - Conservation Principles in Chemical Engineering
2. Credits and contact hours: 4 credit hours, 195 minutes per week
3. Instructor's or course coordinator's name: Professor Courtney Pfluger
4. Text book, title, author, and year:

FR&B: *Elementary Principles of Chemical Processes*, Felder, Rousseau, and Bullard, John Wiley & Sons, Hoboken, NJ, 4th edition.

- a. Other supplemental materials: None.

5. Specific course information:

- a. Brief description of the content of the course (catalog description):

Examines the applications of fundamental laws of mass and energy conservation to chemical and physical processes. Emphasizes material and energy balances on chemical processes. Offers students an opportunity to develop skills in applying chemistry, physics, and mathematics to identify and solve chemical engineering problems.

- b. Prerequisites or co-requisites

Prereq. CHEM 1151 or CHEM 1211.

- c. Indicate whether a required, elective, or selected elective (as per Table 10) course in the program
Required

6. COURSE OUTCOMES

ABET Student Outcomes (SO's 1-7) which map from the COURSE OUTCOMES listed below are shown in parentheses. Students will:

- Express process variables representing pressure, temperature, composition, and flow rates in different unit systems and express the role of dimensionality. (SO 1)
- Evaluate, estimate, and interpret data for process variables, including following rules for significant figures. (SO 1)
- Implement material balances to describe both batch and continuous processes, based on drawing and labeling a process flow sheet and performing a degree-of-freedom analysis. (SO 1)
- Formulate material balances for multiple unit operation processes, including processes with recycle, bypass, and purge streams, based on overall balances and balances on independent subunits. (SO 1)
- Identify and solve material balances for reactive processes, including combustion processes with different types of feed of oxygen, in terms of molecular and atomic species balances and extent of reaction. (SO 1)
- Use physical chemical descriptions for solids, liquids, gases, and their mixtures and solutions to solve material balances. (SO 1)
- Use and solve energy balances for closed and open systems. (SO 1)
- Combine and solve material and energy balances with physical and chemical data to address

chemical engineering processes (SO 1)

- Evaluate potential safety hazards for chemical engineering processes. (SO 2)
- Research and develop a plan to approach a real-world engineering topic. (SO 3, 7)
- Communicate engineering ideas in writing. (SO 3)

7. Brief list of topics to be covered

- Overview of chemical engineering as it relates to conservation principles
- SI, CGS, and American standard base, derived, and dimensionless units; recognize significant figures, problems dealing with the process variables, including mass flow rate, molar flow rate, volumetric flow rate, mass fraction, mole fraction, weight fractions, composition, pressure;
- Material balances (no reaction);
- Definition of a system and determination of a degree of freedom analysis;
- Recognition and solution for processes with bypass, purge, and recycle streams.
- Inclusion of reactions to the material balances applied to single unit, reactive systems using molecular species balances, extent of reaction, and atomic balances;
- Gibbs Phase Rule
- General Energy Balance applied to open and closed, continuous, batch, and semi-batch systems;
- Application of the energy balance to non-reactive systems;
- Mechanical Energy Balance as derived from the General Energy Balance;
- Bernoulli's equation

Additional course material to be added to the syllabus at the discretion of the instructor.

CHME 2308 Chemical Engineering Conservation Principles Syllabus

Instructor: Dr. Courtney Pfluger
Semester Offered: Summer 1 2020
Class location: Online
Office Hours: TBD

E-mail: c.pfluger@neu.edu
Class Times: MTWR 9:50-11:30 AM

PREREQUISITES:

CHEM 1151, CHEM 1211, or approved equivalent

REQUIRED MATERIALS:

- 1) Felder RM, RW Rousseau, & LG Bullard. Elementary Principles of Chemical Processes, 4th ed. Hoboken, NJ: John Wiley & Sons, 2016. ISBN 978-0-470-61629-1. You will need this textbook for homework and during open-book quizzes & exams.

COURSE WEBSITE AND RESOURCES

- 1) We will be using Canvas to post assignments, grades, and most course related materials
- 2) Slack Workspace for this course, to be used as a watercooler to ask questions, get to know your classmates, and course updates. The Slack workspace can be found here:
- 3) Website for videos can be found here: <http://www.learncheme.com/screencasts/mass-energy-balances/textbook-felder-3rd>

Course Structure: Lectures during class meeting times. Assigned reading and homeworks due approximately each week. Homework assigned approximately weekly, with an accompanying reading assignment. Assignments are due at the beginning of class on the days indicated on the calendar. Five exams.

Evaluation and grading

| | |
|-----------------------|------------|
| Assignments | 10% |
| Weekly Quizzes | 25% |
| Participation | 20% |
| Final Project | 35% |
| Reflection | 10% |

The following grade cutoffs will be used, with no rounding:

| | | |
|--------------|-------------|--------------|
| | $A \geq 94$ | $A- \geq 90$ |
| $B+ \geq 87$ | $B \geq 84$ | $B- \geq 80$ |
| $C+ \geq 77$ | $C \geq 74$ | $C- \geq 70$ |
| $D+ \geq 67$ | $D \geq 64$ | $D- \geq 60$ |
| | | $F > 0$ |

Class Participation: Participation is important to get the most of the online format of this course. This includes working together in breakout rooms to solve class problems, peer feedback on class assignments and project milestones.

Assignments: These will include practice problems done in break out rooms.

Quizzes: Online quizzes will be announced the class before they occur.

Emergencies and Unforeseeable Circumstances: If class is cancelled due to a weather emergency or other unforeseeable circumstances the exam scheduled will be administered at the next class meeting.

Excused Absences and Make-Ups: Absences from exams will be excused only under appropriate circumstances (e.g., illness, death of an immediate family member, or other unusual situation) and by discretion of instructor. *If at all possible, please take one minute to email and say you will not make it.*

Academic Integrity: A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to <http://www.northeastern.edu/osccr/academic-integrity-policy/> to access the full academic integrity policy.

Student Accommodations: Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.

For more information, visit <http://www.northeastern.edu/drc/getting-started-with-the-drc/>.

Diversity and Inclusion: Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice.

Please visit <http://www.northeastern.edu/oidi/> for complete information on Diversity and Inclusion.

TITLE IX

Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance. Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff. In case of an emergency, please call 911. ***Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus***

A detailed course calendar follows (Subject to change):