CBEE 212, Energy Balances
3 Credit Hours
Winter 2014

Instructor: Adam Higgins
100B Merryfield South
737-6245
adam.higgins@oregonstate.edu
Office Hours: Tuesday 10-11am, Friday, 12-1pm and by appointment

Co-Instructors: Devlin Montfort
103 Gleeson Hall
devlin.montfort@oregonstate.edu
Office Hours: Monday 3-4pm

Elain Fu
301B Gleeson Hall
elain.fu@oregonstate.edu
Office Hours: Monday 1-2pm

TAs: Tianyi Li
litia@onid.orst.edu
Office Hours: Wednesday 4-5pm, Gleeson lobby

Grace Panther
pantherg@onid.orst.edu
Office Hours: Tuesday 4-5pm, Gleeson lobby

Mingyang Tan
tanmi@onid.orst.edu
Office Hours: Thursday 4-5pm, Gleeson lobby

Peer Helper: Maxwell Hays
Office Hours: Tuesday 12-1pm, Gleeson lobby

Meeting time:

Lecture:	MF 11:00-11:50 am, Gilbert 124
Recitation:	T 8:00-8:50 am, Owen 102
	T 9:00-9:50 am, Owen 102
Studio:	R 8:00-8:50 am, Graf 208, Higgins
	R 9:00-9:50 am, Graf 208, Tan
	R 10:00-10:50 am, Graf 208, Tan
	R 11:00-11:50 am, Graf 208, Tan
	R 12:00-12:50 pm, Graf 208, Fu
	R 1:00-1:50 pm, Graf 208, Montfort
	R 2:00-2:50 pm, Graf 208, Panther
	R 3:00-3:50 pm, Graf 208, Panther
	R 4:00-4:50 pm, Graf 208, Panther
Midterms:	R 7:00-8:20 pm, Location TBD

Prerequisites:
One year general chemistry, sophomore standing in engineering, CBEE 211.

Catalog Description:

Energy balances, thermophysical and thermochemical calculations.

Required Text:

Felder, R.M., Rousseau, R.W. *Elementary Principles of Chemical Processes*, 3rd ed., John Wiley & Sons, New York, NY, 2005.

Email:

Every student must have ENGR and ONID accounts. Read email daily. Note: a class email distribution list will be generated from ONID accounts. You should not forward your ONID or ENGR account to a non-OSU account (ONID to ENGR or vice-versa is fine), as many commercial internet providers (such as Yahoo!, hotmail, etc.) will have distribution list filters on received messages.

Learning Objectives:

The goals of this course are to introduce students to fundamental principles governing natural and industrial processes, and to basic process calculations. By the end of the course, students must demonstrate an ability to:

1. Define and solve steady-state energy balance problems on non-reactive processes;
2. Define and solve steady-state energy balance problems on reactive processes;
3. Define and solve steady-state problems that include both mass and energy balances; and
4. Define and solve unsteady-state material and energy balance problems.

Course Grading: Letter option only (A-F).

Performance evaluation will be based on the following:

- **Computer activities during recitation** **5% (+5% bonus)**
- **Studio participation and completion** **10%**
- **Problem Sets** **15%**
  8 problem sets will be assigned, with the due dates announced in class or over email. Problem sets that are turned in late will not be graded.
- **Midterm Exams** **45% (15% each)**
  There will be midterm exams on January 30, February 20 and March 6. Note that midterm exams will take place on Thursday at 7pm.
- **Final Exam** **25%**
  This will occur on **Monday March 17 at 6:00 pm**

Final performance percentage will be assigned a letter grade by the following scale:

100-94	A	74-76	C
90-93	A-	70-73	C-
87-89	B+	67-69	D+
84-86	B	64-66	D
80-83	B-	60-63	D-
77-79	C+	60<	F

Course Policies

I expect that you will be in class, every time. If you can't be in class for some reason, I expect that you will notify me ahead of time (in person or via email) that you will not be in class on a certain date and give me some idea of the reason. Please show respect to me and your peers; this includes being punctual and

minimizing disruptions. Please turn off all cell-phones, mp3 players, etc. during class. Also, no use of laptops or other electronic devices for activity outside of its use in THIS class will be tolerated.

We will do computer exercises during recitation each week using the AIChE Concept Warehouse: http://jimi.cbee.oregonstate.edu/concept_warehouse/. You will need to bring your laptop to every recitation. You will receive full credit for participation for submitting an answer to the questions (even if your answer is wrong), and you will get bonus points if you answer the questions correctly.

Studios will review lecture materials in an "active learning" environment. 70% of the studio grade will be based on participation in the assigned activities during the studio class period. Students who are not on task will be given one warning, after which further offenses will result in a grade reduction. The other 30% of the studio grade will be based on submission of a completed studio worksheet. The studio worksheet can be submitted at the end of the class period, or at the beginning of the studio in the following week.

The Problem Sets will consist of two parts. The first part will be completed using the Sapling Learning Interactive Homework and Instruction system. This will be worth 80% of your homework grade. Details on how to set up a Sapling account are provided below. The second part will consist of a traditional homework problem handed in on paper. This will be worth 20% of your homework grade. Each student is required to submit an original assignment. However, working together in small groups (2-4) is acceptable (and encouraged) **as long it is a mutual learning experience for all involved**. Direct copying of a peer's assignment is unacceptable, as is splitting up an assignment and exchanging solutions later. If you get stuck and cannot solve a problem after putting in a reasonable effort, it is completely acceptable for another student who has solved the problem to teach you how to solve it; it is not acceptable to offer or accept a completed solution as a guide.

For the exams, I will allow you to use your textbook and 1 sheet of paper with hand written notes. The tables in the back of textbook will be needed to solve many of the exam problems. If you do not have the textbook, or if you have the E-book (and not the hard copy), please notify me **at least 48 hr before** the exam so that I can make you a copy of the tables. All exams in this class will be cumulative. I consider it a matter of academic dishonesty for a student to have access to previous examinations in this class, except for any that I make available to everyone in the class.

Unless otherwise stated by the instructor, you are not allowed to look at any previously worked solutions to any of the problems assigned in this class (including multiple choice computer exercises, studio worksheets, and homework) before the due date for the assignment. Using worked solutions will be considered as a case of academic dishonesty.

Sapling Learning

Sapling Learning is an online homework system that has been shown to be an effective learning tool, particularly in large classes where it is difficult for the instructor to provide feedback to each student. Instructions for signing up for a Sapling account are given below:

1. Go to http://saplinglearning.com and do one of the following:
   a. If you already have a Sapling account, log in, click "View Available Courses," then skip to step 2.
   b. If you have a Facebook account you can use it to quickly create a Sapling Learning account. Click "create account" located under the username box, then click "Login with Facebook." The form will auto-fill with information from your Facebook account (you may need to log into Facebook in the popup window first). Choose a password and time zone, accept the site policy agreement and click "Create my new account." You can then skip to step 2
   c. Otherwise, click "create account" located under the username box. Supply the requested information and click "Create my new account." Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in the email.
2. Find your course in the list (listed by school, course and instructor) and click the link
3. Select your payment options and follow the remaining instructions
4. Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments

5. During sign up – and throughout the term – if you have any technical problems or grading issues, send an email to support@saplinglearning.com explaining the issue. The Sapling support team is almost always more able (and faster) to resolve issues than your instructor.

Guidelines for Homework Preparation:

- Use clean, 8.5 x 11 inch paper. Engineering paper is preferred; neatness is important and appreciated.
- Write on only one side of the paper, and start a new problem on a new sheet of paper.
- Write the following in the upper right corner of each page:
  CBEE 212, Your Name
  Problem Set No.
  Page number/Total pages
- Securely staple all pages; do not fold or paper clip together.
- Show all of your work. Draw a block around your final answer(s).
- For graphical solutions, use graph paper. Label the axes of your graph and include units.
- Provide computer printouts, if used, on a separate sheet.

Blackboard:

Course materials will be posted on the CBEE 212 Blackboard site. These materials include supplemental material for lectures, problem sets and solutions, grades and other material relevant to the course. Students should become familiar with the Blackboard site and check it frequently.

Course/Instructor Evaluation

Near the end of the term students will have an opportunity to evaluate the instructor (me) and this course using the online evaluation system. I will make an effort to solicit feedback from you throughout the term and *you are encouraged to provide feedback to me throughout the course.*

Academic Honesty Statement

Academic honesty is very important, and academic dishonesty such as plagiarism and cheating will not be tolerated. Academic dishonesty is defined as an act of deception in which a student seeks to claim credit for the work or effort of another person or uses unauthorized materials or fabricated information in any academic work or research, either through the student's own efforts or the efforts of another. It includes:

- cheating- use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a student attempts to misrepresent mastery of academic effort or information.
- fabrication- falsification or invention of any information
- assisting- helping another commit an act of academic dishonesty.
- tampering- altering or interfering with evaluation instruments and documents
- plagiarism- representing the words or ideas of another person or presenting someone else's words, ideas, artistry or data as one's own, or using one's own previously submitted work.

For more information about academic integrity and the University's policies and procedures in this area, please refer to the Student Conduct web site at: **http://www.orst.edu/admin/stucon/achon.htm** and the section on Academic Regulations in the OSU Schedule of Classes.

Course Values Statement

I am dedicated to establishing an inclusive learning environment that values all students' experiences. Therefore, disrespectful and demeaning statements, attitudes, and behaviors based on age, ability, color/ethnicity/race, gender identity/expression, immigration status, marital/parental status, military/veteran's

status, national origin, political affiliation, religious/spiritual beliefs, sex, sexual orientation, socioeconomic status will not be tolerated.

Disability Statement

Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

Course Outline:

Weeks 1-3	Simple thermodynamic concepts	Chapter 7.0 – 7.2
	• Energy	
	• Intensive and extensive properties	
	• Enthalpy	
	Energy balances on closed systems	Chapter 7.3
	Energy balances on open systems at steady-state	Chapter 7.4
	Tables of thermodynamic data	Chapter 7.5
	Energy balance procedures	Chapter 7.6
	Mechanical energy balances	Chapter 7.7
Weeks 4-6	Enthalpy calculation procedures	
	• Reference states and state properties	Chapter 8.0 – 8.1
	• Changes in pressure at constant temperature	Chapter 8.2
	• Changes in temperature	Chapter 8.3
	• Phase change operations	Chapter 8.4
	• Heats of mixing and solution	Chapter 8.5
Weeks 7-8	Energy balances on reactive processes	
	Heats of reaction for processes	Chapter 9.0 – 9.1
	Heats of formation and heats of combustion	Chapter 9.3 – 9.4
	Energy balance procedures	Chapter 9.5
Weeks 9-10	Transient processes	Chapter 11.1 – 11.3