

CBE 205: Chemical Process Principles – Fall 2005

Section 001: MWF, 8:30 – 9:20AM, 1007 EB1

Section 002: TH, 8:05 – 9:20AM, 1231 EB2

<http://courses.ncsu.edu/che205/lec/001/>

Instructor (001): Dr. Lisa G. Bullard (lisa_bullard@ncsu.edu), 2012 EB1, (919)515-7455

Office Hours: M 10:30AM - noon, W 1:30 – 3PM

Instructor (002): Dr. Richard Felder (rmfelder@mindspring.com), 2088D EB1, (919)515-2327

Office Hours: T H 3:30 – 5PM

TA's and Grader: You can consult with any TA regarding questions on the homework or course material. You can consult with graders with questions about the grading of a homework assignment or exam.

TA/Graders	Role	E-mail	Office Hours 1	Office Hours 2	Problem session

Course Text: R.M Felder and R.W. Rousseau, *Elementary Principles of Chemical Processes*, 2005 Edition with Integrated Study and Media Tools, Wiley (2005). .

Course prerequisites: C– or better in MA 241, PY 205, and CH 201 or the transfer equivalent. This requirement is strictly enforced. If you have questions, see Dr. Bullard.

Course purpose: CBE 205 prepares you to formulate and solve material and energy balances on chemical process systems and lays the foundation for subsequent courses in thermodynamics, unit operations, kinetics, and process dynamics and control. More fundamentally, it introduces the engineering approach to problem solving: breaking a process down into its components, establishing the relations between known and unknown process variables, assembling the information needed to solve for the unknowns, and finally obtaining the solution using appropriate computational methods.

Course objectives: By the end of the course, you should be able to do the following things:

- **Basic engineering calculations.** Convert quantities from one set of units to another quickly and accurately; define, calculate, and estimate properties of process materials including fluid density, flow rate, chemical composition variables (mass and mole fractions, concentrations), fluid pressure, and temperature.
- **Material and energy balance calculations.** Draw and label process flowcharts from verbal process descriptions; carry out degree-of-freedom analyses; write and solve material and energy balance equations for single-unit and multiple-unit processes, processes with recycle and bypass, and reactive processes.
- **Applied physical chemistry.** Perform pressure-volume-temperature calculations for ideal and nonideal gases. Perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multicomponent solutions. Calculate internal energy and enthalpy changes for process fluids undergoing specified changes in temperature, pressure, phase, and chemical composition. Incorporate the results of these calculations into process material and energy calculations.
- **Computation.** Use spreadsheets (EXCEL) and an equation-solving program (EZ-Solve) to solve material and energy balance problems.
- **Teamwork.** Work effectively in problem-solving teams, and carry out meaningful performance assessments of individual team members.

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POLICIES AND PROCEDURES

- **Academic integrity.** Students should refer to the University policy on academic integrity found in the Code of Student Conduct (found in [Appendix L](#) of the *Handbook for Advising and Teaching*). It is the instructor's understanding and expectation that the student's signature on any test or assignment means that the student contributed to the assignment in question (if a group assignment) and that they neither gave nor received unauthorized aid (if an individual assignment). Authorized aid on an individual assignment includes discussing the interpretation of the problem statement, sharing ideas or approaches for solving the problem, and explaining concepts involved in the problem. Any other aid would be unauthorized and a violation of the academic integrity policy. All cases of academic misconduct will be submitted to the Office of Student Conduct. If you are found guilty of academic misconduct in the course, you will be on academic integrity probation for the remainder of your years at NCSU and may be required to report your violation on future professional school applications. It's not worth it!
- **Homework.** Students will submit homework individually for the first few homework assignments. Early in the semester, the instructors will designate teams of 3-4 individuals, and all subsequent assignments should be submitted by those teams unless otherwise specified. The assignment schedule will be posted on the course web site.
- **Homework format.** Use engineering paper (available in the Student Supply Store), one side of each page; begin each problem on a new page; and box the final answers. Each completed assignment should be in one person's handwriting (the recorder's). Staple the pages and fold them vertically when you hand them in, putting your name (individual assignments) or the names and roles (coordinator, recorder, checker, and monitor) of the *participating* team members (team assignment), and the problem set number and date on the outside. *If a student's name appears on a solution set, it certifies that he/she has participated in solving the problems. If this turns out not to be the case, both the nonparticipating student and the recorder will get zeros for that assignment.*
- **Late homework.** Completed assignments should be turned in at the *beginning* of class on the due date (Bullard section) or to the homework box in the CHE lounge (Felder's section) between 5PM on Thursday (day before the due date) and 9:30AM on Friday (the due date). If it's your job to turn in the homework and you're late, so is the homework. Late assignments will receive a maximum grade of 60. Late solution sets will be accepted up to 8AM on the Monday after the due date, turned in to your instructor's mailbox in the CHE office, 2001 EB1. *However, once an individual or a group hands in two late assignments, they will no longer be accepted.*
- **Posted solutions.** *Problem set solutions will not be posted.* It is your responsibility to make sure you find out how to solve the problems by asking about them in class, during office hours, or in the problem session after they have been handed in.
- **Individual effort assessments for team homework.** Teams will periodically be asked to submit individual effort assessments with completed assignments. These assessments will be incorporated into the assignment of homework grades. *If repeated efforts to improve team functioning (including faculty intervention) fail, a non-participant may be fired by unanimous consent of the rest of the team, and a team member doing essentially all the work may quit.* (Details of the required procedures are given in the handout on team policies and expectations.) Individuals who quit or are fired must find a team unanimously willing to accept them; otherwise they will receive zeros for the remainder of the homework.
- **Tests.** There will be three tests during the semester and a comprehensive final exam. *All tests will be open-book, closed-notes.* The lowest test grade will count half as much as each of the other two. Tests will be given as a common exam for both sections on scheduled Fridays from 3-5PM (see detailed course schedule for dates). Students who are unable to take the test at those times (with a documented excuse—not just that you don't want to) will schedule an alternate time to take the exam. To account for the additional test time required out of class, the class period before the exam will be an optional review session conducted by the instructor or a TA.

- **Test and homework grading.** The responsibility for grading tests and homework assignments resides with the graders. If you believe an error has been made in grading on a problem set, bring it to the grader who did the grading during his or her office hours. If you believe that you should have gotten more points than you got for any reason other than a simple addition error, write a statement making your case and take it to the grader. If you are not satisfied with the grader's decision, bring the statement to your course instructor, who will make the final decision.
- **Missed tests.** If you miss a test without either a certified medical excuse or prior instructor approval, you will take a makeup test at a designated time during the last week of the semester. The makeup exam will be fair but comprehensive (covering all the course material) and challenging. Tests missed with certified medical excuses or prior instructor approval will be dealt with individually. Only one missed test can be made up.
- **Problem session.** *All 205 students must be registered for one of the weekly problem sessions (205P).* Several computer applications will be taught during the problem sessions. 10% of your grade is based on problem session quizzes and in-class exercises. Attendance is expected. You should not float between problem sessions; stay in the one in which you are registered. However, if it is necessary to miss a problem session, you may attend another session to make up the time as long as you notify the TA of the problem session you attend so that your attendance can be recorded.
- **Attendance.** Students who miss class due to an excused absence should work with the instructor or problem session TA to make up any missed work. Documented medical excuses should be presented to the instructor. Examples of anticipated situations where a student would qualify for an excused absence are:
 - a. The student is away from campus representing an official university function, e.g., participating in a professional meeting, as part of a judging team, or athletic team. These students would typically be accompanied by a University faculty or staff member.
 - b. Required court attendance as certified by the Clerk of Court.
 - c. Religious observances as verified by Parents & Constituent Services (515-2441). For more information about a variety of religious observances, visit the [Diversity Calendar](#).
 - d. Required military duty as certified by the student's commanding officer.

For a full statement of the university attendance policy, see www.ncsu.edu/provost/academic_regulations/attend/reg.htm
- **Calculation of course grade.** A weighted average grade will be calculated as follows:
 - Midterm tests = 40% (Lowest grade counts ½ of each of the other two)
 - Final examination = 30%
 - Homework = 20%
 - Problem session quizzes and in-class exercises = 10%.

Weighted average	>97	93-96.9	90-92.9	87-89.9	83-86.9	80-82.9	77-79.9	73-76.9	70-72.9	67-69.9	63-66.9	60-62.9	< 60
Letter grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

The homework grades will only count if the average grade on class tests and the final exam is 60 or above—in other words, if you can't pass the individual tests, then you can't pass the course.

Note: We do not curve grades in this course. It is theoretically possible for everyone in the class to get an A (or an F). Your performance depends only on how you do, not on how everyone else in the class does. It is therefore in your best interests to help your classmates, while keeping the academic integrity policy in mind.

- **Instructors' commitment.** You can expect your instructors to be courteous, punctual, well organized, and prepared for lecture and other class activities; to answer questions clearly and in a non-negative fashion; to be available during office hours or to notify you beforehand if they are unable to keep them; to provide a suitable guest lecturer when they are traveling; and to grade uniformly and consistently according to the posted guidelines.
- **Consulting with faculty.** We strongly encourage you to discuss academic or personal questions with either of the CBE 205 course instructors during their office hours or by email.
- **Disabled students.** North Carolina State is subject to the Department of Health, Education, and Welfare regulations implementing Section 504 of the Rehabilitation Act of 1973. Section 504 provides that: "No otherwise qualified handicapped individual in the United States. . . shall, solely by reason of his handicap be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." This regulation includes students with hearing, visual, motor, or learning disabilities and states that colleges and universities must make "reasonable adjustments" to ensure that academic requirements are not discriminatory. Modifications may require rescheduling classes from inaccessible to accessible buildings, providing access to auxiliary aids such as tape recorders, special lab equipment, or other services such as readers, note takers, or interpreters. It further requires that exams actually evaluate students' progress and achievement rather than reflect their impaired skills. This may require oral or taped tests, readers, scribes, separate testing rooms, or extension of time limits.

CBE 205: ASSIGNMENT SCHEDULE

<u>DUE DATE</u>	<u>READ</u> (Chapters in F&R)	<u>SUBJECT</u>	<u>DO</u>
Week of 8/15	Syllabus, Course Policies, Team Policies; F&R 1; 2-2.7; 3-3.3	Introduction to engineering calculations; process data representation and analysis	
Week of 8/22	3.4-3.6; 4.1-4.3e	Processes and process variables; fundamentals of material balances	Problem Set 1 Due Fri. 8/26
Week of 8/29	4.4-4.6	Balances on multiple unit processes; chemical reaction stoichiometry	Problem Set 2 Due Fri. 9/2
Week of 9/5	Monday 9/5: LABOR DAY (no class) <i>No problem session this week</i> 4.6e-g 4.7	Balances on reactive processes	Problem Set 3 Due Fri. 9/9
Week of 9/12	4.8 – 4.10	Balances on reactive processes	9/16: QUIZ #1 THROUGH SECTION 4.7 3-5PM
Week of 9/19	5-5.5	Single phase systems and nonideal gases	Problem Set 4 Due Fri. 9/23
Week of 9/26	6-6.4	Single component gas-liquid systems	Problem Set 5 Due Fri. 9/30
Week of 10/3	6.5-6.8 Thursday and Friday 10/6-7: Fall Break <i>No problem session this week</i>	Multicomponent gas-liquid systems	
Week of 10/10	Quiz review		10/14: QUIZ #2 THROUGH CH. 5 3-5PM
Week of 10/17	7-7.8	First Law of Thermodynamics Energy and energy balances	Problem Set 6 Due Fri. 10/21
Week of 10/24	8-8.3 (except 8.3e)	Balances on non-reactive processes	Problem Set 7 Due Fri. 10/28
Week of 10/31	8.4-8.6	Balances on process involving phase change operations	Problem Set 8 Due Fri. 11/4
Week of 11/7	9-9.3	Balances on reactive processes: heats of reaction	11/11: QUIZ #3 THROUGH 8.3 3-5PM
Week of 11/14	9.4 – 9.5	Balances on reactive processes: heats of combustion	Problem Set 9 Due Fri 11/18
Week of 11/21	Wednesday-Friday 11/23-25: THANKSGIVING HOLIDAYS <i>No problem session this week</i>	Review	
Week of 11/28	Exam review	Summary	Problem Set 10 Due Wed. 11/30
Week of 12/5	FINAL EXAM -- 8-11 a.m. Monday, Dec. 5 (Bullard) Thursday, Dec. 8 (Felder)		

CBE 205 -- CHEMICAL PROCESS PRINCIPLES

TEAM POLICIES AND EXPECTATIONS

Your team will have a number of responsibilities as it completes problem and project assignments.

- *Designate a coordinator, recorder, a monitor, and a checker for each assignment*, with each of these roles having responsibilities defined below. In teams of three, the same individual functions as monitor and checker. Rotate these roles for every assignment.
- *Agree on a common meeting time and what each member should have done before the meeting by way of preparation.*
- *Do the required individual preparation.* Each team member should attempt to outline the solution of each problem before the team meets.
- *Meet and work out the complete solutions to all assigned problems.* Agree on next meeting time and roles for next assignment.
- *Review returned assignments.* Make sure everyone understands why points were lost and how to correct errors.
- *Complete and submit peer rating sheets for all team members when required.* Ratings will be collected near midterm and near the end of the semester. They will be confidential, and will be used to adjust *homework* grades for every student.

[Click here](#) to see the form that will be used for the ratings.

- *Consult with the instructor if a conflict arises that can't be worked through by the team.*

Team roles.

- *Coordinator* checks with other team members before the meeting to remind them of when and where they will meet and what they are supposed to do, keeps everyone on task and makes sure everyone is involved during the meeting.
- *Recorder* prepares final solution to be turned in.
- *Monitor* makes sure everyone understands both the problem solutions and the strategies used to get them.
- *Checker* checks the final solution for accuracy, makes necessary corrections, and turns it in at the beginning of the class session when it is due. If the checker anticipates a problem getting to class on time on the due date of the assignment, it is his/her responsibility to make sure *someone* turns it in.

Note to monitors: If you ask people if they understand something and they say yes, you've learned nothing. **To check for understanding in a way that means something, ask for an explanation.** If someone on a team misses a problem on a test that is very much like a homework problem, the monitor has not done his/her job.

Omitting names from completed assignments, firing, and quitting

- If a team member refuses to cooperate on an assignment, his/her name should not be included on the completed work. If the non-cooperation continues, the team should meet with the course instructor and attempt to resolve the problem. If no resolution is achieved, the cooperating team members may notify the uncooperative member in writing that he/she is in danger of being fired, sending a copy of the memo to

the course instructor. If there is no subsequent improvement, they should notify the individual in writing (copy to their instructor) that he/she is no longer part of the team.

- Similarly, a student who is consistently doing most of the work on a team may issue a warning memo (copy to instructor) that he/she will quit unless more cooperation is forthcoming. The team should meet with the course instructor at this point so that the problem can be resolved, if possible. If the non-cooperation continues, the student doing the work may notify the others in writing (copy to instructor) that he/she is no longer part of the team.
- *Students who are fired or who quit must find a team of 3 unanimously willing to accept them as a member, otherwise they get zeroes for the remaining assignments.*

As you will find out, group work isn't always easy: team members sometimes cannot prepare for or attend group sessions because of other responsibilities, and conflicts often result from differing skill levels and work ethics. When teams work and communicate well, however, the benefits more than compensate for the difficulties. One way to improve the chances that a team will work well is to agree beforehand on what everyone on the team expects from everyone else. Reaching this agreement is the goal of the next assignment.

TEAM EXPECTATIONS ASSIGNMENT

On a single sheet of paper, put your names and list the rules and expectations you agree as a team to adopt. You should deal with any or all aspects of the responsibilities outlined above: preparation for and attendance at group meetings, making sure everyone understands all the solutions, cooperating with the team effort, communicating frankly but with respect when conflicts arise, etc. Each team member should sign the sheet, indicating acceptance of these expectations and intention to fulfill them.

These expectations are for your use and benefit: we won't grade them or even comment on them unless you ask us to. Note, however, that if you make the list fairly thorough without being unrealistic you'll be giving yourselves the best chance. For example, "We will each solve every problem in every assignment completely before we get together" or "We will get 100 on every assignment" or "We will never miss a meeting" are probably unrealistic, but "We will try to set up the problems individually before meeting" and "We will make sure that anyone who misses a meeting for good cause gets caught up on the work" are reasonable.