Welcome!

I’m delighted to have you in this course this semester! I hope this course ignites a passion and purpose for your career and your life, and I hope that you find some part of the course to be transformative for yourself. In this course I have five general STEPS (acronym) that we will work toward this semester

- **scope.** You will know roughly 25-35 “standard problems” in the field, and be able to adapt and apply them as tools to solve or approximate new problems. We will focus on the important, well-studied, idealized problems listed in the Topics section of this syllabus.

- **translation.** You will be able to translate an engineering problem into the proper chemical engineering language, so that you can engage a dialogue with an expert. You will be able to ask questions, evaluate assumptions, and make drawings.

- **estimates.** By knowing solutions for standard problems, you will be able to “size up” and solve new and unfamiliar problems rapidly – a key advantage. You will learn to gather information, make sound approximations and assumptions, and compute results quickly.

- **perspective.** CENTER. I see Chemical Engineering as a beautiful and powerful set of tools. I see these tools as part of a larger vision of career and life success, characterized by the acronym CENTER = Character + Entrepreneurship + owNership + Tenacity + Excellence + Relationship. See [http://www.velegol.org/CENTER.htm](http://www.velegol.org/CENTER.htm). We will explore 2-minute career lessons each class.

- **safety.** I aim to create a safe space for you to learn. I want your grade to be commensurate with your demonstrated achievements in the learning outcomes, and I want to minimize risk. I also want your learning to be as fast and straightforward as possible -- no unnecessary pains!

estimates have approx. models, assumptions, approximations

### Course Details

Instructor: Professor Darrell Velegol. 108 Fenske Lab, 814-865-8739, velegol@psu.edu.

TA and IAs: Anish Dasgupta (aud224@psu.edu), Sean Halper (sxh456@psu.edu), Abdullah Albesher (aqa5450@psu.edu), Kimberly Shelton (kks5214@psu.edu).

Location: 101 Thomas.

Time: 3:35-4:25 MWF.

Pre-requisites: Prerequisite: or concurrent: MATH 251.


Homework: due as a single PDF file submitted on Canvas by 11:59 Wed in odd numbered weeks.

Tests: 3 mid-term tests in class (Wed of week 4, 8, 12), 1 final test (as Penn State dictates).

Office hours: We will answer questions about class material in Class and on the Discussion Board. For other matters (career, life challenges, opportunities), email separately for an appointment.

Emails to me: Always put “CH E 210” in the subject line, so that the email gets routed properly.

Web: Canvas (replacement for Angel), at [http://canvas.psu.edu](http://canvas.psu.edu).
Grading

I try to keep course grading as simple as possible:

- homework average (8 homeworks) 10
- tests (3 midterms at 20%, 1 final at 30%) 90

The grading scale is: A = 90%, A- = 88%, B+ = 86%, B = 80%, B- = 78%, C+ = 76%, C = 70%, D = 60%.

I do two things to keep grades clear: 1) There is no “curve” in the course. I haven’t used one for many years, and it has worked well. b) I do not “round”, so that a score of 87.96 gives a B+, not an A-. In this course, history shows that 50-70% of students who start, finish with a “C” or better. Of those students who finish, the history is that the course GPA is about 2.20. There are no dropped homeworks or tests.

Tips on improving test scores

The most common concern I hear about quizzes is “I didn’t have enough time.” I want you to do well on tests, and so here are some tips for improving speed and accuracy on tests:

- **study time.** If you have a super strong math background, take 6-8 h/wk (including class time). If not – and this is probably most students – take 10-12 h/wk.

- **study partner(s).** Find 1-3 study partners, who have a compatible schedule and work habits as you do. This is important for all your CH E courses.

- **problem creation.** In your study groups, create your own problem statements, and solve them. By working through all the details not only of problem solution, but of creation, you will blast your way to deeper knowledge. In other words, “think of the test, before you take it.”

- **repetition.** Rework problems done during lectures, and for homeworks. When you first do the problems, you often do them with others, and that can be helpful. But when you re-work problems, do them solo, and do them without the solutions nearby. If you struggle with a problem, do not look at the solution; rather, allow yourself to STRUGGLE with the problem. This is where real intellectual growth occurs. Practice – deliberate and well-done – builds speed and accuracy.

- **beginnings.** In re-working problems, focus more on the start of problems than the final calculations, which gives you more practice in the most challenging part of the problem.

- **summaries.** Write and maintain a 1-page study sheet – perhaps in the blank pages of your book – with the key concepts and equations. Keep updating this throughout the semester. Force yourself to distill the concepts over and over. Not only does this save you the time of searching through the book for the equation you want, but seeing all the equations at once can suggest to you ideas for how to attack the problem.

- **mark the data sections.** In your book there will be tables of data. Mark them with a post-it note or some similar tab, so that you can turn to the proper location very quickly.

- **details.** Sleep enough the night before the exam. Eat enough. Bring your calculator-pencil-book.

- **test anxiety.** See the Penn State sites at [http://tutorials.istudy.psu.edu/testanxiety](http://tutorials.istudy.psu.edu/testanxiety) and [http://studentaffairs.psu.edu/counseling/self-help_anxiety.shtml](http://studentaffairs.psu.edu/counseling/self-help_anxiety.shtml) (see below for contacting CAPS).

MAKEUP TEST. If you miss a test for some reason during the semester, and you let me know before the test that you will be missing it, you may take the makeup test that will be given at the end of the semester. This will be one test, with material from all sections of the course. You may do this for only one test. I won’t be able to do this if you do not let me know ahead of time. If you are having tremendous personal hardship, please visit CAPS. They can provide a letter that will enable me to help make adjustments.
RE-GRADES: If you think your test was not graded properly, please submit a re-grade request in writing, with the original quiz. Please 1) submit the re-grade request within one week of getting the test returned, 2) keep the request to a few sentences – if the request is too long, we'll return it to you to shorten, within the same 1 week time-frame, 3) suggest a specific remedy (e.g., “I believe that part c deserves 10 extra points”, or “please add this test to your ‘close calls’ folder”), 4) include your psu email (and gmail if you have one, not NOT your student ID).

NOTE: CH E 210 is a required C-grade course in the Chemical Engineering major. This means that students must receive at least a grade of C in order to graduate with a BS in Chemical Engineering. Furthermore, you will not be able to take any of the 300-level courses until you have obtained a C grade in CH E 210. Students receiving a grade below C will be required to re-take the class until they meet the C-grade requirement.

Notes on academic integrity
- Integrity is important to me. Violations will be sent through the Penn State system with vigor.
- You may work with others on homework assignments. In fact, I encourage it. Make sure you later work all the homework problems by yourself as well, so that you do well on the tests.
- If you work with others, list the names of the people you work with on the first sheet of your homework. For example, you could put your name, and then a few lines below, just write, “Worked with: person A, B, C ...” This is especially important when you get to homeworks involving Excel files for instance, where several of you might have the same Excel printout.
- Please do not submit a photocopy or similar of someone else’s homework. It will be handled as academic dishonesty.

Notes on submitting homework in the electronic dropbox.
- Late homework is not accepted for credit.
- Please submit only ONE PDF file, less than 5.0 MB. No other file type will be graded, nor larger files. If you need a PDF writer, get the free download from www.primopdf.com.
- Name your files with the assignment, your name, and the date, as “Doe, Jane CH E 320 homework 7, 2016 Jan 01.pdf”
- Include the assignment, your name, and the date on at least one page of the homework itself.
- Please make sure that if you scan your homework – and that is how most students submit online, using scanned copies of their originals – that your scans are legible. I have found that scanning in “grayscale” at 150 dpi works well, better than “black and white”.
- If you type your homework in Word, please use Equation Editor so that your equations are readable.
- Please submit all homework in “portrait” mode (upright), one page of homework per page. If the homework is sideways or two per page, it is too hard to grade on a computer screen.
- Please number your problems clearly, and please box your answers.

Honors Options
If you want to do an Honors Option in this course, please see me. The grade on your Honors Option will depend on your results, and will replace your median quiz grade. I have ideas, and they require a committed effort.
Resource for students with disabilities.
Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at http://equity.psu.edu/ods/.

In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at http://equity.psu.edu/ods/guidelines/documentation-guidelines). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.

Course Outcomes

By the end of the course, technically you will be able to …
- use mixed units and obtain the result in the desired units
- setup the equations and solve simple steady and unsteady-state balances.
- setup material balances for simple process flow sheets and analyze the degrees of freedom
- setup the stoichiometric table for one or two simultaneous reactions and perform material balance
- calculate material balances in processes with recycle and purge streams
- list numerous professional responsibilities of chemical engineers

Tentative schedule of topics
We will learn the topics below. Each semester brings a new set of students, with new interests and new abilities, and so adjustments will be made as the semester proceeds.

A Engineering calculations. Overview, career opportunities, ideal gas law, concentration and density, numerical calculation, estimates, approximations, units and conversions, manometers, experimental data and analysis, dimensionless numbers, Excel, ethics.

B Material balances on processes. Variables, equipment, process flow diagrams (PFDs), control volume, conservation equation, component balances, recycle-purge-bypass, pressure drop, draining tank, microscopic balances and math, process economics and ROI.

C Reactive processes. Stoichiometric table, extent of reaction, multiple reactions, kinetics and rate laws, continuous reactors, combustion reactions, catalysts, safety.

D Multiphase systems. Distillation, absorption, adsorption, extraction, separation processes, adsorption, extraction, phase diagrams.

* Possible topics (given throughout semester). Safety, financial documents (cash flow, balance sheet, other), Hysys, sustainability, continuity equation, startups, patents.
Chemical Engineering References

General references

- *Perry’s chemical engineers’ handbook*, 7th ed. Eds. Robert H. Perry and Don W. Green [TP151.P45 1997]. This classic reference text has extensive data, formulae, and design criteria for a very wide range of chemical engineering practices. To use this book, start with the index.
- *CRC CRC Handbook of Chemistry and Physics*. [QD65.H301] This classic reference text also has extensive data and formulae, but more for chemical products than about equipment and practice.

Thermodynamics


Transport phenomena


Chemical reactions


Process Design


Other books