

Course Objectives and Topics

Upon completion of this class, the student will be able to apply green engineering principals in evaluation, design, commercialization and use of processes and products.

Specific topics for this class include:

- Introduction to Green Engineering and Sustainability in Chemical Process Engineering
- Environmental Laws
- Green Engineering & Chemistry
- Environmental Health & Safety
- Green Chemistry Metrics
- Metrics in EHS
- Sources of Environmental Impacts
- Environmental Impacts of Utilities
- EPA Waste Reduction Algorithm and GREENSCOPE
- Life Cycle Assessment
- Total Cost Assessment
- Mass and Heat Integration
- Waste Minimization in Reactors and Process Intensification
- Waste Minimization in Separations

Textbook

Primary text:

David Allen and David Shonnard, Green Engineering, 2002, Prentice Hall.

Reference texts:

Concepcion Jimenez-Gonzalez, David Constable, Green Chemistry and Engineering, 2011, John Wiley & Sons.

David Brennan, Sustainable Process Engineering, 2013, Pan Stanford Publishing PTE, Ltd.

Paul Bishop, Pollution Prevention, 2000, McGraw-Hill.

Instructor

Dr. Connie Schall

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Instructor Office Hours

You are welcome to stop by my office at any time and if I can't see you at that moment we will make an appointment. Making an appointment by e-mail is the best way to set up a mutually convenient time.

Grading

Letter grades will be assigned based on the percentage of points accumulated using the scale: A, 90- 100; B, 80-89; C, 70-79; D, 65-69; F, below 65.

Exams & quizzes: All cell phones must be out of sight during an exam or quiz. Two exams will be given during the semester. Quizzes will be given periodically.

Homework: Homework is due at the start of class on the due date. Late homeworks will not be accepted and will be assigned a grade of zero. Most homeworks will be assigned one of three grades; $\sqrt{+}$ (95%), $\sqrt{}$ (82%); or $\sqrt{-}$ (70%). These homeworks will not be graded in detail. Solutions will be posted on the course website. Some homeworks will be graded on a scale of 1 to 100% (indicated on assignment).

Participation: A participation grade will be based on class discussion

The course point total will consist of a sum of the following items.

CHEE 4110

Exams (two)	56%
Quizzes	10%
Homework	9%
PFD (WaR & GREENSCOPE)	20%
Participation	5%

CHEE 6/8110

Exams (two)	50%
Quizzes	10%
Homework	5%
PFD (WAR & GREENSCOPE)	18%
Report & Presentation	12%
Participation	5%

CHEE6/8110: Report and Presentation: You will be assigned a topic for a group (two students) report and presentation of report summary and important findings to the class. You may formulate your own topic area or you may choose from one of the topics listed below. The written report must be submitted 10 days prior to your oral presentation. Sources of information in the report should be thoroughly cited (number references). You must cite at least three refereed journal articles in your report. All electronic source material should be submitted with the report with reference number indicated in the file name. The written report will be given to all students as assigned reading material.

You should prepare lecture material that will be presented to the class. This material can include a combination of formats including handouts, power point presentations or board work. Each student will provide an evaluation of the presentations. Presentations should be 30 minutes plus 5 to 10 minutes for questions and discussion.

Each presenter must prepare five short quiz questions that highlight the important findings in your report. The format of the quiz can be short answers, multiple choice or true and false.

The presentations will start on April 6th and will be scheduled for most Wednesdays in subsequent weeks.

Topic areas:

- *Environmental Impact of Natural Gas Drilling – Safety and Impact of Drilling Chemicals, Fugitive Emissions & Flowback*
- *Solar Panel Manufacture: Essential Materials & Elements – evaluation of world resources and impact of procurement*
- *Rare Earth Elements for Wind Turbines- evaluation of world resources and impact of procurement*
- *Sustainability of Concrete Manufacture*
- *Recycling & Recovery of Materials in Electronics*

Academic Misconduct Policy

Consistent with the University of Toledo Academic Dishonesty Policy (3364-71-04), a grade of zero will be given for any assignment in violation of the academic dishonesty policy. A failing grade for the course will be given for repeated offenses.

A grade of F for the course will be assigned for cheating on any exam. This includes: communicating during an examination in any manner with any unauthorized person concerning the examination or any part of it; and giving or receiving substantive aid during the course of an examination.

If you have any questions regarding this policy or what constitutes academic misconduct, please contact the instructor.