THE SUSTAINABLE WORLD

Syllabus for Chemistry 321, Summer 2015, SUNY Potsdam

Is it possible to maintain or improve our standard of living without depleting the world's resources and destroying our environment? Sustainable development is widely regarded as a responsible approach to economic growth- yet this is only possible if we can find new sustainable methods of using our resources.

In this one-semester, non-majors lecture course, sustainability is explained in terms of the Earth's carrying capacity and matter/energy flow, as a manifestation of the basic laws of chemistry. The course considers the roles of science, technology, government and business in shaping environmental policies and meeting the challenges of sustainability. It also examines different approaches that industry can use to produce materials and goods while minimizing environmental impact. The chemical industry is used as an example of how manufacturing must change, and how this has (or has not) been achieved in practice.

Format
Online lecture/seminar/discussion combination.

Prerequisites
One semester of college-level science.

Instructor
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Class wiki: *http://pluto.potsdam.edu/wikichem/index.php/Chem321:Welcome* (password required)
Office hours: 10-11am, Mon-Fri unless otherwise posted.
You should receive a response within 24 hours to an email or a message on my wiki page.

Text
"An Introduction to Sustainable Resource Use" by Callum Hill, Earthscan Publications Ltd., 2011, ISBN 9781844079278. This will be greatly supplemented by readings from other sources, as well as videos.

Technology needs
You will need a computer with a good internet connection and a modern browser such as Mozilla Firefox or Google Chrome. To get the full benefit from the slide presentations, you will need Microsoft Powerpoint or its free equivalent (Impress) from LibreOffice (*www.libreoffice.org*) or Apache OpenOffice (*www.openoffice.org*). You should also have Skype available for group discussions.

Course wiki and Moodle site
A **wiki** is a user-editable website, and the course wiki will be the main "classroom" for this online course. This will be where you look at lectures, participate in discussions and contribute assignments. Writing on the wiki is very simple, but you will have a chance to learn & practice at the start of the semester. You will be expected to check in on the wiki at least once every weekday (unless this is waived by the instructor), and you will be posting in weekly discussions. Students will be broken up into groups of five or less, and each group will participate in a twice-weekly discussion for fifty minutes (at a time that is mutually agreed by the group). The online version of any document supersedes any offline version (PDF, Word file).

Moodle is a restricted-access course management system, and the Moodle site for CHEM 321 may be used as a repository for alternative versions (e.g., PDF or Microsoft Word) of some documents, including this syllabus. It will also contain the grade book, where your grades (marks) are only visible to you and your instructor.

Schedule

This is included below, and it is also available on the wiki at *http://pluto.potsdam.edu/wikichem/index.php/Chem321:Schedule* and as a static document in Moodle. This includes links to weekly schedules to guide you through the course, beginning with week one. In addition, on the wiki there is a "daily tasks" page updated each day, where you will be checking in.

Content

For details on the content, please see the schedule, which lists the course units. The course approaches environmental problems, sustainability and manufacturing from a scientific perspective. No formal chemistry background is required. General chemical concepts will underpin nearly all of the course material, but details of chemical reactions will not typically be discussed.

The readings from the textbook form an important foundation for the course material. There is also a series of course units, based on slide presentations on the course material, roughly three per week. These presentations take the place of lectures in a traditional college course. They should be studied carefully, because many of the assignments and other graded work will be based on this material (as well as the textbook). There is a Powerpoint version for study, and a PDF version for printing. These presentations may contain interactive quizzes at appropriate points, to help you to assimilate the content. This material will be enhanced by a variety of other readings and videos. The course content for each week is given in the course schedule, with more details given on the individual week's page. Topics covered include: Sustainable development, government policies, economics of sustainability, science & technology, manufacturing, waste, energy, agriculture, mining, environmental management, green chemistry, green engineering, and planning for the future.

Learning objectives

By the end of the course, the student will have demonstrated (through assessments outlined below) a basic understanding of the core concepts of sustainability and sustainable development, particularly from a scientific perspective. The student will be able to show knowledge of the impact of sustainability on science & technology, manufacturing, waste, energy, agriculture, mining and environmental management. The student will have participated in a role-playing scenario, through which they will present work that successfully integrates the "book learning" with real-world problems.

General education component

This course is designed to provide the students with an introduction to the physical sciences. As such, the course incorporates the scientific method, both explicitly as coursework, and implicitly in assignments where students need to develop their own hypotheses and defend them. The environment provides many excellent case studies where students can examine data, explore causal relationships (Does human activity cause climate change?), and evaluate alternative hypotheses. Science and technology, including their differences and codependence, are studied explicitly as one of the 14 course units.

Grading
The final grade will be based upon a combination of five assignments (6% each), one case presentation (10%), a term paper on a sustainable technology (15%), weekly discussions (20% total), a role-playing scenario (5%) and a final exam (20%). SUNY Potsdam uses a point system for final grades, ranging from 4.0 (A, excellent) down to 0.0 (F, fail); the minimum pass grade is 1.0, though a 2.0 grade may be needed if the course is to count as an elective for a major. Please see *http://www.potsdam.edu/offices/registrar/grades/index.cfm* for more details.

Assignments
http://pluto.potsdam.edu/wikichem/index.php/Chem321:Assignments
The five problem sets and the papers will be done via the wiki, and after submission the papers will be visible to the entire class. Papers will be submitted to the wiki under the Creative Commons Share-Alike license and may be published more widely (though they can be deleted upon request by the student). Work may initially be done offline in word processing software such as Microsoft Word, but it should be uploaded and formatted for the wiki in order to receive a grade.

Term Paper
You will be expected to write and present on a paper of around 2000 words on one particular green product or process. The product or process should already exist and should have reached at least the prototype stage.

Role-play/Case presentation
Students will take on various roles on the environmental committee of a fictitious chemical manufacturing company. One assignment will involve at least two "virtual meetings" taking place during the regular discussion timeslot, when environmental problems will be reviewed and an environmental management system will be discussed. You will also need to write a paper, give an oral presentation, or upload a video (you can choose your preferred medium), making the case for (or against!) the company to invest in something to meet its sustainability goals. This part of the course aims to bring home the real-world problems of managing resources and designing a sustainable manufacturing enterprise.

Discussions
"Real-time" discussions on the specified topics will be described on the wiki, and held on Skype or Etherpad at least twice a week. Each group will have one or more 50 minute time slot set aside (at a mutually acceptable time), so a group of us can all "talk" about the topic in real time. If we have a small class, we can hopefully find one single time slot; if the class is larger we may set up other times, but your attendance will only be required at least twice per week. If you need to work at variable times, we will design a variable schedule to match. Your grade will depend on your level of contribution, and missing more than two discussions will result in an automatic fail.

In addition to these discussions, there will also be an "asynchronous" discussion held weekly, where you post your comments alongside others. You should make one statement of your own viewpoint, then at least two substantial responses to others' comments. You may make your comments at any time over a three day period. For times and more details on both types of discussion, see the discussions page at *http://pluto.potsdam.edu/wikichem/index.php/Chem321:Discussions*

Disabilities
If you have a documented disability that may affect your ability to participate in the class, please let me know at the beginning of the course.

Finally
I am here to help! Please contact me if you are falling behind or experiencing other difficulties, and I will do what I can.

Chemistry 321 Class Schedule Summer 2015				
Dates	**Unit**	**Topics**	**Readings**	**Assignments**
July 6-8	Unit 1	What is sustainability? What is sustainable development? Agenda 21, government responses to sustainability. Current environmental problems.	Hill Ch. 1	
July 9-10	Unit 2	Economic & political aspects	Hill Ch. 1	
July 13-14	Unit 3	Science and technology. Matter, energy and thermodynamics	Hill Ch. 2	Problem Set 1 due (July 13)
July 14-16	Unit 4	Business and sustainability, uses of technology, manufacturing	Dorf reading	Problem Set 2 due (July 16)
July 17	Unit 5	Consumption	Hill Ch. 4	
July 17	Unit 6	Impacts, carbon footprints, waste management & reduction	Hill Ch. 5, EPA vision	
July 20-21	Unit 7	Energy resources		Problem Set 3 due (July 20)
July 22-23	Unit 8	Material resources and mining, chemicals	Hill Ch. 3, 7	First draft of case presentns. due (July 23)
July 24	Unit 9	Forestry, food & agriculture	Hill Ch. 8	Problem Set 4 due
July 27	Unit 10	Environmental management systems and ISO 14000	Sample plans	Final draft of case presentations due
July 28-29	Unit 11	Ecologic, green engineering, green chemistry, green manufacturing	Hill Ch. 6, Anastas video	Problem Set 5 due (July 29)
July 30	Unit 12	New business models		First draft of term paper due
Jul 31-Aug 3	Unit 13	Models for sustainable living	Hill Ch. 9	
Aug 4-5	Unit 14	What does the future hold?	Hill Ch. 9	Final draft of term paper due
Aug 7		Final exam		

Note: Additional readings will be assigned as the semester progresses.