Introduction to Green Chemistry (CHMD89H) – Fall 2017
University of Toronto at Scarborough

Welcome to CHMD89! This course will introduce you to the growing field of green chemistry – an interdisciplinary approach to chemistry that strives to develop environmentally benign chemical reactions and processes. The course will begin by introducing the twelve principles of green chemistry followed by the use of green chemistry metrics for quantifying 'greenness.' In this context, we will move on to explore major areas of green chemistry research including alternative solvents, catalysis and renewable feedstocks. Examples from industry and from the current literature will be used to reinforce the material and highlight recent advances. The topics covered will be multidisciplinary in nature and will draw on aspects of organic, inorganic and polymer chemistry. Prerequisites for this course include CHMB31 and one of either CHMC41 or CHMC42; CHMC31 is recommended, but not required.

Please take a few minutes to read through this document. It contains important information that will help ensure your success in this course.

Instructor:

Dr. Effie Sauer
EV554
Email: esauer@utsc.utoronto.ca
Office Hours: TBD

Lecture Schedule:

Wednesdays 9 am - 12 pm in EV140 (Boardroom)

Website:

CHMD89 maintains a Blackboard web space which archives a variety of course-related information including: class announcements, assigned readings, grades, discussion board posts, contact information and links to outside resources. In addition, class emails will periodically be sent via Blackboard. ***In order for you to receive these emails, you must have a valid "utoronto.ca" email account registered with ACORN.***

Method of Evaluation:

Your grade in this course will be calculated as follows. More detailed descriptions of each item can be found below.

Problem Sets (3)	30%
Quizzes (3)	15%
Writing Assignment	35%
Presentation	10%
Course Participation	10%
Total	**100%**

Problem Sets:

There will be three problem sets due throughout the semester, each worth 10% of your final grade. You are welcome to collaborate with your peers while working through the problems; however, each student is expected to hand in their own original work for grading.

Quizzes:

There will be three quizzes during the semester, each worth 5% of your final grade. The questions will be based on lectures and readings from prior weeks; however, the dates of the quizzes will not be announced in advance.

Assignment:

After selecting a current topic of interest within the field of green chemistry, you will write a critical review of the recent advancements made in this area of research. You will use the principles of green chemistry and the metrics discussed in class to critique the recent research in your selected area. As part of this assignment, you will also be asked to formulate your own ideas for future research directions in this area. The grade for this assignment will be made up of three components. Details on each will be provided on Blackboard.

5 pts - Topic selection/proposal (including in-person discussion with Dr. Sauer)
10 pts - Detailed outline
20 pts - Final paper

Presentation:

Working in pairs or individually, students will select a Canadian researcher working in Green Chemistry to profile during the last week of classes. Presentations will cover the major research interests of the researcher, as well as a summary of a recently published article.

Course Participation:

A significant portion of your grade will come from your participation in the course. For the most part, this means making a *meaningful* contribution to class discussions; however, there are other ways of contributing that may also be considered when assigning your grade such as posing thoughtful questions during student presentations, or one-on-one exchanges via email or office hours (provided they demonstrate critical thought about the course material). Below is a sample rubric of how I will grade your in-class participation.

	Excellent	**Needs Some Improvement**	**Unsatisfactory**
Listening	Actively and respectively listens to peers and instructor	Sometimes displays lack of interest in comments of others	Projects lack of interest or disrespect for others
Preparation	Arrives fully prepared having thoroughly read and thought about the assigned readings	Sometimes arrives unprepared of with only superficial preparation	Exhibits little evidence of having read or thought about the assigned readings
Quality of Contributions	Comments are relevant and reflect a deep understanding of the material and the remarks of other students	Comments are sometimes irrelevant, suggesting a lack of preparation, or lack of attention to previous remarks by students	Comments reflect little understanding of either the assigned readings or the remarks of others
Impact on Seminar	Comments frequently help move the conversation forward	Comments sometimes advance the conversation, but other times do little to move it forward	Comments do not advance the conversation or are actively harmful to it
Frequency of Participation	Actively participates at appropriate times	Sometimes participates but at other times is "tuned out"	Seldom participates and is generally not engaged

Lecture Schedule (tentative):

Date	Lecture Topic	Course Work Due*
Sept 6th	Introduction to the course; The 12 principles of green chemistry	
Sept 13th		
Sept 20th	Green chemistry metrics	
Sept 27th	Life cycle analysis; Intro to the solvent problem	
Oct 4th	The solvent problem (and some solutions!)	Problem Set 1
Oct 18th		Assignment Proposal
Oct 25th	Catalysis	Problem Set 2
Nov 1st		Assignment Outline
Nov 8th		
Nov 15th	Renewable feedstock chemicals	Problem Set 3
Nov 22nd	Commercialization of Green Chemistry Technologies	Final Paper
Nov 29th	--- *Student Presentations* ---	Presentation

*Unless otherwise instructed, all graded work will be due at the start of lecture.

Texts:

There is no required text for this course; however, there are several recommended texts from which I will be assigning readings throughout the semester. They may also prove useful for your problem sets and assignment. Each is available either online through the UTSC library website, or on reserve in the library for 3-hour short term loans. In addition, articles from the primary literature will be assigned as reading on a regular basis.

1) Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*; Oxford University Press: New York, 2000.
   (on reserve at the UTSC library)
2) Lancaster, M. *Green Chemistry: An Introductory Text*; RSC: Cambridge, 2002.
   (available online through the UTSC library website)
3) Tundo, P.; Perosa, A.; Zecchini, F. *Methods and Reagents for Green Chemistry: an Introduction*; Wiley: Hoboken, 2007.
   (available online through the UTSC library website)
4) Rothenberg, G. *Catalysis: Concepts and Green Applications*; Wiley: Weinhein, 2008.
   (available online through the UTSC library website)

Late or Missing Work:

Late work will be accepted at a penalty of -10% per day (including weekends/holidays) for up to 5 days from the due date; after day 5, a grade of zero will be assigned. Missed quizzes will result in a grade of zero (no make-ups). Should you miss a quiz or due date for a legitimate reason, you must contact Dr. Sauer as soon as possible and submit appropriate documentation. If the reason for your absence is medical, a UTSC medical note must be submitted http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf).
Note that the completed note must meet the following criteria:

- A doctor must have examined you during the period of illness/injury (not after the fact).

- The missed quiz/submission date must fall within the indicated start date and anticipated end date.
- The physician must rank your illness as either moderate, serious or severe; illnesses deemed mild or negligible will not be considered valid excuses.

Accessibility:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Access*Ability* Services Office as soon as possible. I will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

Academic Integrity:

Academic integrity is one of the cornerstones of the University of Toronto. It is critically important both to maintain our community which honours the values of honesty, trust, respect, fairness and responsibility and to protect you, the students within this community, and the value of the degree towards which you are all working so diligently. According to Section B of the University of Toronto's Code of Behaviour on Academic Matters http://www.governingcouncil.utoronto.ca/policies/behaveac.htm which all students are expected to know and respect, it is an offence for students to:

- To use someone else's ideas or words in their own work without acknowledging that those ideas/words are not their own with a citation and quotation marks, i.e. to commit plagiarism.
- To include false, misleading or concocted citations in their work.
- To obtain unauthorized assistance on any assignment.
- To provide unauthorized assistance to another student. This includes showing another student completed work.
- To submit their own work for credit in more than one course without the permission of the instructor.
- To falsify or alter any documentation required by the University. This includes, but is not limited to, doctor's notes.
- To use or possess an unauthorized aid in any test or exam.

There are other offences covered under the Code, but these are by far the most common. Please respect these rules and the values which they protect. Offences against academic integrity will be dealt with according to the procedures outlined in the Code of Behaviour on Academic Matters.

Turnitin.com:

Normally, students will required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.