University of Guelph

College of Engineering and Physical Sciences

Department of Chemistry

Chemistry & Industry (CHEM*4010) Winter 2020 [0.50 credit]

Instructor	Khashayar Ghandi; Department of Chemistry
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Prerequisite(s)	CHEM*2700, (CHEM*3430 or TOX*3300), (1 of IPS*1510, MATH*1210, MATH*2080)
Classes	MACN 118; LEC Mon, Wed, Fri: 11:30AM - 12:20PM
Office hours	Fridays 2:30 to 3:30.

Course Description

This course examines industrial processes for the production of organic and inorganic chemicals. The environmental impact and the challenges of a large-scale operation will be considered alongside the actual chemical processes involved. The chemicals could be at the molecular level or material level that involve many molecules. Also, the chemicals could be used directly or be feed streams to other industries such as energy industry. Therefore the course also examines different aspects of energy industry.

The course material is conveyed mostly through lectures, seminars and active participation of students in discussions in lectures and seminars associated with this course. The course is organized in a way to facilitate research by students related to industry and chemistry, facilitate discussions in class, and also teach presentation skills to students related to subjects of this course. Many of the lectures involve presentation of students. Due to the vast fields involved it is inevitable to focus on only a selection of relevant material. The topics of material to be covered are:

1. Innovation in chemistry and business aspects of chemistry (this will address some futuristic aspect of chemistry in the context of industry).

2. The students will learn how to write a review on a subject related to the interface of industry and chemistry (in the broadest sense) on a topic that is within the interests of the student. **The subject will be selected in the first two weeks of classes (should be approved by instructor). The due date for review paper is March 1, 11 pm. All reports should be submitted electronically and in word**

format. The presentation associated with the review is due from Feb 28 (determined by a draw in class on the first day of class.).

3. How to write research proposals and plans for industries that would make business sense on ideas related to industrial applications of chemistry. This will involve topics related to innovations in industrial chemistry.
4. Inorganic material in industry including in energy industry and electronics.
5. Organic material in industry including those used for energy storage, fuels and organic material for electricity generation in general.
6. In addition to discussing the chemical industries processes, part of the course will include an overview of energy and power, sources of information on matters related to the interface of energy and environment, efficiency and energy conservations, principles of electricity generation, energy consumption trend, fossil fuels and their environmental impact, greenhouse effect, introduction to nuclear energy, CANDU reactors, environmental impacts of nuclear energy, future generation of nuclear reactors, fuel cells, and bioenergy.
7. Chemical resources production, population growth and sustainability.
8. Whenever possible, policy making at the interface of chemistry and industry will be discussed.

Students by the end of semester should be able to:

1. explain the details of at least one particular chemical industry in depth,
2. use effective communications skills for oral presentations while strengthening their skills in working with different sources to develop research and analytical skills in industrial chemistry,
3. write a research proposal to address problems in industry, using their chemistry knowledge.
4. understand the introductory topics in industrial chemistry,
5. analyze the modern literature on issues related to application of chemistry in industry,
6. evaluate the environmental impacts of chemical industries described above,

Resources will be made available electronically (including lecture notes, reports and review and research articles that will be provided to the students) on D2L CourseLink site.

Marking scheme

The marking scheme is as follows:

- 28 percent: active contribution/involvement in class discussions and seminars (the most important component is asking questions during presentations and answering the questions that would be asked during the lectures after group discussions), 10 marks are for asking pertinent questions

regarding the content at the advanced academic level appropriate for a 4000-level course during seminars, and 18 marks for demonstrated ability to answer questions that are asked mostly to trigger the group discussions during lectures. When a question is asked for group discussions, after a certain amount of time allocated for group discussions, the groups are invited to answer the questions. Those groups that have the right answers will receive the mark for that answer. Some questions will be asked during the classes and seminars and some questions will be asked in form of assignments.

- 34 percent for a review paper. The review is expected to be around ten pages single space, excluding an additional reference section (28 percent is for written review). 6 percent for presenting the review to class in a 10 minutes presentation (3 percent for presentation and 3 percent for answering questions). There will be ~ 5 minutes for questions and answers after each presentation. The presentation time/date was determined by a random draw in the first day of classes but students could switch their presentation times among each other if they wish by mutual agreements. The students will have a chance to vote if they want to give marks to other students' presentations or if they prefer if the presentations are only marked by the instructor.

- 38 percent is the take home exam that will be a research proposal or an innovative and inventive plan (that makes business sense) on a topic of your interest (to be approved by the instructor, therefore I recommend that you consult the instructor before March 1). Submission deadline is the third day of the exam period.

Nature of Classes

The classes will be a mix of lectures and seminars (mostly by students) and significant amounts of collaborative guided inquiry. Many classes will have short discussion periods.

Guidelines for the review paper

Your review can be on a subject that deals with any aspect of chemical industry (chemistry, energy, material science, environmental impacts, mathematical modeling, economic analysis or policymaking). The topic should be of interest to you and also approved by the instructor. The report is expected to provide a summary and/or a synthesis of the findings of selected research contributions being published by different authors on that topic over the last 2-5 years (the time window will be decided by instructor based on the topic). The main purpose of your review is to examine the current state of the relevant publications including refereed research papers and patents on the given topic and to initiate a discussion about the research methodologies and the findings related to the said topic. Therefore, your review should contain a comprehensive list of supporting references being thoroughly cited in the text. The amount of text should be balanced with the number of figures so that the addressed issues are clearly stated in an efficient way. The most important learning experience here comes from your efforts in transforming a collection of technical information into a coherent script which provides an alternative point of view on previously unknown or not well understood relations among distinct studies. Please note that the review has to provide media for discussions about the topic not just summarize the features of each cited paper. It should transform the presented information into an inspirational material that is basis of your short presentation to class. Note that to

have an inspirational material does not mean to accept everything you read in the publications. It could well be a critical review in which you state what could be wrong in some of the works that you have reviewed.

Guidelines for your take home exam (preparing a proposal based on a novel idea)

You review the literature first related to your proposed idea to make sure your idea is indeed novel. It is OK to write your proposal on a subject that you wrote your review paper on. You should put your idea in the context of existing literature. In the next stage, you need to outline your plans for the research in a step by step manner addressing both long and short term aspects. Eventually you need to refine your plans and consider as much as you can the potential pragmatic aspects, what can be learned from this study, what are the potential problems that needs to be solved, how you would collect the data, how you would extract the information, how you would design your setup, what computational methods you will use, why and how you would take care of safety aspects or research ethics if required, etc.

If you choose to write an industrial chemistry related business plan instead of a detailed research proposal, then instead of focusing on detailed step by step research plan towards answering fundamental chemistry questions to solve industrial problems, your focus will be on market for a practical idea and some economic estimations. In this case the important aspects are: 1) potential market, 2) innovation, 3) clear existence of an inventive step. These are the subjects that will be discussed in detail during our lectures.

In the case of a research proposal the program details are more important and you would be dealing with the fundamental questions that would be important to address a certain industrial issue. More details will be discussed in the lectures.

E-mail Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for Academic Consideration.

Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.
Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Policy for late work
If the late work is not due to a health issue any late work after 48 hours will receive zero. For any hour late submission, there would be 0.5 percent penalty up to 48 hours.

Academic Integrity
The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

I hope that you will enjoy the course and find it rewarding. I welcome your comments and suggestions at any time.