**Department of Chemistry, Western University**

**Chemistry 3330F 2016-2017**

**Industrial Chemistry**

**Instructors:** J. Clara Wren, jcwren@uwo.ca, ChB 019  
(Course coordinator)  
Brian L. Pagenkopf, bpagenko@uwo.ca, BGS 2020

In addition, several speakers are invited from the local chemical industry.

**Office hours:** By appointment or after class

**Lectures:** Monday, Wednesday and Friday at 12:30 pm in ChB 09.

**Prerequisite(s):** Either Chemistry 2273A and 2283G or Chemistry 2213A/B, or the former Chemistry 253; either Chemistry 2384B or Chemistry 2214A/B or the former 2284B, or the former Chemistry 254.

**Antirequisite(s):** The former CBE 2216, or the former Chemistry 358a/b.

*Note: Unless you have either the prerequisite for this course or written special permission from your Dean to enrol in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.*

**Course Materials:** There is no required text for the course. See the attached list of reference materials.

**Evaluation:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight (%)</th>
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<tbody>
<tr>
<td>Writing Assignments (3 x 10%)</td>
<td>30%</td>
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<tr>
<td>Peer Review (2 x 2.5%)</td>
<td>5%</td>
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<tr>
<td>7-min Presentation (on one of the writing assignment topics)</td>
<td>10%</td>
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<tr>
<td>3 Midterms (in class, except for the last one) (15, 25, 15%)</td>
<td>55%</td>
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You must complete the writing/peer review/presentation assignments, and the midterm exams to pass the course.

**Approximate Dates**

<table>
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<tr>
<th>Component</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>Writing/Peer Review Assignments</td>
<td>Sept 30/Oct 5, 2016</td>
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<td>Oct 31/Nov 4, 2016</td>
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<td>Nov 18/Nov 23, 2016</td>
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<tr>
<td>Mid Terms</td>
<td>Oct 7/Nov 11/TBA, 2016</td>
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**Course Description:** Industrial applications of chemistry including a survey of the chemical industry and its principal products; mass and energy balances as applied to chemical processes and the comparative economics of chemical processes will be discussed.
Important Announcements:

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Plagiarism

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Electronic Device

Electronic devices, other than a hand calculator, will not be permitted on tests and exams.

Illness or other serious circumstances

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid supporting documentation to your instructor (missed assignment deadlines) or the Academic Counselors in the Dean's office (for a missed midterm/exam) as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see:

Students seeking academic accommodations based on medical (physical or mental) illness should begin by contacting the Academic Counsellors of their home faculty. Please visit the following link for policy on Accommodation for illness:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

Accessibility

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 for any specific questions regarding an accommodation.

Other Links

Registrarial Services: https://www.registrar.uwo.ca
Student Development Centre: https://www.sdc.uwo.ca
University Students’ Council: https://westernusc.ca/services/
Course Topics:

Part I. Industrial Physical/Inorganic Chemistry (JCW)

1. Nuclear Energy Production
   Underlying principles for energy production; Different reactor designs; Fuel enrichment; Coolant types; Neutron activation; Fission products; Waste treatment and disposal; Chemical issues (water chemistry control, corrosion).

2. Isotopes and Radiation
   Isotopes; Radiation sources; Ionizing radiation and radioactivity; Nuclear medicine – diagnosis, therapy and surgery; Food irradiation; Chemical and materials processing; Synchrotron spectroscopy.

Part II. Industrial Organic Chemistry (BLP)

3. Pharmaceutical Chemistry
   Drug approval process; Process chemistry

4. Petroleum Chemistry
   Distillation; Thermal cracking; Hydrotreating; Catalytic Cracking and Reforming

5. Primary Organic Chemicals
   Synthesis Gas; Methanol and other chemicals from methane; Chemicals derived from ethylene, propene, and butenes; Basic aromatics and derivatives

6. Polymer Chemistry
   Terminology; Types of Polymers; Polymerization: Chain growth versus Step growth; Copolymerization

7. Surfactants, Soaps and Detergents
   Anionic, cationic and non-ionic surfactants; Detergent formulations

Part I. Industrial Physical/Inorganic Chemistry - continued (JCW)

8. Ammonia Production: Haber-Bosch Process
   Use of ammonia; Production challenges; Optimization; Van’t-Hoff equation versus Arrhenius equation; Le Chetaliere principle; Catalyst.

Course-Specific Expectations

1. Recognize the importance of the chemical and materials science underlying a range of industries.
2. Be able to identify and describe the underlying principles of physical and chemical processes and technologies relevant to industry.
3. Recognize the constraints and limitations that the industrial processes and technologies need to work with and the optimization methodologies that address the constraints.
4. Be able to explain, integrate and apply relevant knowledge to problems that emerge from industry’s responses to environmental, health and energy issues.

5. Obtain information from library, online and literature resources on the technical and scientific processes used in the chemical, energy, pharmaceutical and materials industry sectors.

6. Integrate, and critically assess any collected data.

7. Be able to prepare logical, organized and concise written reports, and oral presentations that effectively communicate industrial processes and technologies to classmates.

**Soft-Skill Expectations**

1. Analyze and critically assess problems, and take a systematic approach to solve them.
2. Work independently.
3. Form productive and collaborative working relationships with other individuals.
4. Obtain, evaluate, and integrate information from various sources, and determine its relevance.
5. Prioritize a set of tasks and manage the use of his or her time.
6. Execute mathematical calculations accurately.
7. Communicate thoughts, ideas, and observations verbally and in writing.
8. Recognize when to seek assistance.
9. Develop respect for, and comply with, regulations and policies.
10. Learn to accept responsibility for his or her decisions, actions, and non-actions.

**Reference Materials:**


**Books in Stack S2:**


**Database:**

*SciFinder Scholar* (1907 - current) can be used to search the chemical literature for information on chemical substances and reactions, research topics, patents, and author names. Go to the Libraries website, select Data Bases by Title, under the letter S select SciFinder Scholar, log in, and begin search.