

SYLLABUS
16 NOVEMBER EDITION
INDUSTRIAL CHEMISTRY
CHEM 470, FALL 2019

Tuesday/Thursday, 11:10-12:25 pm, Room 2121

Professor John A. Gladysz
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Office Hours

Tuesday 12:45 pm – 1:45 pm
Wednesday 12:00 noon – 01:00 pm

Dr. Gladysz can be available at additional times by appointment (best done via the administrative assistant below). He is generally "off limits" during nights and weekends (the times he devotes to graduate courses and research).

Communication

In connection with his Editing and University responsibilities, Dr. Gladysz receives approximately 200 e-mails per day (often more) and alternative communication modes are appreciated when feasible. For example, many matters of a routine nature can often be directed to the e-mail address of the administrative assistant, Ms. Susan Burton: susan.burton@chem.tamu.edu

Administrative Assistant

Ms. Susan Burton (susan.burton@chem.tamu.edu) is available on most days from 08:00-12:00 and 13:00-17:00 in 318 Reed McDonald (RMD). She maintains the records for the course.

Course Description and Prerequisites

Applications of organic and inorganic chemical reactions in the manufacture of commercial chemical products; chemistry of petroleum refining and petrochemical processing; industrial polymerization processes; commodity and fine chemical production; influence of kinetics and thermodynamics on economics of chemical production; pollution abatement technology.

Prerequisites

CHEM 228 and junior or senior standing.

Course Overview

The course will treat diverse industrially relevant chemistry topics from the fields of petrochemicals, pharmaceuticals, polymers, bio-derived chemicals, inorganics, etc. Both the production and application of such compounds will be presented, including consumer uses such as medicines, foods, clothing, sports equipment, microelectronics, hair care, and cosmetics. The course is expected to be of broad interest, with coverage of the fundamental chemistry involved, as well as the legal and business sides of the chemical industry, from large-scale corporations to entrepreneurial start-ups. Periodic guest lectures from experts and A&M alumni who are working in the chemical industry will be presented.

Course Objectives

The main course objective is to provide an overview of industrial chemistry in terms of chemical properties and uses, fundamentals of chemical reactions involved, technological practicality of engineering processes for chemical production, and economic drivers to business development. The importance of the chemical industry to society will be a key focus for selection of topics for discussion, including chemistry that promotes food production (fertilizers, nutrients, antibiotics,

etc.), security (rubber, ballistics, explosives, armor, microelectronics, etc.), clean water (membranes, chlorination, etc.), health (soap, pharmaceuticals, etc.), beauty (hair and skin products, etc.), among others. Historical manufacturing trends will be reviewed, and the possible evolution of manufacturing in the future will be discussed.

Learning Outcomes

Demonstrate familiarity with industrial chemistry and its benefits to society.

Demonstrate an understanding of the properties of commercial chemicals and their uses.

Identify chemical reactions involved in the production of major industrial chemicals.

Diagram technological practicality of engineering processes for chemical production.

Define economic drivers to business development.

Consider the evolution of chemical industry needed to meet future environmental/societal needs.

Solve chemical problems using the basic generalizations and principles covered in the course and reasoning by deduction and analogy.

Textbooks

(1) Tyrell, J. A. *Fundamentals of Industrial Chemistry – Pharmaceuticals, Polymers and Business*. (FIC) Hoboken, NJ: John Wiley & Sons, Inc., 2014. ISBN: 978-1-118-61756-4

(2) Cayuela Valencia, R. *The Future of the Chemical Industry by 2050*.

(FCI2050) Weinheim, Germany: Wiley-VCH, 2013. ISBN: 978-3-527-33257-

to access the textbooks in electronic form via the library, use the following urls:

<http://proxy.library.tamu.edu/login?url=https://ebookcentral.proquest.com/lib/tamucs/detail.action?docID=1680242>

<http://proxy.library.tamu.edu/login?url=https://ebookcentral.proquest.com/lib/tamucs/detail.action?docID=1162077>

Handouts and Supplementary Materials

Please go to *eCampus* in your *Howdy* portal (<https://howdy.tamu.edu/cp/home/displaylogin> and log in with your NetID and Password and then click on the eCampus icon at the top of the page) for copies of all course handouts and materials.

Requirements and Grading

midterm examination	100 points (16.7%)	(Thursday 10 Oct, in class)
final examination	200 points (33.3%)	(Friday, 06 Dec, 3:00-5:00 pm)
in class presentation	100 points (16.7%)	(class dates between 05 Nov and 14 Nov)
term paper outline	025 points (04.2%)	(Tuesday, 22 Oct, in class)
<u>term paper</u>	<u>175 points (29.2%)</u>	<u>(Tuesday, 03 Dec, in class)</u>
<i>Total points</i>	600 points	

The class GPA likely will likely be close to that of past years. Last year this course was taught by Dr. K. Wooley, who gave the following grades: A, 6 (33%); B, 7 (47%); C, 2 (13%); D, 0 (0%).

General Exam Policies

Each exam will emphasize course material covered during the interval since the previous exam. However, the course material will build over the semester, so that each exam will involve concepts discussed throughout the semester. Note below that half of the questions on the final exam will come from in class presentations given by the enrolled students.

Access to personal calculators, smart phones, smart watches, and similar devices is forbidden during exams.

Attendance at all exams is rigorously required. Only absences officially sanctioned by University regulations are allowed. Makeup exams must be completed for all missed exams. All makeup exams will be oral exams.

In Class Presentation

This will be one vehicle for covering the content in the FCI2050 book. Four students will give four

presentations of 15-20 minutes length in each of four class periods. These may cover any of the "future" topics in FCI2050 but none from Chapter 3 ("the chemical industry in 2010"). The idea is that each of the four teams will cover a somewhat unified theme. Examples may include: "adapting to shifts in feedstock availability"; "emergence of a recycling industry"; "consequences and mitigation of climate change"; "biofuels and chemicals from sustainable sources"; "what does universal health care mean for chemistry"; "the future of green chemistry and the E-factor".

The weekly "house organ" of the American Chemical Society, "*Chemical & Engineering News*" or *C&EN* also extensively covers industrial chemistry (as well as academic chemistry). Industrial topics treated in *C&EN* are also "fair game" for the in class presentations (many overlap with or are complementary to FCI2050 content).

Each student will distribute two potential final exam questions germane to his/her presentation. It is the intention of Dr. Gladysz to use half of these on the final, where they will count for at least half the points. So, this can sort of be viewed as "make your own final exam in advance".

Grading of in class presentations (20% each):

- (1) topic and presentation looks towards the future?
- (2) content
 - 2.1. substance and at in-depth content that indicates a well researched talk?
 - 2.2. powerpoint file submitted immediately following presentation?
- (3) organization
 - 3.1. main source literature referenced?
- (4) quality of slides and graphics
 - 4.1. labels on x and y axes of graphs easy to read?
- (5) quality of exam questions proposed
 - 5.1. do-able for someone who attended the presentation?
 - 5.2. answers can be found in the powerpoint file for the presentation?
 - 5.3. question can be "graded" (an imprecise/vague question can be impossible to grade)

Term Paper and Outline

There will be one major writing project, which will involve research, drafting of an outline (due 22 October), and completing a term paper (due 03 December). There are several content options:

IDEA: major problem with 2019 papers was poor referencing, or only wikipedia type stuff, no journals; require the outline to include at least 5 journal references given in ACS format?

- (1) a particular chemical may be identified (e.g. acetylsalicylic acid), with research to provide detail of the history of its production, including the use of the chemical, the companies involved in its production, the chemistry and engineering involved in its production, the economics of its business, and future projections;
- (2) a particular company may be identified with research to detail the history of its products, business units and the chemicals involved in those products and units;
- (3) a particular application (e.g., tires, antibiotics) may be identified, with research to detail the types of chemicals and materials that have met the needs of that application;
- (4) a proposal may be made as to a future chemical solution to an unmet need, including a projection for the chemistry that would be involved, cost and market analyses, and a potential pipeline to industrial production (e.g. a start-up company vs. partnership or expansion of chemistry within an existing company).

The term paper is limited to four pages, single spaced, two columns, per the format of a *J. Am. Chem. Soc.* communication, including figures, schemes and references. Documentation is important and at least half of the references must be journal articles as opposed to wikipedia pages and the like. Details will be discussed. Electronic files will be required so that the content can be run through a "plagiarism detector".

Grading Points, term paper:

general theme and content, readability (50%)
quality and content of graphics
consistency of nomenclature, abbreviations, formatting
quality of references and ACS formatting of references
concise and informative abstract
typos and errors; spell checker used?

Professional Behavior

Dr. Gladysz will not publically embarrass anyone who uses a smart phone or similar device for texting, personal messages, game-playing, or the like during lecture (using a smart device to look up a point of chemistry during a presentation is acceptable professional behavior). However, he does not write letters of recommendation for individuals who engage in texting and personal mobile device use during lectures.



"You know I hate when you check your messages at the table."

Cheating

Cheating will not be tolerated. The minimum penalty for cheating is an automatic zero on the exam or assignment in question. Suspension from the University may also result. Don't risk it. It's not worth it.

Plagiarism consists of passing off as one's own the ideas, words, writings, etc. that belong to someone else. You are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have that person's permission. For further information, consult the latest Texas A&M University Student Rules (see the section "Scholastic Dishonesty").

AGGIE HONOR CODE: "An Aggie does not lie, cheat, or steal or tolerate those who do." Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit: <http://aggiehonor.tamu.edu>



Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building, or call 845-1637.

Title IX and Statement on Limits to Confidentiality

Texas A&M University and the College of Science are committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws provide guidance for achieving such an environment. Although class materials are generally considered confidential pursuant to student record policies and laws, University employees — including instructors — cannot maintain confidentiality when it conflicts with their responsibility to report certain issues that jeopardize the health and safety of our community. As the instructor, I must

report (per Texas A&M System Regulation 08.01.01) the following information to other University offices if you share it with me, even if you do not want the disclosed information to be shared:

- Allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus.

These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In many cases, it will be your decision whether or not you wish to speak with that individual. If you would like to talk about these events in a more confidential setting, you are encouraged to make an appointment with the Student Counseling Service (<https://scs.tamu.edu/>).

Students and faculty can report non-emergency behavior that causes them to be concerned at <http://tellsomebody.tamu.edu>.

Course Topics, Calendar of Activities, Major Assignment Dates

01: Tu, 27 Aug.	historical perspectives; C&EN for current events sulfuric acid and related inorganic chemicals	FIC Ch. 2.1 FCI2050 Ch. 8.1
02: Th, 29 Aug.	phosphoric acid and phosphorus chemicals	FIC Ch. 2.2
03: Tu, 03 Sept.	nitrogen and ammonia; production and uses	FIC Ch. 3.2, 3.3
04: Th, 05 Sept.	introduction to petrochemicals; refining	FIC Ch. 5
05: Tu, 10 Sept.	chemicals from synthesis gas	FIC Ch. 5
06: Th, 12 Sept.	some major processes involving petrochemicals	FIC Ch. 5
07: Tu, 17 Sept.	Dr. Mark Jones, Dow Chemical Co, Midland MI The chloralkali process and chlorinated organics	FIC Ch. 8.1-8.4
08: Th, 19 Sept.	polymer basics	FIC Ch. 8.1-8.4
09: Tu, 24 Sept.	polyolefins	FIC Ch. 8.5-8.12
10: Th, 26 Sept.	no class due to Gladysz travel teams for in class presentations due	FIC Ch. 8.5-8.12
11: Tu, 01 Oct.	other polymers I	FIC Ch. 8.1-8.4
12: Th, 03 Oct.	other polymers II hints/suggestions on term papers	FIC Ch. 10
13: Tu, 08 Oct.	pharmaceuticals I	FIC Ch. 11
14: Th, 10 Oct.	MIDTERM EXAM (covering thru polymers) subjects for in class presentations due	
15: Tu, 15 Oct.	Dr. John Weston, Dow Chemical Co. polyols and polyurethanes	FIC Ch. 11

16: Th, 17 Oct.	pharmaceuticals II	FIC Ch. 12
17: Tu, 22 Oct.	Dr. Hubert Nienaber, Strem Chemicals outline of term paper due	FIC Ch. 12
18: Th, 24 Oct.	pharmaceuticals III	
19: Tu, 29 Oct.	Dr. Kenrick Marshall, Dow Chemical Co, TX propylene oxide	
20: Th, 31 Oct.	the dye industry (I)	
21: Tu, 05 Nov.	Dr. Tejas Shah, Corteva Agriscience, Indianapolis IN introduction to agricultural chemicals	
22: Th, 07 Nov.	student presentations I	students deliver 15-20 min. presentations
23: Tu, 12 Nov.	student presentations II	students deliver 15-20 min. presentations
24: Th, 14 Nov.	student presentations III	students deliver 15- 20 min. presentations
25: Tu, 19 Nov.	student presentations IV	students deliver 15- 20 min. presentations
26: Th, 21 Nov.	Dr. Dimi Katsoulis, Dow Chemical Co, Midland MI the silicone industry	
27: Tu, 26 Nov.	agricultural chemistry II	
28: Tu, 03 Dec.	Term paper due lecture topic to be determined	