CHEM 2343: Advanced Chemical Technologies Laboratory Fall 2018 (ACT 1.3)

Instructors:

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Sections; Time and Place of Class/Lab Meetings:

Sections	Days	Times	Places
CHEM 2343-001 # 90801	Mon. Wed. Fri.	1-4:50 PM	SH 129 (1-2 PM) CPB 212 (2-4:50 PM)

Description of Course Content: The Advanced Chemical Technologies track for majors introduced research and scientific methods in CHEM 1181/1182. Analytical and synthetic chemistry concepts will be further developed in CHEM 2343, through the completion of student-selected research projects. Students will develop their synthesis and analytical research skills through training experiments selected to support their specific research projects. Various forms of research presentations related to student project share broader chemical techniques within the class, with a focus on proper data communication and scientific literacy skills. Additionally, laboratory exercises will involve basic synthetic, titrimetric, spectrophotometric, and chromatographic methods introduced in CHEM 2322 and CHEM 2335. This course, CHEM 2343, is the equivalent of CHEM 2181 and CHEM 2285. Prerequisites: CHEM 1442/CHEM 1342 and CHEM 1182 or equivalent with a grade of C or better. Corequisites: Concurrent enrollment or previous credit in CHEM 2321 and CHEM 2335. Students must remain enrolled in at least one of CHEM 2321 and CHEM 2335 beyond the mid-semester date to remain enrolled in <u>CHEM 2343</u>.

Student Learning Outcomes: To provide students with the theories and skills needed to participate in modern scientific research, and to introduce students to the frontiers of advanced chemical technologies and current research challenges, each student in this course will:

- 1. Propose a feasible research plan using synthetic and quantitative techniques to answer questions related to structure and function of interesting materials,
- 2. Execute the research plan, focused on testing student-generated hypotheses,
- 3. Work responsibly in small research teams (1-4) and as a part of a larger cohort of students (<24), pursuing various aspects of a broader research project,
- 4. Communicate with instructors and peers, through research updates and formal presentations, about the significance and specific motivation of a student-selected research project, experimental results and an interpretation of those results, and how this research has answered stated questions/hypotheses,
- 5. Provide a written reflection/response to current topics in chemistry and biochemistry
- 6. Present their research to the UT Arlington Chemistry and Biochemistry community in the form of a poster.

Required Textbooks and Other Course Materials:

Personal LinkedIn Account (free), Chromacademy Account (free), Laboratory Notebook (provided)

Descriptions of major assignments and examinations:

Proposal Revision (50 pts) and Finalization (150 pts)

Through an iterative process, based on feedback by TAs and course instructors, the proposals initially conceived and submitted in Chem 1182 will be revised and polished to create a final proposal document. The revised proposal is due Friday, August 31 (by 5 pm, emailed to Foss and Schug). Further feedback will be given within one week. The final proposal is due Friday, September 21 (by 5 pm, emailed to Foss and Schug).

- Refer to proposal format hand-out for specific section/content guidelines
- 2-3 pages, single spaced, 12 pt font, 1" margins with 1-2 figures tables

Proposal update presentations (complete 2; 100 pts each)

Throughout the course of the semester, each student or group will give a short update presentation about the progress of their research topic. The first set of these (Research Update #1) will be given in *poster format* on either Monday, September 24 or Wednesday, September 26. Please schedule your time with your TA (half of the presentations each day). Research Update #1 will be in poster format to prepare for presentation of your projects at the CBS Undergraduate Research Poster Day (Friday, October 5); see below. The poster slide will be projected on an overhead (do not print the posters) and each student or group should expect to give a 5 - 8 minute overview of their work. The goal will be to gain feedback to polish the poster presentations for the Undergraduate Research Day. Research Update #2 will be given either Monday, October 29 or Wednesday, October 31. Again, please schedule your slot with the TA. This update should be in the format of a short Powerpoint presentation (5 - 8 minutes, ~5 slides), but omitting background information of the project, in order to focus on the data and results generated to that point. Feedback will be given in order to prepare for the Final Project Presentation, which will be delivered in class on Wednesday, November 28; see below.

- Refer to presentation preparation check-list handout

Chem/Biochem Society Undergraduate Research Day Poster Presentation (150 pts)

The CBS Undergraduate Research Day was established several years ago and has become a vibrant tradition in the department, to showcase the research being performed by undergraduates. Each student or group will prepare and present a poster detailing the current status of their research project. This event will be held Friday, October 5. Besides preparing and presenting your research in the form of a poster, each student or group should be sure to adhere to any presented guidelines for entry into the symposium (e.g., submission of title, authors, and an abstract, as requested).

Final Research Presentation (200 pts)

Synthesis and Analysis Training Experiments (complete 3; 50 pts each)

Choose from a list of experiments three activities that will support your specific research project to gain appropriate skills.

ChromAcademy Modules (complete 4, 25 pts each)

Choose specific modules that go deeper than the introductory material you learned last year to support your project progression

Participation (Notebook, Attendance, Quant-In-A-Day, LinkedIn, FACT talks) (100 pts)

Notebooks: Students will keep careful and detailed notes of their laboratory work and preparation for research projects. Notebooks will be collected and checked at least twice during the semester.

For experiments, your TA will be looking that you include the following items in pen:

Table of Contents (TOC) entries
Date(s)
Title/Name of Experiment
Chemical Reaction(s) Equation, if applicable
Chemical and Reagent Details (MW, mmoles, mass, density, volume, and
stoichiometry/concentration)
Theoretical and Observed Yields
Chemical Characterization Details (color, state, spectroscopic data)
Detailed Procedure
Observations during and following experiment
Conclusion(s)
Notes for Future Experiments
all in a legible and logical format

You are encouraged to use your notebook to record essential non-experimental details as well: Planning and brainstorming as you prepare to perform experiments, and for taking important notes during meetings with faculty, TA's, and outside speakers. These notes should also be dated, and a title or heading to each entry may be helpful for reference in the future. Remember to keep your TOC up to date. **LinkedIn Profile and Interactions**: Each student should have a personal LinkedIn account. If not, students should request to join the "ACT 1: Advanced Chemical Technologies at UTA" and "UT Arlington Department of Chemistry and Biochemistry" groups. In the LinkedIn group, a series of news articles and commentaries relevant to the course and modern chemistry topics will be posted. We encourage constructive discussion through the LinkedIn forum on all postings. However, as a minimum, throughout the semester, each student is expected to make <u>at least three</u> substantive and thoughtful comments in response to the various postings. Original posts of interest can also be shared by ACT students to the ACT 2 page, and these will count towards LinkedIn participation for the course.

We envision that your interaction with your ACT group on LinkedIn (and your peers in this course) will continue through your time at UT Arlington. Further, we envision that your profile will become a place where you can disseminate and brand your efforts and experiences (a sort of "research profile", where presentations and publications can be listed to promote yourself), so that your involvement in ACT becomes a multiplier in your eventual efforts to seek further schooling and employment.

Online Learning Modules and Assessments: In addition to learning how to work and communicate in science, we must continually learn the tools that modern chemists use in their research. There are no defined course materials to match the curriculum you will follow in this lab course. As such, it is important to start to familiarize yourself with relevant topics that might be more advanced than you have covered thus far in your schooling. The instructors have chosen a series of online learning modules and videos that should be completed weekly before coming to lab. Many of these will be taken from an online resource called Chromacademy (www.chromacademy.com). A free registration is afforded to the resources for all university students for a period of five years (click the "University Sponsorship" tab in the middle panel of the homepage to subscribe). Each assigned module is accompanied by an assessment that must be completed prior to lab meeting in the week assigned. *A screenshot of your dashboard should be emailed to the GTA before noon on Wednesday/Thursday (the day that your lab meets)*.

A schedule of learning modules and assessments can be found in the detailed schedule below. Some modules will be videos or readings, with an appropriate link provided, and a separate assessment will be provided electronically. Expect to be able to discuss the techniques and theories introduced in the modules during our briefing. You will learn these techniques at a deeper level of understanding as you implement them in your CMBs and SAPs.

"UTAchemistry" on YouTube also has a plethora of informational videos on how to use particular instruments, reviews of chemistry concepts, organic synthesis skills and techniques, etc.: <u>https://www.youtube.com/user/UTAchemistry/videos?disable_polymer=1</u>

Frontiers in Advanced Chemical Technologies (FACTs): Over the course of the semester, five 1-hr presentations will be given by faculty members and industrial professionals regarding modern/important areas of chemical research. These will be presented on Fridays, as part of UNIV-SC-1131. Following the presentation, there will be some time for discussion, and it is also

likely that the discussion will move to LinkedIn. The schedule of speakers for this semester are as follows:

- All FACT talks will be held in SEIR 198 -

- 1. F, 9/14/18, 1 pm: Curran Parpia, RCP Consulting Solutions, LLC, "Experiences with Start-Ups and Consulting"
- F, 9/28/18, 1 pm: Dr. Zacariah Hildenbrand, Inform Environmental, LLC, "Development of Technologies for Recycling and Reuse of Produced Oilfield Waste"
- 3. F, 10/19/18, 1 pm: Dr. He Dong, UTA Chemistry & Biochemistry, "Nanomaterials for Anticancer and Antimicrobial Therapy Development"
- 4. F, 11/9/18 (Science Week), 1 pm: Keith Crandell, Archventures, "From Chemistry to Venture Capital"
- 5. F, 11/30/18, 1 pm: Dr. Sam Yang, Genentech, "Biopharmaceutical Drug Development, Impurity Profiling and Quality Control"

Grading

Proposal Revision	50
Proposal Final	150
Project Update Presentations (complete 2)	200
Final Research Presentation	250
Synthesis and Analysis Training Experiments (complete 3)	150
Chromacademy Modules (complete 4)	100
Participation (Notebook, Attendance, Quant-In-A-Day, LinkedIn)	100
Undergraduate Research Day Poster Presentation (Oct. 5th)	<u>150</u>

TOTAL 1150

Approximate Schedule of Events/Activities

Week 1 (Aug. 22 (W) - Aug. 24)

M: N/A

W: 1st day of classes; no Chem 2343

F: 1st class meeting (SH 129 @ 1 pm) Syllabus overview, proposal revisions/comments returned to students.

Week 2 (Aug. 27 - Aug. 31) (KAS away)

M: Short project overview presentation; CEMS training; Compile list of materials needed for project

W: Experiment planning, material gathering; list of materials to be ordered finalized/due

F: Revised proposal due (email to Foss and Schug by 5 pm)

Week 3 (Sept. 3 - Sept. 7)

M: Quantitative Chem in a Day (data collection)W:Quantitative Chem in a Day (data analysis)F: Instrumental/Synthesis Pre-Experiments

Week 4 (Sept. 10 - Sept. 14) (KAS away)

M: Research

W: Research

F: FACT speaker at 1 pm (SEIR Building Rm 198)

Week 5 (Sept. 17 - Sept. 21)

M: Research

W: Research

F: Final revised proposal due (email to Foss and Schug by 5 pm) (F away)

Week 6 (Sept. 24 - Sept. 28)

M: Research Update #1 (8 min, Projected Poster) W: Research Update #1 (8 min, Projected Poster) F: FACT speaker at 1 pm (SEIR Building Rm 198)

Week 7 (Oct. 1 - Oct. 5)

M: Research

W: Research

F: CBS Undergraduate Research Poster Presentations

Week 8 (Oct. 8 - Oct. 12)

- M: Research
- W: Research
- F: Research

Week 9 (Oct. 15 - Oct. 19)

M: Research

W: Research

F: FACT speaker at 1 pm (SEIR Building Rm 198)

Week 10 (Oct. 22 - Oct. 26)

- M: Research
- W: Research
- F: Research

Week 11 (Oct. 29 - Nov. 2)

M: Research Update #2 (8 min. ~5 slides)

- W: Research Update #2 (8 min. ~5 slides)
- F: Research

Week 12 (Nov. 5 - Nov. 9)

- M: Research
- W: Research
- F: FACT speaker at 1 pm (SEIR Building Rm 198)

Week 13 (Nov. 12 - Nov. 16)

- M: Research
- W: Research
- F: Research

Week 14 (Nov. 19 - Nov. 23)

- M: Research
- W: Research
- F: No Class; Thanksgiving Break

Week 15 (Nov. 26 - Nov. 30)

- M: Research
- W: Semester project presentations (final overall)
- F: FACT speaker at 1 pm (SEIR Building Rm 198); Dept. Seminar at 3 pm (CRB 114)

Week 16 (Dec. 3 - Dec. 4 (T))

M: Research Dec. 4 (T) is the last day of classes

List (non-inclusive) of Possible Synthesis and Analysis Training Experiments:

Elimination-Dehydration of cyclooctanol (CHEM 2181) Electrophilic Addition - Bromination of *trans*-cinnamic acid (CHEM 2181) Substitution- S_N 1 halogenation-dehydroxylation (CHEM 2181) Grignard Addition (CHEM 2182) Diels-Alder Reaction (CHEM 2182) Aldol Condensation (CHEM 2182) HWE-Olefination (CHEM 2182)

LC-UV Pre-experiment (Chem 4461) LC-MS Pre-experiment (Chem 4461) GC/GC-MS Pre-experiment (Chem 4461) Spectroscopy (UV, fluorescence, atomic spectroscopy) Pre-Experiment (Chem 4461) DSC/TGA Pre-experiment (Chem 4461)