CHEM 497 – Advanced Undergraduate Research Techniques and Design
Course Information Summer 2014

LAB TIME AND LOCATION: Mon/Tues/Wed/Thurs: SCI # 325, 327, 328

INSTRUCTOR: Dr. Stephen Starnes, SCI 339 Phone: 5389, Stephen.Starnes@tamuc.edu

OFFICE HOURS: Mon-Fri: 12:00-1:00 pm.

COURSE DESCRIPTION: The course will provide students with the knowledge and skills needed to conduct laboratory research, design research experiments, analyze research data, and write research reports. Data analysis and report writing skills are important aspects for interpreting the laboratory research and producing technically written, scientific reports. Over the duration of the course you will be expected to apply a range of instrumental and data analysis techniques and we will develop report writing skills all of which are needed to interpret laboratory research and produce technical scientific reports. You will become familiar with NMR, UV/Vis, Computational Chemistry experimental techniques and the use of SciFinder, Web of Knowledge and Endnote for searching and collecting scientific literature related to your project and developing a bibliography. You will also be required to develop your critical reading skills of research papers and develop your technical writing skills. The class will be assessed by the completion of weekly research assignments, the submission of bi-weekly written reports, a midterm and end of semester research report, and research presentations. The class is 1-3 semester hours.

STUDENT LEARNING OUTCOMES: Students will gain the necessary skills involved in conducting organic chemistry-related research and computational scientific research. The skills will include organic synthesis techniques, computational chemistry, oral presentations, report writing, critical reading of literature, chemical database searching and review of the literature. During the course you will develop the skills and material needed for a technical research report. The database searching portion of the course will familiarize you with the software tools of Web of Science, SciFinder, and Endnote. The instrumental analysis portion of the course will cover nuclear magnetic resonance spectroscopy (NMR), infrared spectroscopy (IR), ultra-violet and visible (UV-VIS) spectroscopy, polarimetry, and may include fluorescence spectroscopy and circular dichroism spectroscopy. The computational portion of the course will use the Spartan software package on the computer cluster for exploring a range of chemical properties. Students will be required to complete weekly research assignments, to regularly present their research to the group and write bi-weekly research progress reports.

By the end of the semester, the goal is for you to be able to demonstrate the following skills:

1. How to set up a reaction under an inert atmosphere
2. How to monitor a reaction by TLC
3. The theory of TLC, how to do TLC analysis
4. How to manage chemical waste
5. How to maintain a research notebook

6. How to purify a compound using chromatography (plate and column)
7. How to pour your own TLC plates
8. How to do an extraction
9. How to use drying agents
10. Understand solvent polarities
11. How to record a ^{1}H-NMR and ^{13}C-NMR spectrum
12. How to do UV/Vis titrations
13. How to do NMR titrations
14. How to use the 90 MHz NMR
15. How to record an IR spectrum
16. How to do a recrystallization
17. How to calculate percent yields
18. How to use the rotovap
19. How to blow your own TLC capillaries
20. How to prepare NMR and UV samples
21. Understand the basic principles of UV/Vis spectroscopy (Beer's Law)
22. How to interpret an NMR spectrum (chemical shift, integration, splitting pattern)
23. How to conduct molecular modeling experiments using Spartan software using the 2nd floor computer lab and the Beowulf cluster.
24. How to use SciFinder Scholar and Web of science
25. How to access chemical journals online

More skills than this may be learned this summer, but these are the basic skills that you will want to hone. Once you learn these skills, you can become a more independent researcher in lab.

COURSE REQUIREMENTS, ASSIGNMENTS AND GRADING:
Research background report: introduction to a scientific problem, literature review (20%)
Final Oral presentation: based on your lab and literature research (20%)
Midterm research report: based on literature review, research results, and bibliography (20%)
Final research report: based on literature review research results, and bibliography (20%)
Final poster developed based on your lab and literature research (20%)

A: >85.0; **B**: 75.0 ~ 84.9; **C**: 65.0 ~ 74.9; **D**: 55.0 ~64.9; **F**: <55.0

Attendance Policy: All students are expected to attend classes on a regular basis. The Department of Chemistry adheres to the attendance policy set by the University as stated in the most current Undergraduate Catalog. The attendance record is taken from a daily sign-in sheet. A student who is late by more than 5 minutes or fails to sign the sign-in sheet will be counted as missing a lecture. Excessive absence is defined as missing more than 10% of the lectures or more than 10% of the laboratory sessions without excusable reasons. Excessive absence will be reported to the Dean of the College and the Dean of Students. In addition, **according to the TAMU-Commerce Procedure 13.99.99.R0.01, if a student has excessive absences, the instructor may drop the student from the course**. The instructor will only excuse an absence if the student provides, with appropriate documentation, an excusable reason allowed by the TAMU-Commerce Procedure 13.99.99.R0.01. Good class attendance will be necessary in order to pass this course.

Student Conduct Policy: All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment (see Student¹s Guidebook, Policies and Procedures, Conduct, TAMU-Commerce Procedure 13.02.99.R0.06). Any student engaging in disruptive behavior will be dismissed from class on the first offence. A second offence may constitute dismissal from the course with a failing grade.

Cheating and other Breaches of Academic Conduct: Academic cheating, plagiarism, and other forms of academic misconduct may result in removal of the student from class with a failing grade or may in extreme cases result in suspension or expulsion from the University as described in the Code of Student Conduct section of the Student¹s Guidebook A&M-Commerce Procedure 13.99.99.R0.10.

Students with Disabilities:
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 have a disability requiring an accommodation, please contact:
Office of Student Disability Resources and Services, Texas A&M University-Commerce
Gee Library, Room 132, Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148, StudentDisabilityServices@tamuc.edu