CHEM 441: Instrumental Analysis

Instructor: Laurence Angel **Office:** Science 341 **Email:** Laurence.Angel@tamuc.edu
Phone: 903-886-5391 **Office Hours:** Mon- Fri: 4:00 – 5:00pm
Class Meetings: Tuesday/Thursday 9:30a-10:45a **Location**: STC 313
Laboratory Section: Tuesday 2:00p-5:50p **Location**: STC 313

Course Description: The course will cover a detailed examination of the principles and practical applications of electrochemistry, ultraviolet and visible spectroscopy, infrared spectroscopy, lasers, fluorescence spectroscopy, atomic absorption spectroscopy, mass spectrometry, high performance liquid chromatography, gas chromatography and electrophoresis.

Student Learning Outcomes: Students will gain a broad and in-depth knowledge of a range of instrumental techniques for accurately measuring the quantity and identity of atomic and molecular species in a sample.

1. The student will understand the theory and practical application of these instrumental techniques and be able to explain the concepts to their peers.
2. Students will demonstrate broad knowledge of and successful problem solving skills in instrumental analysis as examined by lab work, lab reports and exams.
3. Students will demonstrate knowledge for choosing an instrumental method that can be applied to solve a specific analytical chemistry problem.

This is what you'll learn during the course	This will help you learn how to have	This is what you'll do to learn how to do this	This is how you'll show me that you've learned this
You will understand the theory and practical application of a range of instrumental techniques and be able to explain these concepts to your peers	A broad knowledge of instrumental analysis techniques	Attend and participate in class. Complete all reading and homework assignments. Conduct instrumental analyses techniques. Apply data analyses methods and write concise lab reports.	You will demonstrate broad knowledge of instrumental techniques and successful problem solving skills in instrumental analysis as examined by lab work, lab reports and exams.
Choose an instrumental method, or combination of methods, that can be applied to solve a specific analytical chemistry problem	An in-depth knowledge of instrumental analysis techniques	Complete a range of instrumental analyses techniques and apply the correct data analyses to present in your lab reports.	You will accurately determine the quantity or identify the chemical species in a sample. Be evaluated by a comprehensive exam.

Class Material: ***Quantitative Chemical Analysis***, 8th edition, Daniel C. Harris. ISBN: 9781429254366.
Credits: 4 credit hours for class and laboratory.
Laboratory Experiments: I will be giving out the laboratory procedures throughout the semester. You will also need a ***laboratory notebook***, ***safety goggles***, and a ***non-programmable*** calculator. The experiments will closely correlate with the class material.
Prerequisite: The student must have completed CHEM 340 in order to enroll in CHEM 441. It is also desirable to have completed CHEM 351 and CHEM 352.

Evaluation:
Mid-term exams: 4 exams will be held during the semester (11% each, 44% total)
12-Laboratory reports: Graded laboratory reports (3% each, 36% total)
Final American Chemical Society Exam: 2-hour comprehensive final exam (20%)
Grading: General grade range of A: > 86%, B: 75-86%, C: 63-74%, D: 50-62%, F: <50%

Laboratory Procedures and Requirements: We shall go over laboratory safety, lab books and report writing in the first week of the scheduled laboratory sections at 2 pm in Science 313. The laboratory experiments will follow the theory of the instrumentation covered in class. For the laboratory report, the correct identification of the unknown sample or quantity is worth 75% of the final grade and the laboratory report, computer analysis and performance in the laboratory worth 25%.
Late work will not be accepted, and makeup exams or labs will not be given. If you miss an exam, for whatever reason, the points for the missed exam will be placed on your final exam, making your final exam count for a greater percentage of your grade. The final exam will be comprehensive. Laboratory Portion: 36% of course grade. Twelve laboratory reports will be required. Any additional missed labs will result in a zero for that lab.

Tentative Class Schedule Topics:

Week	Topics
1	Electrode Potentials
2	Instrumental Methods in Electrochemistry
3	Spectrophotometry Instrumentation and Applications
4	Spectrophotometers, Luminescence and Lasers
5	Calibration Methods **Exam 1**
6	Introduction to Atomic Absorption Spectroscopy
7	Methods of Atomic Spectroscopy
8	Inductively Coupled Plasma Mass Spectrometry **Exam 2**
9	Spring Break
10	Mass Spectrometry Instrumentation and Techniques
11	Quadrupole - Time-of-Flight Mass Spectrometry
12	Introduction to Analytical Separations
13	High Performance Liquid Chromatography **Exam 3**
14	Gas Chromatography
15	Chromatographic Methods / Capillary Electrophoresis
16	Capillary Electrophoresis **Exam 4**
17	**ACS Final Exam**

Tentative Laboratory Schedule

Week	Laboratory
1	Lab safety / Fuel Cell: Assembling an Zn-Air Battery
2	Electrodeposition of Copper
3	Spectrophotometric Analysis: Caffeine and Benzoic Acid in Mountain Dew
4	Spectrophotometric Measurement of an Equilibrium Constant: The Scatchard Plot
5	Solvent Effects on the Absorption and Fluorescence Spectrum of Perylene
6	Mn^{2+} Standardization by EDTA
7	Measuring Manganese in Steel by Spectrophotometry with Standard Addition
8	Measuring Manganese in Steel by Atomic Absorption Using a Calibration Curve
9	Spring Break
10	Measuring Lead in Bourbon by Atomic Absorption Using Standard Addition
11	Mass Spectrometry of Peptides and Proteins
12	Mass Spectrometry: Collision-Induced Dissociation Analysis of Oligopeptides
13	High Performance Liquid Chromatography Analysis of Oligopeptides
14	Analysis of Analgesic Tablets by High Performance Liquid Chromatography
15	Gas Chromatography: Retention Indexes for Common Stationary Phases
16	Lab clean-up and sign-out

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Interaction with Instructor Statement

The instructor's communication response time and feedback on assessments will be completed by the next scheduled meeting time.

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.
http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: Netiquette
http://www.albion.com/netiquette/corerules.html

TAMUC Attendance

For more information about the attendance policy please visit the Attendance webpage and Procedure 13.99.99.R0.01.
http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty 13.99.99.R0.03

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf

Graduate Student Academic Dishonesty 13.99.99.R0.10

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf

ADA Statement

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 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@tamuc.edu
Website: Office of Student Disability Resources and Services
http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an

environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the Carrying Concealed Handguns On Campus document and/or consult your event organizer.
Web url:
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by Texas A&M University-Commerce have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements
LMS Requirements:
https://community.brightspace.com/s/article/Brightspace-Platform-Requirements
LMS Browser Support:
https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm
YouSeeU Virtual Classroom Requirements:
https://support.youseeu.com/hc/en-us/articles/115007031107-Basic-System-Requirements

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu**.**

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

COMMUNICATION AND SUPPORT

If you have any questions or are having difficulties with the course material, please contact your Instructor.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:
https://community.brightspace.com/support/s/contactsupport