

**CHEM 541-01W: Advanced Analytical Chemistry**

Instructor: **Dr. Laurence Angel** Office: Science 341

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This is a web-based class delivered through the MyLeo online platform D2L, with recorded online lectures, weekly reading and homework assignments, end-of-week Excel assignments and tests, which will count towards your final grade. Class runs through the 16-weeks of Fall 2023 (8/28/2023 through 12/15/2023).

Course Book: Quantitative Chemical Analysis, 8th Ed., Daniel C. Harris, W.H. Freeman and Co. ISBN-13: 978-1-4292-5436-6

You will need access to the Excel program, preferably Excel 2016.

Student Learning Outcomes: To familiarize the student with the methods and techniques of quantitative chemical analysis for accurately determining the quantities of a chemical species in a sample. The student will be expected to understand the theory and application of these analytical techniques and be able to provide explanations and results to the instructor. Material of the following will be covered.

- 1) Quality assurance and the validation of analytical procedure.
- 2) Volumetric analysis, titration calculations, solubility product, titration of a mixture, titration involving silver ion.
- 3) Equilibrium and thermodynamics, solubility product and complex formation.
- 4) Protic acids and bases, pH, strength of acids and bases, weak acid and base equilibrium.
- 5) Activity and the systematic treatment of equilibrium, ionic strength and solubility, activity coefficients, charge and mass balance.
- 6) Acid-base equilibria, buffers, Henderson-Hasselbalch equation, preparing buffers, buffer capacity,
- 7) Polyprotic acids and bases, amino acids, pH of diprotic systems, principal species, titrations of polyprotic systems, proteins, fractional composition, isoelectric focusing.
- 8) Acid-base titrations, titration curves, determining the end point, acid-base indicators, Kjeldahl nitrogen analysis, and the levelling effect.
- 9) Metal-chelate complexes, EDTA, metal ion indicators, EDTA titrations, pH-dependent EDTA equilibrium, auxiliary complexing agents, EDTA titration curves.
- 10) Advanced topics in equilibrium, general approach to acid-base systems, activity coefficients, dependence on solubility on pH, analyzing acid-base titrations.
- 11) Electrochemistry, electrode potentials, redox chemistry and electricity, galvanic cells, standard potentials, Nernst equations, reference electrodes.
- 12) Cells as chemical probes, why biochemists use E° , reference electrodes, silver indicator electrode, junction potentials, ion-selective electrodes, glass electrode, solid state chemical sensors.

Student Learning Outcomes: By the end of the course, the student will be able to select and apply an analytical technique suitable for solving a given quantitative analytical problem. Knowledge of quantitative chemical analysis techniques is essential for a wide range of potential employment positions in industry, government and academia.

Evaluation: Weekly evaluation will include online tests, which are open books/notes and must be completed by the Sunday of that week. You must take the tests individually. Students working together will receive a zero. Tests are made available at the end of the week Friday-Sunday and once entered students have the allotted time to complete. There will also be weekly graded assignments using Excel and advanced equilibrium techniques.

Weekly tests and assignments: (18) tests and assignments due at the end of each week, 3.89% each (70% total, **open books/notes must be taken individually**)

Final exam: 2.0-hour comprehensive exam held at the end of the semester (30% total, **open books/notes must be taken individually**)

Grading: A: > 85%, B: 75-84.9%, C: 65-74.9%, D: 50-64.9%, F: <50%

Tentative Class Schedule and Reading Assignments from Quantitative Chemical Analysis 8th Ed., Daniel C. Harris, W.H. Freeman and Co. ISBN-13: 978-1-4292-5436-6

Week	Chapter and Topics
1	Chapter 5: Quality Assurance and Calibration Methods Test 1
2	Chapter 6: Chemical Equilibrium, Solubility and Ion Pairs Test 2
3	Chapter 6: Monoprotic Acid-Bases Test 3
4	Chapter 7: Activity Coefficients Test 4
5	Chapter 7: Systematic Treatment of Equilibrium Assignment 5
6	Chapter 8: Acid-Base Equilibria Test 6
7	Chapter 8: Buffers Assignment 7, Test 8
8	Chapter 9: Polyprotic Acid-Base Equilibria Assignment 9, Test 10
9	Chapter 10: Acid-Base Titrations Assignment 11, Test 12
10	Chapter 11: Metal-Chelate Complexes and EDTA Titrations Assignment 13, Test 14
11	Chapter 12: Advanced Equilibrium Topics Assignment 15
12	Chapter 12: Advanced Equilibrium Topics Assignment 16
13	Chapter 13: Electrochemistry (Thanksgiving)
14	Chapters 13/14: Electrodes and Potentiometry Test 17
15	Chapters 14: Electrodes and Potentiometry Test 18
16	Finals week: Final Comprehensive Exam

COURSE AND UNIVERSITY PROCEDURES/POLICIES

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

Coronavirus Protection Measures

A&M-Commerce suggests the use of face-coverings in all instructional and research classrooms/laboratories. Exceptions may be made by faculty where warranted. Faculty have management over their classrooms. Students should not attend class when ill or after exposure to anyone with a communicable illness. Communicate such instances directly with your instructor. Faculty will work to support the student getting access to missed content or completing missed assignments.

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

Velma K Waters 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.

The Counseling Center at A&M-Commerce, located in the Halladay Building, Room 203, offers counseling services, educational programming, and connection to community resources for students. Students have 24/7 access to the Counseling Center's crisis assessment services by calling 903-886-5145. For more information regarding Counseling Center events and confidential services, please visit www.tamuc.edu/counsel

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.

AI Use Policy

Texas A&M University-Commerce acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors' guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources.

13.99.99.R0.03 Undergraduate Academic Dishonesty

13.99.99.R0.10 Graduate Student Academic Dishonesty

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>