

**SUL ROSS STATE UNIVERSITY**  
**Syllabus for Analytical Chemistry I-21697**  
**CHEM 2401 (Spring 2025)**

Analytical Chemistry I: Lecture  
Room: WSB 307  
Time: T/TR 9:30 – 10:45 pm  
Date: Jan. 15 to May 7

Instructor: Dr. Hong Young Chang  
Office: WSB 219  
Email: hxc19tv@sulross.edu  
Office Hour: MTWRF 2:00-6:30 pm

**Distance Education Statement:**

Students enrolled in distance education courses have equal access to the university's academic support services, library resources, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should submit online assignments through Blackboard or SRSU email, which require secure login information to verify students' identities and to protect students' information. The procedures for filing a student complaint are included in the student handbook. Students enrolled in distance education courses at SRSU are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook.

**SRSU Disability Services: ADA (Americans with Disabilities Act):**

*Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Students seeking accessibility/accommodations services must contact Rebecca Greathouse Wren, LPC-S, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a*

message and we'll get back to you as soon as we can during working hours), or email [rebecca.wren@sulross.edu](mailto:rebecca.wren@sulross.edu). Their office is located on the first floor of Ferguson Hall (Room 112), and our mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas, 79832.

**Scholastic Dishonesty:**

*Students who violate the University rules on scholastic dishonesty are subject to penalties, including the possibility of an **F** in the course and/or dismissal from the University.*

**OBJECTIVES:**

***Student Learning Objectives (SLO):***

A student graduating with a **chemistry major** is expected to demonstrate that (s)he is able to do the following:

1. Organic Chemistry—Students will be able to draw organic molecular structures and explain organic reactions, stereochemistry, structural analysis and reactions in biological systems.
2. Inorganic Chemistry—The student will be able to demonstrate understanding of coordination chemistry, valence theory, elementary actions and advanced molecular theory.
3. Analytical Chemistry—The student will be able to demonstrate an understanding of theory of analytical chemistry and conduct analytical analysis, including data

analysis and calibration, equilibrium chemistry, gravimetric analysis, titrimetric analysis, spectroscopic analysis, and electrochemical analysis.

4. Physical Chemistry—The student will be able to demonstrate an understanding of the application and theory of physical chemistry, including topics such as atomic structure, electrochemistry, surface chemistry, solid-state chemistry, and thermodynamics.

5. Research—The student will collect and analyze published chemical literature and undertake a chemistry research project.

### ***BSc in Chemistry Marketable Skills***

1. Students will become good at punctuality and time management.
2. Students will analyze &/or synthesize molecules and perform spectroscopic characterization and interpret their results scientifically.
3. Students will become proficient at writing scientific papers and to identify appropriate references for their paper.
4. Students will be become proficient at orally presenting scientific topics including the use of visual aids.

### ***Course Description:***

**Analytical Chemistry course** is appropriate for students who are majoring in the natural sciences, science education, engineering, and pre-professional programs. This course assumes that an adequate degree of two collegiate level knowledge has been achieved from a two semester General Chemistry sequence since many of the concepts discussed in this class build directly upon the material learned in freshman

level chemistry such as stoichiometry, equilibrium, acid– base reactions, and electrochemistry. This course will study in detail the analytical process including the techniques and methods used to isolate and quantify specific analytes in samples of materials. Major topics that will be discussed in this course include sample preparation, equilibrium, titrations, electrochemistry, spectrophotometry, and separations. This course will focus on the quantitative procedures of measurement using chemical and instrumental methods in order to compare analysis to theoretical information obtained from equilibrium and stoichiometry using statistical methods.

***Analytical Chemistry I Learning Objectives:***

At the end of this course, a student should have a good understanding of:

1. Analytical process, chemical measurements, stoichiometry calculations for gravimetric analysis
2. Students learn about the calibrations for a variety of tools (analytical balance, Burets, Volumetric Glassware, Pipets, Syringes, etc.)
3. Types of experimental error, Gaussian distribution, standard deviations, confidence intervals, t-Tests, the method of least squares, which relates to statistics
4. Chemical equilibrium and equilibrium constant,
5. Complex formation, strengths of acids and bases, activity
6. The systematic treatment of equilibrium, principles of acid-base titrations, and EDTA titrations

The following chapters will be covered in analytical chemistry I

**Chapter 0:** The Analytical Process

**Chapter 1:** Chemical Measurements

**Chapter 2:** Tools of the Trade

**Chapter 3:** Experimental Error

**Chapter 4:** Statistics

**Chapter 5:** Quality Assurance and Calibration Methods

**Chapter 6:** Chemical Equilibrium

**Chapter 7:** Let the Titration Begin

**Chapter 8:** Activity and the Systematic Treatment of Equilibrium

**Chapter 9:** Monoprotic Acid-Base Equilibria

**Chapter 10:** Polyprotic Acid-Base Equilibria

**Chapter 11:** Acid-Base Titrations

**Chapter 12:** EDTA Titrations

**Required Text Book:**

“Quantitative Chemical Analysis” 9<sup>th</sup> Edition, Daniel C. Harris & Charles A. Lucy, 2016, Freeman, W. H. & Company, New York

The SRSU library has one copy of this textbook in the “Textbook Collection” section. Please ask the library front desk if you need help finding this textbook.

**SRSU Library Services:** The Sul Ross Library offers FREE resources and services to the entire SRSU community. *Access and borrow books, articles, and more by visiting the library’s website, [library.sulross.edu](http://library.sulross.edu).* Off-campus access requires your LoboID and password. Check out materials using your photo ID. Librarians are a tremendous resource for your coursework and can be reached in person, by email ([srsulibrary@sulross.edu](mailto:srsulibrary@sulross.edu)), or phone (432-837-8123).

**ChemDraw** is a computer program that you can use to draw organic structures, organic reactions, etc. You can download ChemDraw onto your own personal computer (PC or Mac):

<http://sitelicense.cambridgesoft.com/sitelicense.cfm?sid=3000>

Make sure you follow the requirements for the password and use your SRSU email address to register. Alternatively, you can access **ChemDraw in the GIS lab** (computer room next to the chem TA room) by searching for “ChemDraw” whenever there is no class in that room (open computer lab when no classes are being taught).

**Calculator:** a scientific calculator is required for this course.

**Microsoft Excel software:** is essentially required to visualize experimental data with drawing graphs.

**ATTENDANCE PRERESQUITE: BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THE COURSE.**

**Cell phones ARE NOT** permitted for use in exams and should be turned off during class time.

**Homework:** Twelve (12) homework (each homework is composed by 2 or 3 questions) will be assigned throughout the semester. All of the homework will contribute 30 % of your final mark. Homework must be completed in PEN! You need to keep the due day.

**EXAMINATIONS:** There will be two in-course examinations and a final examination. **NO MAKEUP EXAMS WILL BE GIVEN.** The final is mandatory and will be comprehensive.

## **PERCENTAGE BREAKDOWN OF MARKS:**

Homework: 20 % (Three Homework)

In-Course Questions or Midterm Exams : 60 %

Final Exam: 20%

Midterm Exam I: Thursday, February 13<sup>th</sup>

Midterm Exam II: Thursday, March 6<sup>th</sup>

Final Exam: Tuesday, April 29<sup>th</sup>, Class Time

## **Course Calendar**

**Lecture 1 (January 16):** Discussion on Syllabus, Importance of Analytical Chemistry, Job of Analytical Chemistry

**Lecture 2 (January 21):** SI units; chemical concentrations, General steps of analytical chemistry, Preparing solutions, Stoichiometry calculations

**Lecture 3 (January 23):** Safe, Ethical handling of chemical waste; Lab notebook; Glassware, Basic analytical techniques

**Lecture 4 (January 28):** Significant figures; Types of error; Uncertainty (random error and systematic error), Propagation of uncertainty from random error/systematic error

**Lecture 5 (January 30):** Gaussian distribution; Standard deviation; Confidence intervals

**Lecture 6 (February 4):** Comparison of means with student's t; t tests with a spreadsheet; Grubbs test for an outlier;

**Lecture 7 (February 6):** The method of least squares; Calibration curves

**(Homework 1 Due)**

**Lecture 8 (February 11):** **Exam Revision on Chapters 0, 1 & 2**

**Lecture 9 (February 13):** **Exam I (Chapters 0, 1 & 2)**

**Lecture 10 (February 18):** Basics of Quality Assurance; Method validation

**Lecture 11 (February 20):** Standard addition; Internal standard

**Lecture 12 (February 25):** Thermodynamics; Equilibrium constants

**Lecture 13 (February 27):** Solubility product; Complex formation; Protic acid and base; pH; Strengths of acids and bases

**(Homework 2 Due)**

**Lecture 14 (March 4):** **Exam Revision on Chapters 3, 4 & 5**

**Lecture 15 (March 6):** **Exam II (Chapter 3, 4 & 5)**

**Lecture 16 (March 11):** Titration; Titration calculations



**Lecture 17 (March 13):** Titration of mixture; Titration curves

**NO CLASS: SPRING BREAK (March 17 to March 21)**

**Lecture 18 (March 25):** End-point detection; ionic strength; Activity coefficient

**Lecture 19 (March 27):** pH revised; Systematic treatments of Equilibrium

**Lecture 20 (April 1):** Strong Acids and bases; Weak acids and bases; acid-base equilibrium

**Lecture 21 (April 3):** Buffers; Diprotic acids and bases; Diprotic buffers

**Lecture 22 (April 8):** Polyprotic acids and bases; Principal species; Fractional composition equations; isoelectric and iso-ionic pH

**Lecture 23 (April 10):** Titration weak base with strong acid; Titrations in diprotic systems

**Lecture 24 (April 15):** End point; Practice notes; Leveling effect; Titration curves

**Lecture 27 (April 17):** Metal-chelate complex; EDTA titration; Metal ion indicators

**Lecture 28 (April 22):** Activity coefficients; Dependence of solubility on pH

**(Homework 3 Due)**

**Lecture 29 (April 24):** **Final Exam Revision**

**Lecture 30 (April 29):** **Final Exam** (*Comprehensive*)

## **Libraries:**

The Bryan Wildenthal Memorial Library in Alpine offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, [library.sulross.edu/](http://library.sulross.edu/). Off-campus access requires logging in with your LoboID and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email ([srsulibrary@sulross.edu](mailto:srsulibrary@sulross.edu)), or by phone (432-837-8123).

No matter where you are based, public libraries and many academic and special libraries welcome the general public into their spaces for study. SRSU TexShare Cardholders can access additional services and resources at various libraries across Texas. Learn more about the TexShare program by visiting [library.sulross.edu/find-and-borrow/texshare/](http://library.sulross.edu/find-and-borrow/texshare/) or ask a librarian by emailing [srsulibrary@sulross.edu](mailto:srsulibrary@sulross.edu).

New for Fall 2023: Mike Fernandez, SRSU Librarian, is based in Eagle Pass (Building D-129) to offer specialized library services to students, faculty, and staff. Utilize free services such as Interlibrary Loan (ILL) and Scant to get materials delivered to you at home or via email.

## **Academic Integrity:**

Students in this class are expected to demonstrate scholarly behavior and academic honesty in the use of intellectual property. Students should submit work that is their own and avoid the temptation to engage in behaviors that violate academic integrity, such as turning in work as original that was used in whole or part for another course and/or professor; turning in another person's work as one's own; copying from professional works or internet sites without citation; collaborating on a course assignment, examination, or quiz when collaboration is forbidden. Students should also avoid using open AI sources *unless permission is expressly given* for an assignment or course. Violations of academic integrity can result in failing assignments, failing a

class, and/or more serious university consequences. These behaviors also erode the value of college degrees and higher education overall.

**Counselling:**

Sul Ross has partnered with Timely Care where all SR students will have access to nine free counseling sessions. You can learn more about this 24/7/365 support by visiting [Timely care/SRSU](#). The SR Counseling and Accessibility Services office will continue to offer in-person counseling in Ferguson Hall room 112 (Alpine campus), and telehealth Zoom sessions for remote students and RGC students.

**Classroom Climate of Respect:**

Importantly, this class will foster free expression, critical investigation, and the open discussion of ideas. This means that all of us must help create and sustain an atmosphere of tolerance, civility, and respect for the viewpoints of others. Similarly, we must all learn how to probe, oppose, and disagree without resorting to tactics of intimidation, harassment, or personal attack. No one is entitled to harass, belittle, or discriminate against another on the basis of race, religion, ethnicity, age, gender, national origin, or sexual preference. Still, we will not be silenced by the difficulty of fruitfully discussing politically sensitive issues.