Department of Chemistry

Proposal to Separate Chemistry Laboratories from Lecture Courses

To enhance educational outcomes, optimize resource management, and align with university-wide digital initiatives, the Department of Chemistry would like to separate laboratories from lecture courses in the undergraduate curriculum. This shift aims to reduce student confusion, ensure fairer grading, and create a more focused learning experience. Key reasons for this initiative are:

1. Ease of Scheduling: Currently our many of our courses have a lab and lecture linked. If students have a time conflict during the long lab period time, they either have to try to coordinate with the two professors in the time conflicting courses how they can make it work, or they do not take the course that semester.

2. The Cost of Lab Conflicts: When students end up not taking the course because of time conflicts with the lab section, but it's still required for graduation, then we end up having to offer the course more frequently with lower enrollment.

3. Less Confusion: When our courses contain in the title "with Laboratory," every semester students struggle with registration errors because when they register for only the lecture, they think they are also registering for the lab as well and have to be told multiple times that they have to register for a separate laboratory section in addition to the lecture section. This also stems from biology having their lab and lecture sections separated.

4. Grading Fairness: If a student is excellent at theory but struggles with lab techniques (or vice versa), combined, high-stakes courses can unfairly lower their GPA, or result in an automatic failure of both for failing one part. Separating these formats allows for distinct assessment of theoretical mastery (lecture) and technical proficiency (lab). This ensures grades accurately reflect specific competencies.

5. Digital Asset Development: It is widely accepted that chemistry laboratory skills cannot be taught online. With separating out labs and lectures, faculty can start to focus on creating online courses and certificate programs, something the university has been pushing for to reach a broader demographic of learners.

6. Teaching Load Calculation: A minor note but for faculty who teach the laboratory portion of the course can finally get the correct teaching load credit for what they are actually teaching (Teaching load = credit hours x enrollment).

We recognize that this transition requires updates to CIM records for departments that utilize Chemistry courses as prerequisites or electives. This happens all the time. In December we were told that SCI 522 changed to COM 523 and SCI 511 changed to PM 501. As these courses are electives for our Master of Science in Analytical Chemistry program, we had to make these minor changes in our CIM program management. We wish that these changes could be automatic, but according to the registrar's office, that is not the case. But this pain should only last less than an hour or so for one person in your departments.

CHEM 434 Spectroscopic Methods in Identification and Analysis (3,4,4) ⟹ **CHEM 434 Spectroscopic Methods in Identification and Analysis (3,0,3) and CHEM 435 Spectroscopic Methods in Identification and Analysis Laboratory (0,4,1)**

CHEM 434

Spectroscopic Methods in Identification and Analysis

Characterization and analysis by mass, vibrational, nuclear magnetic resonance, and electronic spectroscopy. Structure-spectra correlations applied to organic and inorganic compounds with examples drawn from diverse areas, e.g., pollutants, toxic materials, polymers, etc. The laboratory work includes characterization of prepared or separated organic compounds by chromatographic, chemical, and spectroscopic methods.

CURRENT

PREREQUISITE(S): CHEM 247 and CHEM 240

LECTURE: 3 **LAB:** 4 **CREDITS:** 4

PROPOSED

CHEM 434

Spectroscopic Methods in Identification and Analysis

An in-depth study of structural characterization techniques including NMR, IR, UV-Vis, and mass spectrometry. Students apply theory to solve complex structural problems in organic and inorganic chemistry, with practical examples drawn from materials science, environmental, and forensic chemistry.

Prerequisite(s): CHEM 247 and CHEM 240

Lecture: 3 Lab: 0 Credits: 3

CHEM 435

Spectroscopic Methods in Identification and Analysis Laboratory

This course provides comprehensive training in the identification of unknown organic compounds. Students will develop proficiency in chromatographic separation techniques, sample preparation for spectroscopic analysis, and the interpretation of 1D/2D NMR, IR, and MS data to determine molecular structure.

Prerequisite(s): CHEM 247, CHEM 240 and CHEM 434*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

CHEM 344 Physical Chemistry II (3,4,4) ⟹ **CHEM 344 Physical Chemistry II (3,0,3) and CHEM 345 Physical Chemistry II Laboratory (0,4,1)**

CHEM 344

Physical Chemistry II

Introduction to quantum mechanics. Applying quantum mechanics to chemical systems. Atomic structure and spectra. Molecular structure and spectroscopy. Statistical mechanics. Chemical kinetics. The laboratory will include experiments dealing with thermochemistry, phase equilibria, chemical kinetics, spectra, molecular structure, and treatment of data.

CURRENT

PREREQUISITE(S): (CHE 202 or CHEM 247) and ((CHEM 343 and MATH 251) or (MATH 252 and PHYS 221))

LECTURE: 3 **LAB:** 4 **CREDITS:** 4

SATISFIES: Communications (C)

PROPOSED

CHEM 344

Physical Chemistry II

This course provides a comprehensive, molecular-level understanding of chemical systems by exploring the fundamental principles of quantum mechanics and statistical mechanics. It covers both the theoretical foundations and practical applications to real chemical phenomena.

Prerequisite(s): (CHE 202 or CHEM 247) and ((CHEM 343 and MATH 251) or (MATH 252 and PHYS 221))

Lecture: 3 Lab: 0 Credits: 3

Satisfies: Communications (C)

CHEM 345

Physical Chemistry II Laboratory

This course provides hands-on experience in experimental physical chemistry, connecting abstract theoretical principles with concrete laboratory observations. Students will perform quantitative experiments in thermochemistry, phase equilibria, and chemical kinetics to study energy transfer and reaction rates.

Prerequisite(s): (CHE 202 or CHEM 247) and ((CHEM 343 and MATH 251) or (MATH 252 and PHYS 221)) and CHEM 344*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

Satisfies: Communications (C)

CHEM 321 Instrumental Analysis (3,4,4) ⟹ **CHEM 321 Instrumental Analysis (3,0,3) and CHEM 322 Instrumental Analysis Laboratory (0,4,1)**

CHEM 321

Instrumental Analysis

This course introduces students to theory and application of modern instruments in chemical procedures. Standard spectroscopic methods including atomic spectrometry, molecular spectrometry, ultraviolet spectroscopy, molecular luminescence, Fourier transform infrared spectroscopy, and nuclear magnetic resonance spectroscopy. Separation techniques using high pressure liquid chromatography and gas chromatography. Other topics relevant to advanced chemical instrumentation.

CURRENT

PREREQUISITE(S): CHEM 247

LECTURE: 3 **LAB:** 4 **CREDITS:** 4

SATISFIES: Communications (C)

PROPOSED

CHEM 321

Instrumental Analysis

This course is a comprehensive study of the theory and application of modern instrumentation in chemical analysis procedures. Students will explore fundamental principles and practical uses of key spectroscopic methods, including: atomic spectrometry, molecular spectrometry, ultraviolet (UV) spectroscopy, molecular luminescence, Fourier transform infrared (FTIR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy The course emphasizes how these powerful tools are used to determine the composition of various samples, providing essential knowledge for careers in analytical chemistry and related scientific fields.

Prerequisite(s): CHEM 247

Lecture: 3 Lab: 0 Credits: 3

Satisfies: Communications (C)

CHEM 322

Instrumental Analysis Laboratory

This is a hands-on laboratory course focused on the principles and practical applications of modern instrumental methods in chemical analysis. Students will gain practical experience with key separation techniques, specifically high-performance liquid chromatography (HPLC) and gas chromatography (GC), used to separate, identify, and quantify components in complex mixtures. The course also introduces other advanced chemical instrumentation and methods for data interpretation, report writing, and quality control, preparing students for analytical roles in industry or future research.

Prerequisite(s): CHEM 247 or CHEM 321*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

Satisfies: Communications (C)

CHEM 247 Analytical Chemistry (3,3,3) ⟹ **CHEM 247 Analytical Chemistry (3,0,3) and CHEM 248 Analytical Chemistry Laboratory (0,4,1)**

CHEM 247

Analytical Chemistry

This course introduces students to the theory and applications of quantitative analytical chemistry. Topics covered include: statistical data analysis; equilibrium constants expressions; acid-base reactions; volumetric analysis; and fundamentals of spectroscopy, electrochemistry, and of separations science. Laboratory experiments include learning about analytical process, calibration of glassware and equipment, wet chemical analysis, electrochemistry, spectroscopy, and chromatography.

CURRENT

PREREQUISITE(S): CHEM 125

LECTURE: 3 **LAB:** 4 **CREDITS:** 4

SATISFIES: Communications (C)

PROPOSED

CHEM 247

Analytical Chemistry

This course delves into the core theory and practical applications of modern quantitative analytical chemistry. Students will develop essential skills in accurate chemical measurement and data interpretation through a series of lecture topics: statistical data analysis, chemical equilibria, classical & instrumental techniques, and applications of key instrumental methods, including: spectroscopy, electrochemistry and separations science. This course provides a foundational understanding of the methods used across diverse fields like biochemistry, environmental science, and forensic science to identify and quantify chemical components in various materials.

Prerequisite(s): CHEM 125

Lecture: 3 Lab: 0 Credits: 3

Satisfies: Communications (C)

CHEM 248

Analytical Chemistry Laboratory

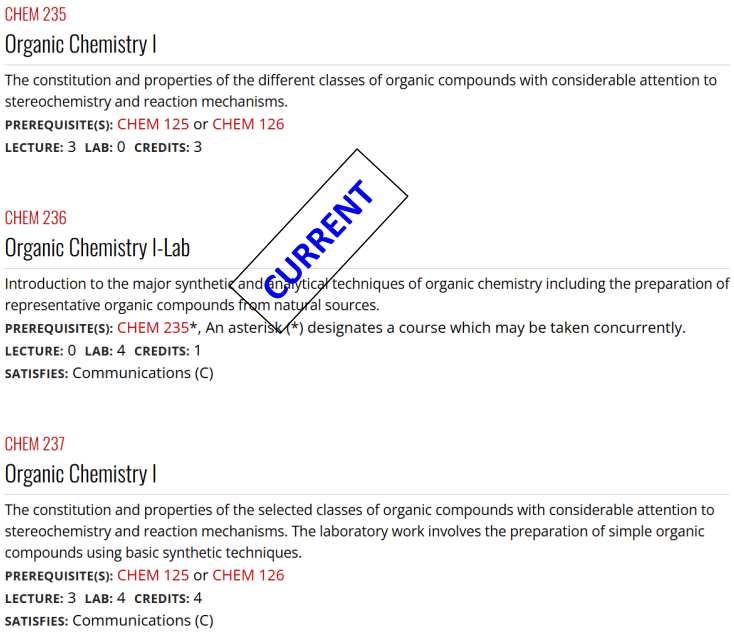
An introduction to the fundamental principles and practical techniques of analytical chemistry. Students will learn the "total analytical process" through hands-on experiments involving calibration, wet chemistry, electrochemistry, and separation science (chromatography). The course emphasizes critical thinking, data quality assessment, and the quantitative analysis of complex, unknown samples.

Prerequisite(s): CHEM 125 and CHEM 247*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

Satisfies: Communications (C)

CHEM 237 Organic Chemistry I (3,4,4) ⟹ CHEM 235 Organic Chemistry I (3,0,3) and CHEM 236 Organic Chemistry I **Laboratory** (0,4,1)



CHEM 235

Organic Chemistry I

The constitution and properties of the different classes of organic compounds with considerable attention to stereochemistry and reaction mechanisms.

PREREQUISITE(S): CHEM 125 or CHEM 126

LECTURE: 3 **LAB:** 0 **CREDITS:** 3

CHEM 236

Organic Chemistry I-Lab

Introduction to the major synthetic and analytical techniques of organic chemistry including the preparation of representative organic compounds from natural sources.

PREREQUISITE(S): CHEM 235*, An asterisk (*) designates a course which may be taken concurrently.

LECTURE: 0 **LAB:** 4 **CREDITS:** 1

SATISFIES: Communications (C)

CURRENT

CHEM 237

Organic Chemistry I

The constitution and properties of the selected classes of organic compounds with considerable attention to stereochemistry and reaction mechanisms. The laboratory work involves the preparation of simple organic compounds using basic synthetic techniques.

PREREQUISITE(S): CHEM 125 or CHEM 126

LECTURE: 3 **LAB:** 4 **CREDITS:** 4

SATISFIES: Communications (C)

PROPOSED

CHEM 235

Organic Chemistry I

A rigorous introduction to the study of carbon-containing compounds with an emphasis on structure, stereochemistry, and reaction mechanisms. Topics include bonding, molecular properties, stereochemistry, and the reactivity of functional groups including alkanes, alkenes, alkynes, and alkyl halides.

Prerequisite(s): CHEM 125 or CHEM 126

Lecture: 3 Lab: 0 Credits: 3

CHEM 236

Organic Chemistry I Laboratory

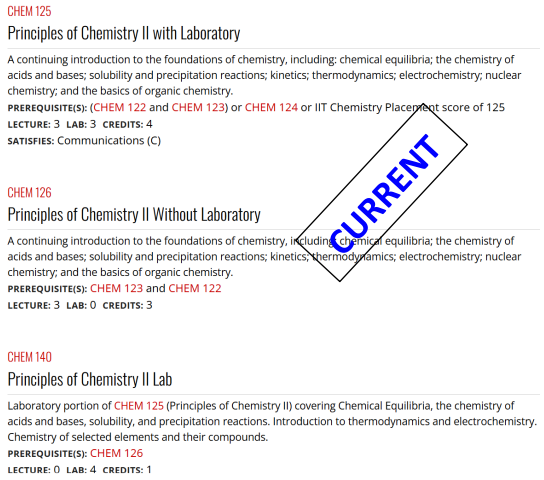
An introduction to essential organic laboratory techniques, including synthesis and purification (distillation, extraction, crystallization). Students will perform organic reactions and isolate compounds from natural sources, focusing on safety, scientific documentation, and mechanistic understanding.

Prerequisite(s): CHEM 235*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

Satisfies: Communications (C)

CHEM 125 Principles of Chemistry II with Laboratory (3,3,4) ⟹ **CHEM 126 Principles of Chemistry II** (3,0,3) and CHEM 140 Principles of Chemistry II **Laboratory** (0,4,1)



CHEM 125

Principles of Chemistry II with Laboratory

A continuing introduction to the foundations of chemistry, including: chemical equilibria; the chemistry of acids and bases; solubility and precipitation reactions; kinetics; thermodynamics; electrochemistry; nuclear chemistry; and the basics of organic chemistry.

PREREQUISITE(S): (CHEM 122 and CHEM 123) or CHEM 124 or IIT Chemistry Placement score of 125

LECTURE: 3 **LAB:** 3 **CREDITS:** 4

SATISFIES: Communications (C)

CURRENT

CHEM 126

Principles of Chemistry II Without Laboratory

A continuing introduction to the foundations of chemistry, including: chemical equilibria; the chemistry of acids and bases; solubility and precipitation reactions; kinetics; thermodynamics; electrochemistry; nuclear chemistry; and the basics of organic chemistry.

PREREQUISITE(S): CHEM 123 and CHEM 122

LECTURE: 3 **LAB:** 0 **CREDITS:** 3

CHEM 140

Principles of Chemistry II Lab

Laboratory portion of CHEM 125 (Principles of Chemistry II) covering Chemical Equilibria, the chemistry of acids and bases, solubility, and precipitation reactions. Introduction to thermodynamics and electrochemistry. Chemistry of selected elements and their compounds.

PREREQUISITE(S): CHEM 126

LECTURE: 0 **LAB:** 4 **CREDITS:** 1

PROPOSED

CHEM 126

Principles of Chemistry II

This course is a comprehensive, continuing introduction to the foundational principles of modern chemistry, building upon concepts from Principles Chemistry I. It explores advanced topics that govern chemical systems and transformations, providing a solid theoretical basis for further study in the sciences. Key areas of study include: chemical equilibria, acid-base chemistry, solubility and precipitation reactions, kinetics, thermodynamics, electrochemistry, nuclear chemistry, and the basics of organic chemistry.

Prerequisite(s): CHEM 122 and CHEM 123

Lecture: 3 Lab: 0 Credits: 3

CHEM 140

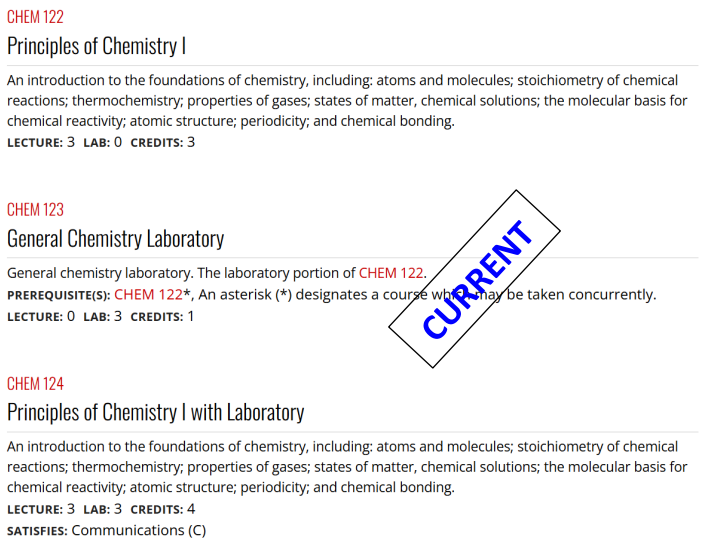
Principles of Chemistry II Laboratory

This laboratory course provides direct participation in experiments, demonstrations, and investigations that reinforce the key concepts of Principles of Chemistry II. Students will explore chemical equilibria, acid-base titration, solubility principles, thermodynamics, and electrochemistry. The course focuses on developing technical proficiency in analytical methods, safe laboratory practices, and the investigation of selected element chemistry to bridge theoretical principles with experimental reality.

Prerequisite(s): CHEM 126*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

CHEM 124 Principles of Chemistry I with Laboratory (3,3,4) ⟹ CHEM **122 Principles of Chemistry I** (3,0,3) and **CHEM 123 Principles of Chemistry I Laboratory (0,4,1)**



CHEM 122

Principles of Chemistry I

An introduction to the foundations of chemistry, including: atoms and molecules; stoichiometry of chemical reactions; thermochemistry; properties of gases; states of matter, chemical solutions; the molecular basis for chemical reactivity; atomic structure; periodicity; and chemical bonding.

LECTURE: 3 **LAB:** 0 **CREDITS:** 3

CHEM 123

General Chemistry Laboratory

General chemistry laboratory. The laboratory portion of CHEM 122.

PREREQUISITE(S): CHEM 122*, An asterisk (*) designates a course which may be taken concurrently.

LECTURE: 0 **LAB:** 3 **CREDITS:** 1

CHEM 124

Principles of Chemistry I with Laboratory

An introduction to the foundations of chemistry, including: atoms and molecules; stoichiometry of chemical reactions; thermochemistry; properties of gases; states of matter, chemical solutions; the molecular basis for chemical reactivity; atomic structure; periodicity; and chemical bonding.

LECTURE: 3 **LAB:** 3 **CREDITS:** 4

SATISFIES: Communications (C)

PROPOSED

CHEM 122

Principles of Chemistry I

This course introduces the foundational principles of chemistry, covering the composition, properties, and interactions of matter. Key topics include atomic and molecular structure, periodicity as described by the periodic table, chemical bonding, and the stoichiometry of chemical reactions. The course also explores the properties of gases and solutions, states of matter, thermochemistry, and the molecular basis for chemical reactivity.

Lecture: 3 Lab: 0 Credits: 3

CHEM 123

Principles of Chemistry I Laboratory

An introduction to chemical laboratory techniques focusing on safety, precision measurement, and data analysis. Students will investigate chemical properties and interactions, developing skills in scientific inquiry and the application of foundational chemical principles.

Prerequisite(s): CHEM 122*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1