KENTUCKY STATE UNIVERSITY

CHEMISTRY

About Us

Welcome to the Chemistry Program at Kentucky State University! Our program is dedicated to fostering a dynamic and supportive learning environment where students are inspired to explore the wonders of chemistry. We offer a robust curriculum that balances theoretical knowledge with practical laboratory experience, preparing our graduates for diverse careers in research, industry, education, and beyond.

Our faculty members are experts in their respective fields and passionate educators and mentors committed to student success. With small class sizes, we ensure personalized attention and a collaborative atmosphere where students can thrive. Our state-of-the-art laboratories and cutting-edge research facilities provide the perfect setting for hands-on learning and innovative scientific discovery.

Our Mission

The Bachelor of Science degree in Chemistry aims to provide our graduates, especially underrepresented groups and minorities, with the conceptual and experimental tools to understand the world at a molecular level as preparation for graduate studies or careers in a chemistry-related field. By providing excellent student-centered learning experiences, our chemistry program will graduate students who demonstrate an ability to think critically, communicate effectively, validate scientific principles in research training, and participate in practical chemical experiences. Our graduates will possess exceptional laboratory skills and modern analytical techniques and value chemists' continual contributions to enhancing society.

Our Vision

The Chemistry program aims to become nationally recognized in the Historically Black Colleges and Universities (HBCUs) and the Commonwealth of Kentucky's STEM community for distinctions in higher education pedagogy, student-centered learning, and participation in the creation and dissemination of new knowledge. The chemistry program strives to contribute economic and intellectual growth to the region and graduating junior scientists who are committed to excellence, leadership, service, and both personal and professional growth through lifelong learning.

Our Core Values

As primary stakeholders, our chemistry faculty, staff, and administrators value:

1. Passion for Mission (We come to work to foster sustainable chemical development and advance human dignity within the Commonwealth, especially for underrepresented minority communities.)
2. A Foundation in Liberal Studies (We design chemistry courses with a multidisciplinary approach, examining how advances in chemical research effects Humanities, Natural Sciences, Social Sciences and the Arts.)
3. Excellence (We strive for efficiency, effectiveness, and meaningful results across our chemical discipline.)
4. Integrity (We are honest and transparent, accountable for our efforts, and maintain a consistently high moral and ethical standard.)
5. Respect (We demonstrate respect for one another, our partners, and the undergraduate students we serve in the Commonwealth, especially for underrepresented communities around the world.)
6. Empowerment (We elevate junior scientist voices striving for regional economic, environmental and social progress)
7. Commitment to Learning (We seek to improve ourselves, chemistry courses, program curriculum, and our work continually through design thinking and assessments.)

CHEMISTRY KNOWLEDGE

PLC #1:

Upon completion of a B.S. degree in Chemistry, graduates are able to acquire knowledge and skills to obtain a professional position or pursue graduate/professional training in chemistry related fields.

- Explains the major systems of nomenclature used in chemistry
- Explains bonding and electronic structure and how these relate to the shape and reactivity of chemical compounds, and how they impact the chemical, physical and electronic properties of molecules
- Explain the principles of thermodynamics, reaction kinetics and reaction mechanisms
- Conducts synthetic studies to create new compounds based on knowledge of biochemical, inorganic, and organic chemical reactions
- Differentiate the principles for separating, detecting and measuring chemical compounds and uses both quantitative and qualitative evaluations to analyze compounds or materials

SCIENTIFIC METHOD

PLC #2:

Upon completion of a B.S. degree in Chemistry, graduates are able to explain and use the principles of the scientific method and the application of experimental techniques to solve specific problems

- Applies productive literature search strategies and critically evaluates the scientific literature
- Applies inductive reasoning and deductive methods to develop a testable, falsifiable hypothesis and predict expected results
- Designs quantitative approaches/experiments to test and evaluate hypothesis
- Gathers empirical and measurable evidence through observation and experimentation
- Demonstrates an excellent level of understanding of the research by proposing future steps required to further the goals of the experiment
- Communicates results and ideas clearly and effectively into scientific reports, papers and oral presentations, following established chemistry norms

LABORATORY SKILLS

PLC #3:

Upon completion of a B.S. degree in Chemistry, graduates are able to apply practical and safe techniques within a laboratory setting

- Applies safe and careful practices at all times
- Keeps accurate laboratory records
- Analyzes, synthesizes, purifies, modifies and/or characterizes compounds, samples, or devices
- Applies instrumentation appropriately
- Calibrates, maintains and troubleshoots instrumentation
- Practices basic skills associated with performing laboratory experiments in chemistry by following standard methods and procedures
- Takes precise and accurate measurements and gains appreciation of potential sources of error associated with laboratory measurements
- Troubleshoots and optimizes methods and techniques
- Develops methods and procedures
- Gains experience critically evaluating data generated

COMPUTATION

PLC #4:

Upon completion of a B.S. degree in Chemistry, graduates are able to develop and use scientific software to support research endeavors

- Utilizes discipline-specific software effectively
- Develops and uses computation modeling as a proxy for physical experimentation
- Creates and modifies scientific software
- Develops and uses computational methods to analyze large data sets

EDUCATION AND TRAINING

PLC #5:

Upon completion of a B.S. degree in Chemistry, graduates are able to instruct students, colleagues or co-workers in scientific procedure

- Teaches chemistry and scientific concepts and knowledge at a level appropriate to the audience
- Assesses achievement of learning outcomes
- Trains and supervises others to perform scientific/laboratory procedures

FIELDWORK

PLC #6:

Upon completion of a B.S. degree in Chemistry, graduates are able to conduct research in the field

- Observes behaviour/properties of subjects/phenomena of interest in situ
- Makes measurements of the subjects/phenomena or their environment
- Identifies and collects samples for analysis
- Operates and uses equipment/tools/machinery appropriately

CHE 101: General Chemistry I
Prerequisite/Corequisite: MAT 115 or MAT 176 or consent of instructor. Introduction to units of scientific measurement, atomic structure, nomenclature, the mole concept, stoichiometry. Introduction to chemical reactions, calculations with chemical equations and formulas, the gas laws, thermochemistry, introduction to quantum theory of the atom and chemical periodicity. (Three hours of lecture per week)
Credit Hours: 3
Contact Hours: 3

CHE 102: General Chemistry II
This course is a continuation of CHE 101. Topics include structure and bonding, states and properties of matter, chemical kinetics, chemical equilibria, acid-base theory, complex ion equilibria, electrochemistry and nuclear chemistry. (Three hours of lecture per week)
Prerequisite: CHE 101 or equivalent
Credit Hours: 3
Contact Hours: 3

CHE 109: Chemistry in Context
An overview of some of the basic concepts and principles of chemistry using a guided inquiry approach incorporating hands-on chemistry activities related to real life applications, environmental, health, and social issues. (Two hours of lecture and two hours of laboratory per week.)
Credit Hours: 3
Contact Hours: 4

CHE 110: General Chem I Laboratory
Prerequisite/Corequisite: CHE 101. Practical methods of measurements and the accuracy. Experimental investigations of common chemical reactions. Quantitative aspects of chemical reactions. Experimental aspects of other selected concepts of CHE 101. (Three hours of lab per week)
Credit Hours: 1
Contact Hours: 1

CHE 120: General Chemistry II Lab
Prerequisites/Corequisite: CHE 102. Elementary statistical analysis and molecular modeling. Experimental aspects of properties of matter, chemical kinetics, chemical equilibria, acid-base theory, complesion equilibria and electrochemistry. (Three hours of laboratory per week)
Credit Hours: 1
Contact Hours: 1

CHE 130: Ferment. & Spirits Chem.
Credit Hours: 4
Contact Hours: 4

CHE 200: Intro to Organic & Biochem
Nomenclature, structure, stereochemistry, and reactivity of basic organic compounds. Emphasis on functional groups commonly found in biologically active compounds. (Four hours of lecture per week)
Prerequisite: CHE 102 or CHE 109
Credit Hours: 4
Contact Hours: 4

CHE 209: Survey Gen/Organic/Biochemi
Topics inlude: properties of matter, atomic structure and the periodic table, chemical bonding, general reactions such as acid-base chemistry, organic functional groups, carbohydrates, proteins, nucleic acids, and lipids. This course is required for sutdents in Nursing. (Three hours of lecture and three hours of lab per week.)
Credit Hours: 4
Contact Hours: 6

CHE 301: Organic Chemistry I
Isomerism in organic molecules, reactivity of hydrocarbons, alkyl halides, free radicals, alcohols, ethers and related compounds. Introduction to reaction mechanisms. Introduction to instrumental methods (NMR, IR). (Three hours of lecture per week)
Prerequisite: CHE 102
Credit Hours: 3
Contact Hours: 3

CHE 302: Organic Chemistry II
A continuation of CHE 301 exploring the reactivity of unsaturated hydrocarbons, carbonyl compounds, and amines. Multistep synthesis of organic molecules with acquired reaction knowledge. Use of Instrumental methods (NMR, IR, MS, and UV-vis) to characterize organic compounds. (Three hours of lecture per week)
Prerequisite: CHE 301
Credit Hours: 3
Contact Hours: 3

CHE 303: Quantitative Analysis
Fundamental theory and practice of volumetric, gravimetric, and electrochemical analysis. Preparation of standard solutions and analysis of salts, alloys, and ores. (Two hours of lecture, four hours of laboratory per week)
Prerequisite: CHE 102
Credit Hours: 4
Contact Hours: 6

CHE 310: Organic Chemistry I Lab.
Prerequisite/Corequisite: CHE 301. Purification, separation (including TLC, GC), and characterization of organic compounds. (Three hours of laboratory per week)
Credit Hours: 1
Contact Hours: 1

CHE 315: Biochemistry
Introduction to amino acids, proteins, buffers, enzymes, nucleic acids, carbohydrates, lipids and other biomolecules. Introduction to the metabolism of carbohydrates, lipids and nitrogen-containing molecules. (Three hours of lecture per week)
Prerequisite: CHE 200 or CHE 302
Credit Hours: 3
Contact Hours: 3

CHE 320: Organic Chemistry II Lab
Prerequisite/Corequisite: CHE 302. Use of the methods of separation and synthesis learned in CHE 310 to prepare new compounds. Compounds are characterized by instrumental methods (GC, IR, NMR) and TLC, along with other methods. (Three hours of laboratory per week)
Credit Hours: 1
Contact Hours: 1

CHE 350: Biochemistry Laboratory
Prerequisite/Corequisite: CHE 315. Experiments with buffers and enzymes. Properties and digestion reactions of carbohydrates, lipids and proteins. HPLC and other methods of separation and purification of compounds. (Three hours of laboratory per week)
Credit Hours: 1
Contact Hours: 3

CHE 399: Undergrad Teaching Experience
Students earn course credit for undergraduate teaching experience including but not limited to (1) assisting students during laboratory sessions, (2) helping to set up laboratories or lecture/lab quizzes, or (3) conducting PLTL-Excel type workshops for students. Course may be repeated for credit.
Prerequisite: Consent of instructor
Credit Hours: 1
Contact Hours: 1

CHE 401: Undergrad Research
This course is designed to give chemistry majors an opportunity to conduct independent research, using techniques in synthesis, analysis, and applications of basic chemical theory. A formal oral presentation of the findings of the student's project is required. May be repeated for credit.
Prerequisite: Consent of instructor
Credit Hours: 1-4
Contact Hours: 1-4

CHE 402: Chemistry Seminar
Students will undertake a review of the chemical literature and give an oral presentation on a specific topic at the end of their course.
Prerequisite: Consent of instructor
Credit Hours: 1
Contact Hours: 1

CHE 407: Physical Chemistry I
Introduction to the theory and application of thermodynamics, molecular kinetics, and chemical kinetics. (Three hours of lecture, three hours of laboratory per week)
Prerequisite: CHE 102 and MAT 131
Credit Hours: 4
Contact Hours: 6

CHE 408: Inorganic Preparation
A continuation of CHE 407. Introduction to quantum mechanics, statistical mechanics, and molecular spectroscopy. (Three hours of lecture, three hours of laboratory per week)
Prerequisite: CHE 407
Credit Hours: 4
Contact Hours: 6

CHE 409: Physical Chemistry II
A continuation of CHE 407. Introduction to quantum mechanics, statistical mechanics, and molecular spectroscopy. (Three hours of lecture, three hours of laboratory per week). CREDIT: 4 SEMESTER HOURS.
Prerequisite: CHE 407
Credit Hours: 4
Contact Hours: 5

CHE 412: Inorganic Chemistry
Quantum theory of polyatomic systems, introduction to group theory, theories on bonding and structure, introduction to coordination chemistry and the chemistry of Transition Elements, inorganic reaction mechanisms, acid-base theories, inorganic reactions in non-aqueous media. (Four hours of lecture per week)
Prerequisite: CHE 101 and CHE 102
Credit Hours: 3
Contact Hours: 3

CHE 414: Instrumental Analysis
Theory and modern methods of instrumental analysis, with emphasis on spectrophotometric, chromatographic, and electroanalytical techniques. (Two hours of lecture, four hours of laboratory per week)
Prerequisite: CHE 303
Credit Hours: 4
Contact Hours: 6

CHE 425: Intro. Physical Chemistry
An introductory one-semester course in physical chemistry. The properties of gases, theory and application of thermodynamics, phase and chemical equilibria, electrochemistry, kinetics, introduction to quantum theory and spectroscopy. Credits: 4 semester hours
Prerequisite: CHE 102
Co-requisite: MAT 131
Credit Hours: 4
Contact Hours: 4