



Department of Chemistry
And Biochemistry

Curriculum Map: B.S. Degree in CHEMISTRY

Learning Goals (Student Learning Outcomes, SLOs)

1. Acquisition of a broad, basic knowledge of chemistry
2. Preparation for employment in industry, government labs or secondary education or to pursue graduate education in chemistry or a related discipline or professional school
3. Critical evaluation of chemical literature and mastery of current technology

*** Indicates required courses for all tracks and both chemistry and biochemistry majors. Unmarked courses may be required in some tracks or are electives**

	<u>SLOs</u>
*CHEM115 General Chemistry Lecture I Frequency: A Nuclear, electronic, and molecular composition and structure and principles of chemical bonding used to describe nature and reactivity of atoms, ions, and molecules. Includes laws governing behavior of gases, liquids, and solids. Credits: 3	1,2
*CHEM116 General Chemistry Lecture II Frequency: A Continuation of CHEM 115. Thermodynamics, chemical kinetics, chemical equilibrium, properties of acids and bases, aqueous solutions, electrochemistry, and nuclear chemistry. Prerequisite(s): CHEM 115 Credits: 3	1,2
*CHEM125 General Chemistry Laboratory I Frequency: A Some fundamental principles in experimental investigation of chemical substances and phenomena. Includes consideration of chemical and physical properties and typical reactions of inorganic	1,2

and organic compounds. Equilibria, thermochemistry, oxidation-reduction, rates of chemical reactions, and volumetric, gravimetric, and qualitative analysis investigated. One laboratory period per week.

Credits: 1

*CHEM126 General Chemistry Laboratory II 1,2

Frequency: A

Some fundamental principles in experimental investigation of chemical substances and phenomena. Includes consideration of chemical and physical properties and typical reactions of inorganic and organic compounds. Equilibria, thermochemistry, oxidation-reduction, rates of chemical reactions, and volumetric, gravimetric, and qualitative analysis investigated. One laboratory period per week.

Credits: 1

CHEM130 Honors General Chemistry Laboratory 1,2

Frequency: B

Directed studies designed to foster independence of thought and improve laboratory technique. Emphasis on quantitative determinations by acid-base, complexation, and spectroscopic methods. Open to Chemistry majors and others by permission of department. One laboratory period per week.

Prerequisite(s): CHEM 115 and CHEM 125

Credits: 1

*CHEM215 Organic Chemistry Lecture I 1,2

Frequency: AB

Structure and reactions of the most important classes of organic compounds: hydrocarbons and principal functional groups of the compounds of carbon. Structure, occurrence, properties of organic compounds of biological significance.

Prerequisite(s): CHEM 116

Credits: 3

*CHEM216 Organic Chemistry Lecture II 1,2

Frequency: B

Structure and reactions of the most important classes of organic compounds: hydrocarbons and principal functional groups of the compounds of carbon. Structure, occurrence, properties of organic compounds of biological significance.

Prerequisite(s): CHEM 116

Credits: 3

*CHEM225 Organic Chemistry Laboratory I 1,2

Frequency: B

Techniques for determination of physical and chemical properties, synthesis, and isolation from natural sources, of organic compounds. Nuclear magnetic resonance and infrared spectroscopy incorporated in experiments. One laboratory period per week.

Credits: 1

*CHEM226 Organic Chemistry Laboratory II 1,2

Frequency: B

Techniques for determination of physical and chemical properties, synthesis, and isolation from natural sources, of organic compounds. Nuclear magnetic resonance and infrared spectroscopy incorporated in experiments. One laboratory period per week.

Credits: 1

CHEM230 Advanced Organic Laboratory	1,2
Frequency: B	
The utilization of instrumental methods and advanced laboratory techniques in organic chemistry. Includes hands-on use of various instrumental methods including infrared, nuclear magnetic resonance, and gas chromatography. One three-hour laboratory period per week.	
Prerequisite(s): CHEM 225	
Credits: 1	
*CHEM315 Physical Chemistry Lecture I	1,2
Frequency: B	
An introductory course which provides an overview of the sub-disciplines of physical chemistry, specifically thermodynamics, kinetics and quantum mechanics. Such topics are relevant to a vast array of scientific endeavors including such multidisciplinary areas as biochemistry and environmental sciences. The course is intended to provide an understanding of the relevant topics without in-depth analyses and discussions.	
Prerequisite(s): CHEM 116 and MATH 123 and PHYS 231 and PHYS 233	
Credits: 3	
CHEM316 Physical Chemistry Lecture II	1,2
Frequency: B	
An in-depth treatment of physical chemistry topics including derivations, analysis and discussion within the areas of kinetics, thermodynamics and quantum mechanics. Applications to chemical systems and implications for spectroscopic analysis of molecular structure	
Prerequisite(s): CHEM 116 and MATH 123 and PHYS 231 and PHYS 233 and CHEM 315	
Credits: 3	
*CHEM317 Analytical Chemistry, Quantitative Analysis	1,2
Frequency: B	
Gravimetric, volumetric, and elementary instrumental determinations. Emphasis on volumetric analysis. Neutralization, oxidation-reduction, complexometric, and electrochemical methods. Introduction to computer methods in chemistry.	
Prerequisite(s): CHEM 116	
Credits: 3	
CHEM318 Analytical Chemistry, Instrumental Analysis	1,2,3
Frequency: B	
Continuation of CHEM 317. Application of instrumental methods to quantitative chemical analysis, including spectroscopy, potentiometry, chromatography, nuclear and chemical methods.	
Prerequisite(s): CHEM 317	
Credits: 3	
CHEM325 Physical Chemistry Laboratory I	1,2
Frequency: B	
Laboratory experiments designed to accompany CHEM 315. One laboratory period per week.	
Credits: 1	
CHEM326 Physical Chemistry Laboratory II	1,2
Frequency: B	
Laboratory experiments designed to accompany CHEM 316. One laboratory period per week.	

Credits: 1

CHEM327 Analytical Chemistry I Laboratory 1,2
 Frequency: B
 Laboratory experiments designed to accompany CHEM 317.
 Credits: 1

CHEM328 Analytical Chemistry II Laboratory 1,2,3
 Frequency: B
 Laboratory experiments designed to accompany CHEM 318.
 Credits: 2

CHEM333 Biochemistry 1,2
 Frequency: B
 The structure and function of proteins and the regulation of metabolic pathways will be the central concepts presented in the course. Students should gain an understanding of the fundamental principles of the biology of protein molecules. BIOL 237 Genetics recommended as prerequisite.
 Prerequisite(s): CHEM 216 and CHEM 226
 Credits: 3

CHEM334 Biochemistry Laboratory 1,2
 Frequency: B
 Introduction to laboratory practice using biochemical techniques to isolate and characterize proteins. Enzyme kinetics and bioinformatics are also covered.
 Credits: 1

CHEM391-392 Independent Lab Research 1,2,3
 Frequency: A
 For students having junior standing. See CHEM 491-492 for list of study and research areas.
 Credits: 1-3

CHEM395 Introduction to Research 2,3
 Frequency: B
 Prepares the student to carry out independent research. Topics include the philosophy of research, descriptions of current faculty research interests, research records, laboratory safety, use of the chemical literature, technical writing, and research tools and methodology. One lecture per week.
 Prerequisite(s): CHEM 216
 Credits: 1

CHEM405 Industrial Chemistry 1,2,3
 Frequency: D
 Application of chemical principles to chemical and environmental processes. Topics include mass and energy balances over complex systems, reaction kinetics and thermodynamics, combustion, behavior of real gases, and waste minimization. Directed toward students with career interests in industry and/or chemical or environmental engineering.
 Prerequisite(s): CHEM 315
 Credits: 3

CHEM407 Organometallics 1,2,3
 Frequency: C
 Introduction to the chemistry of transition metal organometallics. Descriptions of the bonding, synthesis, structures, and reactions of

major classes of organometallic compounds, as well as their role in organic synthesis and catalysis.
Prerequisite(s): CHEM 216
Credits: 3

CHEM412 Advanced Organic Chemistry 1,2,3
Frequency: C
The discussion of certain types of reactions for the synthesis of compounds having significance to organic or bioorganic chemistry. Examples include addition/elimination; oxidation/reduction; free radical; carbanionic; pericyclic; and other types of reactions.
Prerequisite(s): CHEM 215 and CHEM 216
Credits: 3

CHEM417 Polymer Chemistry 1,2,3
Frequency: C
An overview of polymers, with an emphasis on their chemistry, properties, and significance. Focus on the synthesis, characterization, and fabrication, and physical chemistry of polymers.
Prerequisite(s): CHEM 216 and CHEM 315
Credits: 3

CHEM462 Inorganic Chemistry 1,2,3
Frequency: B
Topics include introduction to molecular symmetry and group theory. Discussions of electronic structure of atoms and their periodic properties followed by detailed considerations of ionic and covalent bonding. Acid-base theories presented in addition to general chemistry of the elements with emphasis on transition metals. Introduction to organometallic chemistry and bio-inorganic chemistry included.
Prerequisite(s): CHEM 315 CHEM 216
Credits: 3

CHEM465 Advanced Experimental Biochemistry 1,2,3
Frequency: B
State-of-the art biochemical and molecular techniques are taught within the hands-on, laboratory-based course. Potential topics include the polymerase chain reaction (PCR), oligonucleotide synthesis, DNA/protein sequencing and analysis (BLAST, DNASIS), pulse-field gel electrophoresis, gas chromatography-mass spectroscopy (GC-MS), nuclear magnetic resonance (NMR) spectroscopy, high performance liquid chromatography (HPLC), immunochemistry, and/or other contemporary techniques. Minimum of 2 credits of this course.
Prerequisite(s): BIOL 334 CHEM 216
Credits: 2

CHEM472 Inorganic Chemistry Laboratory 1,2,3
Frequency: B
Laboratory studies of inorganic and organometallic compounds and ions. Synthetic experiments require inert atmosphere (vacuum line, dry box, and Schlenk) techniques; characterization by spectral, solid-state, and electrochemical methods. One laboratory period per week.
Prerequisite(s): CHEM 315 and CHEM 325
Credits: 1

CHEM473 Environmental Aquatic Chemistry 1,2,3

Frequency: C

Explores the interrelationships of chemistry within the aquatic environment. Topics will include (i) energy flow and transformations, (ii) chemical cycles in the environment, (iii) fate and transport of chemical in surface and subsurface water, soil, and air, (iv) aquatic chemistry, including the carbon dioxide cycle, precipitation reactions, complexation reactions, and redox chemistry, (v) phase interactions, (vi) aquatic microbial biochemistry, (vii) water pollution, and (viii) water treatment.

Prerequisite(s): CHEM 215

Credits: 3

CHEM474 Environmental Atmospheric Chemistry

1,2,3

Frequency: C

Introduces the chemistry occurring within both natural and polluted atmospheres, with an emphasis on fundamental principles. Topics include: gas-phase chemistry, aerosol formation and heterogeneous chemistry, meteorology, and current environmental issues (ozone holes, global warming, etc.). Class activities will include discussions of technical papers drawn from contemporary scientific literature and simulations of environmental problems through computer models.

Prerequisite(s): CHEM 215

Credits: 3

CHEM475 Advanced Biochemistry

1,2,3

Frequency: B

A continuation of BIOL 333, the course explores biochemical concepts and pathways with an emphasis on problem solving. Cellular control and coordination of biochemical pathways is emphasized in light of an advanced understanding of protein biochemistry. Lecture only.

Prerequisite(s): BIOL 333

Credits: 3

CHEM481 Special Topics in Chemistry

1,2,3

Frequency: B

Topics of special or current interest offered periodically.

Credits: 1-3

CHEM491-492 Independent Laboratory Research

1,2,3

Frequency: A

For students having senior standing. Study and research areas include analytical, inorganic, organic, physical, and polymer chemistry. Prerequisites depend upon areas of study and research.

Prerequisite(s): CHEM 395

Credits: 1-3

CHEM495-496 Seminar: Advances in Chemistry

1,2,3

Frequency: A

Topics of current research interest; presentations by seniors, graduate students, faculty, and visitors. Every student is required to present one seminar during one of the two semesters. Emphasis on detailed knowledge of subject matter, techniques for searching the professional literature, and procedures for the preparation and presentation of a professional seminar. Majors only.

Prerequisite(s): CHEM 216

Credits: 1