CHEM-135 Principles of Chemistry 3 Credits
Corequisites: CHEM-136
Prerequisites: None
Terms Offered: Summer, Fall
An introduction to fundamental concepts and applications of chemistry, including the Periodic Table and chemical nomenclature, reactions and reaction stoichiometry, atomic structure, chemical bonding and chemical equilibrium. Applied topics include batteries, fuel cells and corrosion, and a description of the chemistry and uses of metals and nonmetals.
Lecture: 3, Lab 0, Other 0

CHEM-136 Principles of Chemistry Lab 1 Credits
Corequisites: CHEM-135
Prerequisites: None
Terms Offered: Summer, Fall
The laboratory introduces and/or illustrates chemical concepts and principles, and teaches the skills of data collection and evaluation. The SI system is emphasized.
Lecture: 0, Lab 2, Other 0

CHEM-137 General Chemistry I 3 Credits
Corequisites: CHEM-136
Prerequisites: None
Terms Offered: Summer, Fall
An introduction to fundamental concepts of chemistry, including the Periodic Table, chemical nomenclature, reactions and reaction stoichiometry, atomic structure and chemical bonding. The course is open to all science majors, and is required for Chemistry majors. Non-science majors require permission of Chemistry Discipline Chair.
Lecture: 3, Lab 0, Other 1

CHEM-145 Industrial Organic Chemistry 3 Credits
Corequisites: CHEM-146
Prerequisites: None
Minimum Class Standing: Freshman 2
Terms Offered: Winter, Spring
A laboratory course to accompany and reinforce the theoretical concepts of organic chemistry covered in CHEM-145. The course will cover safety aspects of organic chemistry, the reactions of organic functional groups and identification of organic chemicals and polymers using chromatography, thermal analysis and infrared spectroscopy techniques.
Lecture: 3, Lab 0, Other 0

CHEM-146 Industrial Organic Chem Lab 1 Credits
Corequisites: CHEM-145
Prerequisites: None
Minimum Class Standing: Freshman 2
Terms Offered: Winter, Spring
A laboratory course to accompany and reinforce the theoretical concepts of organic chemistry covered in CHEM-145. The course will cover safety aspects of organic chemistry, the reactions of organic functional groups and identification of organic chemicals and polymers using chromatography, thermal analysis and infrared spectroscopy techniques.
Lecture: 0, Lab 2, Other 0

CHEM-223 Introduction to Polymer Science 4 Credits
Prerequisites: CHEM-135 or CHEM-137
Minimum Class Standing: Sophomore
Terms Offered: Winter, Spring
An introduction to the fundamental principles of Polymer Science. Topics include the relationship between polymer structure and engineering properties with discussions of the most widely used polymeric materials and processes in terms of their relative costs, design parameters, and applications - thermal, mechanical, and rheological testing is discussed as well as the environmental impact of polymeric materials. Each lecture is augmented by displays of fabricated parts which illustrate general plastic selection principles. Each student makes an oral and written presentation which illustrates the application of polymer science to a specific material, design and/or process.
Lecture: 4, Lab 0, Other 0

CHEM-237 General Chemistry II 3 Credits
Corequisites: CHEM-238
Prerequisites: CHEM-135 or CHEM-137
Minimum Class Standing: Freshman 2
Terms Offered: Winter, Spring
General Chemistry II, is a continuation of CHEM-137, General Chemistry I. Topics covered include: properties of gases, thermochemistry, chemical thermodynamics, ideal and non-ideal solutions, chemical equilibrium, chemical kinetics, nuclear chemistry, and electrochemistry.
Lecture: 3, Lab 0, Other 1

CHEM-238 General Chemistry II Lab 1 Credits
Corequisites: CHEM-237
Prerequisites: CHEM-135 or CHEM-137
Minimum Class Standing: Freshman 2
Terms Offered: Winter, Spring
This laboratory course, taken concurrently with CHEM-237, is designed to continue exploring the experimental principles of chemistry not covered in CHEM-136. Topics covered include empirical formulas of hydrates, gas laws, heats of reactions, freezing point depression, iodine clock, acid dissociation constant determination; buffers, solubility product constant determination, electrolysis of water, and the determination of thermodynamic properties.
Lecture: 0, Lab 3, Other 0

CHEM-245 Appl Chem for Engineers 4 Credits
Prerequisites: CHEM-135 or CHEM-137
Terms Offered: As needed
Knowledge gained in CHEM-135, Principles of Chemistry, will be applied to real world situations. In addition, topics not covered in CHEM-135 will be introduced along with their applications. New topics include: forms of energy, fuels, nuclear chemistry, corrosion, surfaces, polymers and plastics, ceramics and composites. Fuel cells and their basic chemistry are an important component of this class.
Lecture: 4, Lab 0, Other 0

CHEM-247 Survey of Organic Chemistry 4 Credits
Prerequisites: CHEM-135 or CHEM-137
Minimum Class Standing: Freshman 2
Terms Offered: Winter, Spring
The basic principles of organic chemistry are taught in this course. Topics covered in detail include bonding, functional groups, nomenclature, molecular structure, and chemical reactivity. Other fundamental properties of organic molecules such as acidity/basicity, stereochemistry, and reaction mechanisms will be covered.
Lecture: 4, Lab 0, Other 0
CHEM-345  Organic Chemistry I  4 Credits
Prerequisites: CHEM-237
Minimum Class Standing: Sophomore
Terms Offered: Summer, Fall
A thorough coverage of the chemistry of hydrocarbons will be provided. Topics include: valence theory, stereochemistry, structure, addition polymerization, reaction mechanisms and spectroscopy. This course is appropriate for science majors and environmental Chemistry minors.
Lecture: 6, Lab 0, Other 0

CHEM-346  Organic Chemistry I Lab  2 Credits
Corequisites: CHEM-345
Prerequisites: CHEM-237 and CHEM-238
Minimum Class Standing: Sophomore
Terms Offered: Summer, Fall
This laboratory develops the basic skills needed for the separation, identification and synthesis of organic compounds. Instrumental techniques introduced will include FTIR, UV-VIS, GC and GC/MS. One four-hour laboratory per week.
Lecture: 0, Lab 4, Other 0

CHEM-347  Organic Chemistry II  4 Credits
Prerequisites: CHEM-345
Minimum Class Standing: Sophomore 2
Terms Offered: Winter, Spring
A continuation of CHEM-345 with an emphasis on the chemistry of the organic functional groups and the synthesis of polyfunctional molecules will be provided. Appropriate for science majors.
Lecture: 4, Lab 0, Other 0

CHEM-348  Organic Chemistry II Lab  2 Credits
Corequisites: CHEM-347
Prerequisites: CHEM-345 and CHEM-346
Minimum Class Standing: Sophomore 2
Terms Offered: Winter, Spring
A continuation of CHEM-346 with an emphasis on the advanced techniques used to synthesize multifunctional organic compounds will be provided. Instrumental methods will be intensively utilized to characterize complex chemical structures.
Lecture: 0, Lab 4, Other 0

CHEM-351  Biochemistry I  4 Credits
Corequisites: CHEM-352
Prerequisites: CHEM-345 and CHEM-346
Minimum Class Standing: Sophomore
Terms Offered: Summer, Fall
The basic principles of biochemistry will be the focus of this course. Coverage includes a thorough description of the biochemical framework - amino acids, proteins, enzymes, lipids, membranes, carbohydrates, nucleic acids, DNA, and RNA. In addition, the energetics and metabolism of a number of biological processes will be introduced.
Lecture: 4, Lab 0, Other 0

CHEM-352  Biochemistry Lab  2 Credits
Corequisites: CHEM-351
Prerequisites: CHEM-345 and CHEM-346
Minimum Class Standing: Sophomore
Terms Offered: Summer, Fall
An introduction to biochemistry laboratory procedures for the separation and analysis of biologically important molecules. This course also covers techniques and methodology important in the biotechnology field.
Lecture: 0, Lab 4, Other 0

CHEM-361  Physical Chemistry I  4 Credits
Corequisites: CHEM-362
Prerequisites: CHEM-237 and CHEM-238 and PHYS-224 and PHYS-225
Minimum Class Standing: Junior
Terms Offered: Summer, Fall
A first course in physical chemistry, covering the topics of chemical thermodynamics, gas laws, solutions, transport properties, phases and phase diagrams, electrochemistry, colligative properties and the physical chemistry of macromolecules.
Lecture: 4, Lab 0, Other 0

CHEM-362  Physical Chemistry I Lab  2 Credits
Corequisites: CHEM-361
Prerequisites: None
Minimum Class Standing: Junior
Terms Offered: Summer, Fall
This laboratory will illustrate principles covered in the CHEM-361 lecture and introduce the student to methods used in determining physical relationships in nature. Topics include equilibrium, phase diagrams, solutions, thermodynamics, gases, transport properties and error analysis.
Lecture: 0, Lab 4, Other 0

CHEM-363  Physical Chemistry II  4 Credits
Corequisites: CHEM-364
Prerequisites: CHEM-237 and PHYS-224 and PHYS-225 and (MATH-203 or MATH-203H)
Minimum Class Standing: Junior 2
Terms Offered: As needed
The second course in the physical sequence, continuing topics introduced in CHEM-361, Physical Chemistry I. Topics covered will include kinetic molecular theory, kinetics, quantum mechanics, solids and surfaces, photochemistry, atomic and molecular structure theory, spectroscopy, statistical mechanics.
Lecture: 4, Lab 0, Other 0

CHEM-364  Physical Chemistry II Lab  2 Credits
Corequisites: CHEM-363
Prerequisites: None
Minimum Class Standing: Junior 2
Terms Offered: As needed
This laboratory will illustrate principles covered in the CHEM-363 lecture and introduce the student to methods used in determining physical relationships in nature. Topics include kinetics, quantum mechanics, solids, surface chemistry, electrochemistry, photochemistry, and spectroscopic techniques.
Lecture: 0, Lab 4, Other 0

CHEM-373  Analytical Chemistry  4 Credits
Corequisites: CHEM-374
Prerequisites: CHEM-237 and CHEM-238 and CHEM-345 and CHEM-346
Minimum Class Standing: Junior 2
Terms Offered: As needed
Introduction to classical and modern instrumental analytical chemistry. The fundamentals of analytical statistics, acid/base calculations, titrations, basic chemical equilibrium, atomic and molecular spectroscopic, chromatographic, and electroanalytical methods of analysis will be covered.
Lecture: 4, Lab 0, Other 0
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Corequisites</th>
<th>Prerequisites</th>
<th>Minimum Class Standing</th>
<th>Terms Offered</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CHEM-374</td>
<td>Analytical Chemistry Lab</td>
<td>2</td>
<td>CHEM-373</td>
<td>CHEM-345 and CHEM-346</td>
<td>Junior 2</td>
<td>As needed</td>
<td>This laboratory course covers the qualitative and quantitative analysis of chemical compounds including gravimetric, volumetric, and spectrophotometric methods.</td>
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<tr>
<td>CHEM-437</td>
<td>Advanced Inorganic Chemistry</td>
<td>4</td>
<td>CHEM-438</td>
<td>CHEM-345</td>
<td>Junior</td>
<td>As needed</td>
<td>In-depth coverage of the fundamentals of inorganic and bioinorganic chemistry, including structure and bonding of inorganic compounds, as well as their chemical periodicity and reactions. The descriptive chemistry of metals, non-metals and coordination compounds will also be discussed.</td>
</tr>
<tr>
<td>CHEM-451</td>
<td>Biochemistry II</td>
<td>4</td>
<td>CHEM-452</td>
<td>CHEM-351 and CHEM-352</td>
<td>Junior 2</td>
<td>As needed</td>
<td>A comprehensive advanced Biochemistry lecture course. It will cover topics related to the biochemistry of the human body, including the breakdown and synthesis of glucose, fatty acids, amino acids, and nucleotides.</td>
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<tr>
<td>CHEM-452</td>
<td>Biochemistry II Lab</td>
<td>2</td>
<td>CHEM-451</td>
<td>CHEM-351 and CHEM-352</td>
<td>Junior 2</td>
<td>As needed</td>
<td>A comprehensive advanced Biochemistry laboratory. Topics related to the isolation and manipulation of DNA and proteins will be covered. Including techniques such as PCR, Western blotting, mutagenesis, DNA Fingerprinting, and molecular modeling.</td>
</tr>
<tr>
<td>CHEM-461</td>
<td>Colloid Science</td>
<td>4</td>
<td>CHEM-462</td>
<td>CHEM-361 or (CHEM-237 and MECH-320) or (CHEM-237 and PHYS-452)</td>
<td>Junior</td>
<td>As needed</td>
<td>An introduction to Colloid and Surface Chemistry. Topics covered include: colloids, micelles, self-assembled monolayers, thin films, foams, polymers, ceramics, gels, emulsions and sols. The physical properties and methods of studying colloids will also be addressed.</td>
</tr>
<tr>
<td>CHEM-462</td>
<td>Colloid Science Lab</td>
<td>2</td>
<td>CHEM-461</td>
<td>CHEM-361 or (CHEM-237 and MECH-320) or (CHEM-237 and PHYS-452)</td>
<td>Junior</td>
<td>As needed</td>
<td>This laboratory course investigates the preparation, properties and characterization of colloids and colloidal systems.</td>
</tr>
<tr>
<td>CHEM-477</td>
<td>Advanced Organic Chemistry</td>
<td>4</td>
<td>CHEM-478</td>
<td>CHEM-347 and CHEM-348</td>
<td>Senior</td>
<td>As needed</td>
<td>A senior level chemistry elective. This course will cover topics including the principles of structure/reactivity, reaction mechanisms, kinetic and thermodynamic control of reactions, radical and photochemistry, organometallic chemistry and total organic synthesis.</td>
</tr>
<tr>
<td>CHEM-478</td>
<td>Advanced Organic Chemistry Lab</td>
<td>2</td>
<td>CHEM-477</td>
<td>CHEM-347 and CHEM-348</td>
<td>Senior</td>
<td>As needed</td>
<td>A senior level chemistry elective course. The laboratory develops the skills needed to perform variety of organic reactions including photochemistry and organometallic chemistry. It also allows the student to use the knowledge developed to design and carry out a total synthesis for a target compound. Student will employ the separation, purification and identification techniques learned in CHEM-348 to perform the labs. One four-hour laboratory per week.</td>
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<tr>
<td>CHEM-491</td>
<td>Chemistry Special Topics</td>
<td>6</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>As needed</td>
<td>Advanced Chemistry Elective &amp; Lab</td>
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<tr>
<td>CHEM-492</td>
<td>CHEM Special Topics</td>
<td>4</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>As needed</td>
<td>Advanced Chemistry Elective &amp; Lab</td>
</tr>
</tbody>
</table>
CHEM-494  Senior Research/Seminar I  2 Credits
Prerequisites: None
Minimum Class Standing: Junior 2
Terms Offered: Summer, Fall, Winter, Spring
An introduction to the techniques for literature search and document retrieval. Students will initiate a research project under the direction of a chemistry or biochemistry faculty member. Each student will prepare and present a seminar based on their research progress. Each student will also prepare a written report on their research project.
Lecture: 0, Lab 6, Other 0

CHEM-496  Senior Research/Seminar II  2 Credits
Prerequisites: CHEM-494
Minimum Class Standing: Senior
Terms Offered: Summer, Fall, Winter, Spring
Seniors will conclude a senior research project with a faculty member, and prepare and present a seminar dealing with progress achieved during the research period. Guest seminar lectures by visiting faculty, industry or government scientists will also be scheduled. This course may be repeated twice for a total of six credits.
Lecture: 0, Lab 6, Other 0

CHEM-499  Chemistry Independent Study  4 Credits
Prerequisites: None
Terms Offered: As needed
Advanced Chemistry Independent Study
Lecture: 4, Lab 0, Other 0