Degrees Offered
Bachelor of Arts
Bachelor of Science

Majors Offered
Chemistry (BA, BS)
Chemistry with Departmental Honors (BS)
Biochemistry (BS)
Biochemistry with Departmental Honors (BS)
Pharmaceutical/Chemical Science (MS, PhD) (see the Stockton Graduate Catalog)

Minors Offered
Chemistry

Objective
An understanding and appreciation of underlying chemistry is becoming increasingly important for our lives and the future of our small planet. The emphasis in all chemistry classes is to provide a thorough understanding of basic chemical concepts and to develop the competence in how to apply these concepts in a logical fashion to solve real world problems. Students can choose among a variety of degree programs designed to meet a range of career goals. The Chemistry Department has a long history of success in placing students into excellent medical, dental, pharmacy and graduate school programs. Students are also well prepared for rewarding careers in industry, government service and private business. The Bachelor of Science Degrees in Chemistry are certified by the American Chemical Society (ACS). The BS Biochemistry program follows national guidelines.

The Bachelor of Arts degree is designed to give students a broad understanding of chemistry for careers in medicine, dentistry and teaching.

The more rigorous Bachelor of Science degree prepares students for a variety of options including advanced degree studies in chemistry and biochemistry, professional schools of medicine and dentistry, and careers in the chemical industry.

Virtually all Bachelor of Science and many Bachelor of Arts candidates choose undergraduate research as one of their chemistry electives. In this course the student has the opportunity to use the modern instrumentation available in the department and to work closely with faculty and graduate students on an original research project. The graduate students are typically conducting independent research projects as part of a masters or doctoral program.

I. Critical Thinking/Analytical Skills
A. Identify and apply relevant fundamental concepts to solve a variety of problems of different complexity.
B. Analyze theories and methods for both strengths and weaknesses.
C. Respond to analysis of one's own work, theories and/or methods.

II. Laboratory and Research Skills
A. Basic analytical and technical skills necessary to work effectively in fields of chemistry.
B. Perform accurate quantitative measurements using modern chemical instrumentation. Interpret experimental results, perform calculations with these results, and draw reasonable scientific conclusions.
C. Synthesize, separate, and characterize compounds using modern methodologies and techniques.
D. Knowledge and understanding of safety: chemical regulations, laboratory safety, best/safe practices and chemical disposal.

III. Quantitative Reasoning Skills
A. Accurately collect and interpret numerical data.
B. Solve problems competently using mathematical methods such as extrapolation, approximation, and limiting behavior, as well as understand of concepts such as precision, accuracy, estimation, and statistical validity.
C. Proficiency in the scientific method.

IV. Knowledge of Chemical Facts and Information
A. A working knowledge of the chemical principles appropriate for a degree in chemistry: thermodynamics, equilibrium, kinetics, quantum mechanics, structure of materials, reactivities, and synthesis.
B. A broad set of chemical factual knowledge with respect to the properties of substances, molecules, atoms, and elements.

V. Computer, Library and Information Skills
A. Make effective use of the library and other information resources in chemistry. Understand the primary literature, tabulated data, and secondary sources (such as the Internet).
B. Make effective use of chemical software applications including symbolic mathematics, chemical word processing, and data presentation/interpretation software.
C. Describe, perform, and interpret basic molecular modeling and quantum chemical calculations using common software packages.

VI. Oral and Written Communication Skills
A. Skill in technical writing and oral presentations, including electronic slideshows.
B. Communicate chemical research and results in both oral and written formats to both technical and non-technical audiences.

Bachelor of Arts Major in Chemistry
Students must complete a minimum of 120 units with a Pacific cumulative and major/program grade point average of 2.0 in order to earn the bachelor of arts degree with a major in chemistry.

I. General Education Requirements
Minimum 42 units and 12 courses that include:
Bachelor of Science Major in Chemistry
Students must complete a minimum of 120 units with a Pacific cumulative and major/program grade point average of 2.0 in order to earn the bachelor of science degree with a major in chemistry.

I. General Education Requirements
Minimum 42 units and 12 courses that include:
PACS 001 What is a Good Society 4
PACS 002 Topical Seminar on a Good Society 4
PACS 003 What is an Ethical Life? 3

One course from each subdivision below:

Social and Behavioral Sciences
IA. Individual and Interpersonal Behavior
IB. U.S. Studies
IC. Global Studies

Arts and Humanities
IIA. Language and Literature
IIB. Worldviews and Ethics
IIC. Visual and Performing Arts

Natural Sciences and Mathematics *
IIIA. Natural Sciences
IIIB. Mathematics and Formal Logic
IIIC. Science, Technology and Society
or a second IIIA Natural Science course

Note: 1) No more than 2 courses from a discipline may be applied to meet the requirements of the general education program. 2) * Fulfilled by courses required in the major

II. Diversity Requirement
Students must complete one diversity course (3-4 units)

Note: 1) Transfer students with 28 units or more transfer units prior to fall 2011 are encouraged but not required to complete a designated course prior to graduation. 2) Courses may be used also to meet general education and/or major/minor requirements.

III. College of the Pacific BA Requirement
Students must complete one year of college instruction or equivalent training in a language other than English.

Note: 1) Transfer students with sophomore standing are exempt from this requirement.

IV. Fundamental Skills
Students must demonstrate competence in:
Writing
Quantitative analysis

V. Breadth Requirement
Students must complete 60 units outside the primary discipline of the first major, regardless of the department who offers the course(s) in that discipline. (This includes general education courses, transfer courses, CPCE/EXTN units, internships, etc.)

VI. Major Requirements
Minimum 54 units and 12 courses that include:
CHEM 025 General Chemistry 5
CHEM 027 General Chemistry 5
CHEM 121 Organic Chemistry 5
CHEM 123 Organic Chemistry 5
CHEM 141 Analytical Chemistry 4
One of the following courses:
CHEM 159 Biophysical Chemistry
CHEM 161 Physical Chemistry -Thermodynamics and Kinetics
CHEM 163 Theoretical Physical Chemistry
CHEM 165 Physical Chemistry III-Kinetics
CHEM Electives (2 additional courses that exclude CHEM 132 and CHEM 134) 8

One of the following groups:
Group A
PHYS 023 General Physics I
PHYS 025 General Physics II
Group B
PHYS 053 Principles of Physics I
PHYS 055 Principles of Physics II
MATH 051 Calculus I 4
MATH 053 Calculus II 4

Note: 1) At least 4 of your major required courses must be taken at Pacific.

Bachelor of Science Major in Chemistry
Students must complete a minimum of 120 units with a Pacific cumulative and major/program grade point average of 2.0 in order to earn the bachelor of science degree with a major in chemistry.

I. General Education Requirements
Minimum 42 units and 12 courses that include:
PACS 001 What is a Good Society 4
PACS 002 Topical Seminar on a Good Society 4
PACS 003 What is an Ethical Life? 3

One course from each subdivision below:

Social and Behavioral Sciences
IA. Individual and Interpersonal Behavior
IB. U.S. Studies
IC. Global Studies

Arts and Humanities
IIA. Language and Literature
IIB. Worldviews and Ethics
IIC. Visual and Performing Arts

Natural Sciences and Mathematics *
IIIA. Natural Sciences
IIIB. Mathematics and Formal Logic
IIIC. Science, Technology and Society
or a second IIIA Natural Science course

Note: 1) Pacific Seminars cannot be taken for Pass/No Credit. 2) Transfer students with 28 or more transfer units complete 2 additional General Education elective courses from below in place of taking PACS 001 and PACS 002.

One course from each subdivision below:

Social and Behavioral Sciences
IA. Individual and Interpersonal Behavior
IB. U.S. Studies
IC. Global Studies

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or a second IIIA Natural Science course

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or a second IIIA Natural Science course

Note: 1) Pacific Seminars cannot be taken for Pass/No Credit. 2) Transfer students with 28 or more transfer units complete 2 additional General Education elective courses from below in place of taking PACS 001 and PACS 002.

One course from each subdivision below:
II. Diversity Requirement
Students must complete one diversity course (3-4 units)

Note: 1) Transfer students with 28 units or more transfer units prior to fall 2011 are encouraged but not required to complete a designated course prior to graduation. 2) Courses may be used also to meet general education and/or major/minor requirements.

III. Fundamental Skills
Students must demonstrate competence in:

Writing
Quantitative analysis

IV. Breadth Requirement
Students must complete 60 units outside the primary discipline of the first major, regardless of the department who offers the course(s) in that discipline. (This includes general education courses, transfer courses, CPCE/EXTN units, internships, etc.).

V. Major Requirements
Minimum 74 units and 17 courses that include:

CHEM 025  General Chemistry  5
CHEM 027  General Chemistry  5
CHEM 121  Organic Chemistry  5
CHEM 123  Organic Chemistry  5
CHEM 141  Analytical Chemistry  4
CHEM 143  Instrumental Analysis Lab  4
CHEM 151  Biochemistry I  4
CHEM 161  Physical Chemistry-Thermodynamics and Kinetics  4
CHEM 171  Advanced Inorganic Chemistry  4
Two of the following courses:  8
CHEM 153  Biochemistry II
CHEM 158  Nucleic Acid Chemistry
CHEM 163  Theoretical Physical Chemistry
CHEM 167  Experimental Physical Chemistry
Select one of the following:  4
CHEM 157  Biochemistry Laboratory
CHEM 197  Independent Research
PHYS 053  Principles of Physics I  5
PHYS 055  Principles of Physics II  5
MATH 051  Calculus I  4
MATH 053  Calculus II  4
Select one of the following:  4
MATH 055  Calculus III
MATH 057  Applied Differential Equations I: ODEs
MATH 075  Introduction to Linear Algebra

Note: 1) At least 4 of your major required courses must be taken at Pacific. 2) Students are strongly recommended to engage in undergraduate research as an elective.

* One of the courses selected must be CHEM 163 or CHEM 167.
** Any additional chemistry courses above CHEM 123, excluding CHEM 132, CHEM 134, and CHEM 195.

Bachelor of Science Major in Chemistry with Departmental Honors
Students must complete a minimum of 120 units with a Pacific cumulative and major/program grade point average of 3.30 in order to earn the bachelor of science degree with a major in chemistry with departmental honors.

I. General Education Requirements
Minimum 42 units and 12 courses that include:

PACS 001  What is a Good Society  4
PACS 002  Topical Seminar on a Good Society  4
PACS 003  What is an Ethical Life?  3

Note: 1) Pacific Seminars cannot be taken for Pass/No Credit. 2) Transfer students with 28 or more transfer units complete 2 additional General Education elective courses from below in place of taking PACS 001 and PACS 002.

One course from each subdivision below:

Social and Behavioral Sciences
IA. Individual and Interpersonal Behavior
IB. U.S. Studies
IC. Global Studies

Arts and Humanities
IIA. Language and Literature
IIB. Worldviews and Ethics
IIC. Visual and Performing Arts

Natural Sciences and Mathematics *
IIIA. Natural Sciences
IIIB. Mathematics and Formal Logic
IIIC. Science, Technology and Society
or a second IIIA Natural Sciences course

Note: 1) No more than 2 courses from a single discipline may be applied to meet the requirements of the general education program. 2) Fulfilled by courses required in the major.

II. Diversity Requirement
Students must complete one diversity course (3-4 units)

Note: 1) Transfer students with 28 units or more transfer units prior to fall 2011 are encouraged but not required to complete a designated course prior to graduation. 2) Courses may be used also to meet general education and/or major/minor requirements.

III. Fundamental Skills
Students must demonstrate competence in:

Writing
Quantitative analysis

IV. Breadth Requirement
Students must complete 60 units outside the primary discipline of the first major, regardless of the department who offers the course(s) in that
V. Major Requirements

Minimum 74 units and 19 courses that include:

- CHEM 025 General Chemistry 5
- CHEM 027 General Chemistry 5
- CHEM 121 Organic Chemistry 5
- CHEM 123 Organic Chemistry 5
- CHEM 141 Analytical Chemistry 4
- CHEM 143 Instrumental Analysis Lab 4
- CHEM 151 Biochemistry I 4
- CHEM 161 Physical Chemistry -Thermodynamics and Kinetics 4
- CHEM 171 Advanced Inorganic Chemistry 4

Select two of the following:

- CHEM 153 Biochemistry II
- CHEM 158 Nucleic Acid Chemistry
- CHEM 163 Theoretical Physical Chemistry
- CHEM 167 Experimental Physical Chemistry

PHYS 053 Principles of Physics I 5

PHYS 055 Principles of Physics II 5

MATH 051 Calculus I 4

MATH 053 Calculus II 4

Select one of the following or any additional chemistry course above CHEM 123:

- MATH 055 Calculus III
- MATH 057 Applied Differential Equations I: ODEs
- MATH 145 Applied Linear Algebra
- CHEM 195 Chemistry Department Seminars 1
- CHEM 197 Independent Research ** 1-4

* One of the courses selected must be CHEM 163 or CHEM 167.

** Any additional chemistry course above CHEM 123, excluding CHEM 132, CHEM 134, and CHEM 195.

*** Students must complete at least two semesters of CHEM 197. A written research thesis must be submitted, which will be read by the academic advisor and one other Chemistry faculty member. The thesis must be presented to the Department and defended.

Note: 1) At least 4 of your major required courses must be taken at Pacific. 2) Students are strongly recommended to engage in undergraduate research as an elective.

Bachelor of Science Major in Biochemistry

Students must complete a minimum of 120 credits with a Pacific cumulative and major/program grade point average of 2.0 in order to earn the bachelor of science degree with a major in biochemistry.

I. General Education Requirements

Minimum 42 units and 12 courses that include:

- PACS 001 What is a Good Society 4
- PACS 002 Topical Seminar on a Good Society 4
- PACS 003 What is an Ethical Life? 3

Note: 1) Pacific Seminars cannot be taken for Pass/No Credit. 2) Transfer students with 28 or more transfer units complete 2 additional

General Education elective courses from below in place of taking PACS 001 and PACS 002.

One course from each subdivision below:

Social and Behavioral Sciences
- IA. Individual and Interpersonal Behavior
- IB. U.S. Studies
- IC. Global Studies

Arts and Humanities
- IIA. Language and Literature
- IIB. Worldviews and Ethics
- IIC. Visual and Performing Arts

Natural Sciences and Mathematics *
- IIIA. Natural Sciences
- IIIB. Mathematics and Formal Logic
- IIIC. Science, Technology and Society

or a second IIIA Natural Science course

Note: 1) No more than 2 courses from a single discipline may be applied to meet the requirements of the general education program. 2) * Fulfilled by courses required in the major.

II. Diversity Requirement

Students must complete one diversity course (3-4 units)

Note: 1) Transfer students with 28 units or more transfer units prior to fall 2011 are encouraged but not required to complete a designated course prior to graduation. 2) Courses may be used also to meet general education and/or major/minor requirements.

III. Fundamental Skills

The student must demonstrate competence in:

Writing
Quantitative analysis

IV. Breadth Requirement

The student must complete 60 units outside the primary discipline of the first major, regardless of the department who offers the course(s) in that discipline. (This includes general education courses, transfer courses, CPCE/EXTN units, internships, etc.)

V. Major Requirements

Minimum 80 units and 18 courses that includes:

- CHEM 025 General Chemistry 5
- CHEM 027 General Chemistry 5
- CHEM 121 Organic Chemistry 5
- CHEM 123 Organic Chemistry 5
- CHEM 151 Biochemistry I 4
- CHEM 153 Biochemistry II 3
- CHEM 157 Biochemistry Laboratory 4
- BIOL 051 Principles of Biology 5
- BIOL 061 Principles of Biology 5

Select one of the following groups:

Group A
- PHYS 023 General Physics I
- PHYS 025 General Physics II
Bachelor of Science Major in Biochemistry with Departmental Honors

Students must complete a minimum of 120 credits with a Pacific cumulative and major/program grade point average of 3.30 in order to earn the bachelor of science degree with a major in biochemistry with departmental honors.

I. General Education Requirements

Minimum 42 units and 12 courses that include:

- PACS 001 What is a Good Society
- PACS 002 Topical Seminar on a Good Society
- PACS 003 What is an Ethical Life?

Note: 1) Pacific Seminars cannot be taken for Pass/No Credit. 2) Transfer students with 28 or more transfer units complete 2 additional General Education elective courses from below in place of taking PACS 001 and PACS 002.

II. Diversity Requirement

Students must complete one diversity course (3-4 units)

Note: 1) Transfer students with 28 units or more transfer units prior to fall 2011 are encouraged but not required to complete a designated course prior to graduation. 2) Courses may be used also to meet general education and/or major/minor requirements.

III. Fundamental Skills

The student must demonstrate competence in:

- Writing
- Quantitative analysis

IV. Breadth Requirement

The student must complete 60 units outside the primary discipline of the first major, regardless of the department who offers the course(s) in that discipline. (This includes general education courses, transfer courses, CPCE/EXTN units, internships, etc.)

V. Major Requirements

Minimum 80 units and 20 courses that includes:

- CHEM 025 General Chemistry 5
- CHEM 027 General Chemistry 5
- CHEM 121 Organic Chemistry 5
- CHEM 123 Organic Chemistry 5
- CHEM 151 Biochemistry I 4
- CHEM 153 Biochemistry II 3
- CHEM 157 Biochemistry Laboratory 4
- BIOL 051 Principles of Biology 5
- BIOL 061 Principles of Biology 5

Select one of the following groups:

- Group A
  - PHYS 023 General Physics I
  - PHYS 025 General Physics II

Note: 1) At least 4 of your major required courses must be taken at Pacific. 2) In addition, students are encouraged to complete at least one other course in biology and at least one semester of research.
Minor in Chemistry

Students must complete a minimum of 23 units and 5 courses with a Pacific minor grade point average of 2.0 in order to earn the minor in chemistry.

Minor Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 025</td>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 027</td>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 121</td>
<td>Organic Chemistry</td>
<td>5</td>
</tr>
</tbody>
</table>

Select two of the following: 8-9

| CHEM 123  | Organic Chemistry               |       |
| CHEM 141  | Analytical Chemistry            |       |
| CHEM 151  | Biochemistry I                  |       |
| CHEM 159  | Biophysical Chemistry           |       |
| CHEM 161  | Physical Chemistry -Thermodynamics and Kinetics |       |
| CHEM 163  | Theoretical Physical Chemistry  |       |
| CHEM 165  | Physical Chemistry III-Kinetics |       |

Note: 1) At least 2 courses must be taken at Pacific.

Chemistry Courses

CHEM 023. Elements of Chemistry. 4 Units.
This course is designed for general interest in physical science and for preparation for further study in chemistry. Three class periods, one three-hour laboratory period a week, and enrollment in the Chemistry Workshop are required. (ENST, GE3A)

CHEM 024. Fundamentals of Chem. 4 Units.
This course covers general chemistry especially tailored for engineers and earth scientists. Important principles, theories and concepts include: stoichiometry, atomic and molecular structure, equilibrium, gases, thermodynamics, kinetic, electrochemistry and nuclear chemistry. Three lecture periods and one three-hour lab are required. Prerequisites: High school algebra or the equivalent, one year of high school chemistry with a "B" or better, or appropriate score on the Pacific Diagnostic Chemistry test or CHEM 023. (ENST, GE3A)

CHEM 025. General Chemistry. 5 Units.
The important general principles, theories and concepts of chemistry are studied, including fundamentals of chemistry and equilibrium. Three class periods, two three-hour laboratory periods a week, and enrollment in the Chemistry Workshop are required. Prerequisite: high school algebra or the equivalent. High school chemistry is highly recommended. CHEM 023 with a "C-" or better, Chemistry Subject Test, or appropriate score on Pacific Diagnostic Chemistry test. (ENST, GE3A)

CHEM 027. General Chemistry. 5 Units.
More important general principles, theories, and concepts of chemistry are studied including modern applications of quantum mechanics, bonding, chemical kinetics, liquids, solids, and properties of solutions. Additional special topics include coordination compounds, nuclear chemistry, organic chemistry and biochemistry. Three class periods, two three-hour laboratory periods a week, and enrollment in the Chemistry Workshop are required. Prerequisite: At least one year of high school chemistry is highly recommended. CHEM 023 with a "C-" or better, Chemistry Subject Test, or appropriate score on Pacific Diagnostic Chemistry test. (ENST, GE3A)

CHEM 033. Elements of Organic Chemistry. 3 Units.
This is an introductory course for students who do not major in the chemistry or biological sciences, but whose main interest - dental hygiene, medical technology, nursing, nutrition, pharmacy technician, and more - requires some knowledge of organic chemistry. The course provides familiarity with nomenclature and functional groups with special emphasis on practical applications of organic chemistry to everyday life and to biological processes. Does not count towards a major in Chemistry or Biological Sciences. Course is required for Dental Hygiene Program. Prerequisites: CHEM 025 and CHEM 027 with a "C-" or better.

Note: 1) At least 4 of your major required courses must be taken at Pacific. 2) In addition, students are encouraged to complete at least one other course in biology and at least one semester of research.
CHEM 035. Organic Chemistry Primer. 3 Units.
This course is designed to prepare students for a regular one year course in Organic Chemistry. It links and applies the concepts learned in General Chemistry to organic systems, providing familiarity with Organic Chemistry nomenclature and functional groups, emphasizes pattern recognition and introduces basic elements of reaction mechanisms. The course fulfills the Organic Chemistry requirements of the Dental Hygiene program. ONLINE. Prerequisite: CHEM 027 with a "C-" or better.

CHEM 093. Special Topics. 3 or 4 Units.

CHEM 121. Organic Chemistry. 5 Units.
An Introduction to the fundamental principles of organic chemistry including molecular structure, chemical bonding, functional groups, nomenclature, stereochemistry, basic organic reactions, and modern spectroscopy for structural characterization. Three lecture periods and two-three hour laboratory periods per week are required. Prerequisites: CHEM 025 and CHEM 027 with a "C-" or better.

CHEM 123. Organic Chemistry. 5 Units.
This course is a continuation of CHEM 121 with an emphasis on organic synthesis and mechanisms. The reactions of the aromatics, aldehydes, ketones, amines, carboxylic acids and their derivatives, and carbohydrates are covered. The course also touches on polymers and biological molecules including amino acids, proteins, and nucleic acids. Three lecture periods and two-three hour laboratory periods per week and are required. Prerequisite: CHEM 121 with a "C-" or better.

CHEM 125. Teaching and Learning Chemistry. 2 Units.
Students are prepared for participation in peer-led team-learning (PLTL) models of instruction in this course and it provides the opportunity for the students to become student leaders. In the PLTL, or General Chemistry Workshops, a small group of students get together under the guidance of the trained student leaders and work through a set of challenging problems prepared by the instructor of the course. The main idea is for all the students in the group to work together and gain experience and confidence solving challenging problems as a group. The Workshop provides an active teaching and learning experience. This course can be taken multiple times. Prerequisites: CHEM 025 and CHEM 027 with a "B" or better and permission of the instructor.

CHEM 127. Teaching and Learning Organic Chemistry. 2 Units.
Student are introduced to the learning and leadership model, Peer-Led Team Learning (PLTL). The student will gain hands-on experience in leading small discussion groups in organic chemistry. Instructor-covered topics in organic chemistry include specific instructions regarding the workshop lessons, strategies in guided problem solving for the groups, and review of organic chemistry materials. Instructor-covered topics in the didactic portion of the course include, but are not limited to, practical information (understanding motivation, managing time, dealing with dominating students, learning styles, group dynamics, study skills, helping students improve critical thinking, develop logical reasoning, and prepare for tests), and a foundation in learning theory. Prerequisites: CHEM 025 and CHEM 027 with "C-" or better, CHEM 121 and CHEM 123 with "B" or better and permission of instructor.

CHEM 141. Analytical Chemistry. 4 Units.
The roots of analytical chemistry and the principles used in modern instruments come from traditional techniques. These techniques include gravimetry, acid-base, complexometric, and redox titrations form the backbone of the course, which covers most major areas of modern quantitative analysis. The theory behind the techniques is covered through many numerical examples and their applications in environmental and biochemical analyses are emphasized. Standard procedures used in analytical laboratories are introduced, including error reporting, statistics, and quality assurance. Prerequisites: CHEM 025 and CHEM 027 or GEOS 142 with a "C-" or better. (ENST)

CHEM 143. Instrumental Analysis Lab. 4 Units.
Advanced analytical methodology involving electronic instrumentation is offered with emphasis on practical application and "hands-on" experience. The theory of instrumental operation is covered. Examples from modern spectroscopy, mass spectrometry, NMR, chromatography and other methods of analysis are included. Prerequisite: CHEM 141 with a "C-" or better or permission of the instructor.

CHEM 151. Biochemistry I. 4 Units.
This is the first semester of a 2 semester survey of biochemistry. The fundamental building blocks of biochemical systems are introduced covering amino acids and proteins (enzymatic & structural), nucleic acids, lipids and membranes, and carbohydrates. Particular topics of oxygen transport, enzyme kinetics, DNA replication, RNA expression, and protein expression are gone over in detail. Prerequisites: CHEM 121 and CHEM 123; CHEM 159 or CHEM 161 all with a "C-" or better; or permission of instructor.

CHEM 153. Biochemistry II. 3 Units.
As the second semester in this biochemistry series, the detailed biochemical mechanisms of the major metabolic pathways are covered. These pathways include glycolysis, gluconeogenesis, citric acid cycle, electron transport/oxidative phosphorylation, photosynthesis/Calvin cycle, lipid metabolism/fatty acid catabolism, and the synthesis/ degradation of amino and nucleic acids. Discussion centers on the enzymatic mechanisms, energy, reduction/oxidation, control/regulation, and integration of these pathways. Prerequisite: CHEM 151 with a "C-" or better or permission of instructor.

CHEM 155. Biophysical Chemistry. 4 Units.
Standard techniques used in Biochemistry. Exercises focus on the expression, mutation, and purification of a protein target and involves the following techniques: site-directed mutagenesis, column chromatography, electrophoresis, nucleic acid isolation and manipulation/use of relevant databases. Prerequisite: CHEM 151 or BIOL 169 with a "C-" or better; or permission of instructor.

CHEM 157. Nucleic Acid Chemistry. 4 Units.
This course surveys fundamental and advanced knowledge and current biotechnological applications in nucleic acid chemistry. Students completing this course will be able to improve critical thinking skills, oral communication, and technical writing skills. Topics related to structures of DNA and RNA, synthesis of DNA using automated method, small molecule and nucleic acid interactions, DNA damage and repair, representative anticancer drugs, and nucleic acids used in real-life applications are discussed. Prerequisites: CHEM 121 and CHEM 123 with a grade of C- or better or instructor approval.

CHEM 159. Biophysical Chemistry. 4 Units.
This course applies the approaches and concepts of physical chemistry to describe the reactions and phenomena in biological systems. The principles of thermodynamics, kinetics, spectroscopy and transport phenomena are covered. While this is not a mathematic intensive course, the concepts require a basic knowledge of calculus. Prerequisites: MATH 051, CHEM 025, CHEM 027, PHYS 055 all with a "C-" or better or permission of instructor.

CHEM 165. Physical Chemistry -Thermodynamics and Kinetics. 4 Units.
A classical course on equilibrium thermodynamics and kinetics, including the laws of thermodynamics, the Gibbs equations, the phase rule, solutions, chemical reactions, non-ideal systems, multi-component phase equilibrium, equilibrium electrochemistry, kinetics, molecular dynamics and transport properties. Three class periods a week are required. Prerequisites: CHEM 027, MATH 053, PHYS 055 all with a "C-" or better, or permission of instructor. Students may not receive credit for both CHEM 159 and CHEM 161.
CHEM 163. Theoretical Physical Chemistry. 4 Units.
This course covers the principles of quantum theory, atomic structure and spectra, bonding, molecular spectroscopy, the foundations of statistical mechanics, the use of partition functions, the connection between statistical ensembles and thermodynamic potentials, and statistical models of gases, solids and liquids. This 4-unit course requires three class 1-hour periods and one 3-hour laboratory each week, accompanied by substantial out-of-class exercises. Prerequisites: CHEM 161 or CHEM 159, MATH 055, and PHYS 053, all with a C− or better, or permission of the instructor.

CHEM 165. Physical Chemistry III-Kinetics. 4 Units.
The fundamental principles of Chemical Kinetics are introduced in this course which covers: kinetic molecular theory of gases, rates of chemical reactions, rate laws, collision theory and chemical dynamics. Selected applications include photochemistry, catalysis, enzyme kinetics, pharmacodynamics, electrochemical systems, transport properties, viscosity, diffusion, and sedimentation. Prerequisites: CHEM 025, CHEM 027, MATH 053 or MATH 055, PHYS 053 or PHYS 055 or permission of instructor.

CHEM 167. Experimental Physical Chemistry. 4 Units.
This course introduces the principles and practice of physical chemical measurements. Techniques used in the design and construction of apparatus are discussed in lectures, and practice is provided through lab exercises and experiments. Subjects covered include kinetic theory of gases, reaction kinetics, thermodynamics, thermochemistry, and various flavors of spectroscopy. Research orientation is provided through the preparation of article manuscripts and oral presentations of results. Error analysis and statistical treatment of experimental data are emphasized. Prerequisite: CHEM 159 or CHEM 161 with a "C−" or better.

CHEM 171. Advanced Inorganic Chemistry. 4 Units.
This course includes: atomic structure, periodicity, covalent bonding theory, molecular geometry and symmetry, molecular orbital theory and its applications. Also covers coordination and organometallic chemistry, ligand field theory, spectroscopy, structure, reaction mechanisms, introduction to bioinorganic chemistry and metals in medicine. Two class periods and four hours of laboratory per week are required. Prerequisite: CHEM 163 with a "C−" or better or permission of the instructor.

CHEM 181. Intro to Molecular Simulation. 4 Units.
This course enables chemistry and other science students to utilize computational tools for molecular simulation. Students who complete this class are able to understand the theory behind molecular dynamics and force-fields. In addition, students construct and execute molecular simulations using standard tools such as CHARMM, NAMD, VMD and GAUSSIAN. Students then demonstrate an ability to analyze and present the data obtained from such simulations. Prerequisites: CHEM 025 and CHEM 027 with a grade of "C−" or better and permission of instructor.

CHEM 191. Independent Study. 2-4 Units.

CHEM 193. Special Topics. 4 Units.

CHEM 195. Chemistry Department Seminars. 1 Unit.
The Department hosts a series of research seminars in which internationally recognized scientists present their latest research to an audience of Chemistry Faculty, graduate students, and Chemistry/Biochemistry undergraduate students. The selection of the speakers and the talks is designed to display a cross-section of current research trends, with talks representing each significant sub-discipline within Chemistry. Restriction on registration: Honors Students Only. Prerequisite: Permission of instructor.

CHEM 197. Independent Research. 1-4 Units.
Prerequisite: CHEM 025 with a "C−" or better. (ENST)