

CHEMISTRY AND BIOCHEMISTRY (CH)

Faculty:

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The study of chemistry includes the composition, structure and properties of matter in its various solid, liquid and gaseous forms. Chemistry enters every area of our existence and will continue to play a key role in the age of high technology. The need for chemists in so many related and vastly different areas makes the field of chemistry very broad. Our program addresses that diversity.

The Chemistry and Biochemistry Department is listed among the colleges approved by the American Chemical Society. Majors who satisfactorily complete the program outlined below will be certified by the American Chemical Society.

A chemical education first and foremost must consist of certain defined disciplines that establish a strong foundation in chemical knowledge. The curriculum of the department prepares the student for a career in chemistry at the baccalaureate level and provides the background for further study at the graduate level.

Many attractive positions are available for the trained chemist in the inorganic, analytical, organic, physical, agricultural, and pharmaceutical chemical fields. Chemists study and work in the fields of medicine, nutrition, drugs, polymers, electronics, fuels, food and biotechnology. With a good background in chemistry, a student may look forward to employment and career opportunities which are rewarding both in salary and satisfaction. Graduates from DVC with a degree in Chemistry have found positions as: Chemist, Lab Technician, Associate Chemist, Research Assistant, Sales and Marketing Research, and Instrumentation Specialist.

The total number of credits required for graduation with a degree in Chemistry is 128 plus 4 credits earned for successful completion of the Employment Program.

Recommended Course Sequence

Freshman Year

First Semester

Course No.	Course Title	Credits	Hours
CH 1103	General Chemistry I	4	(3-3)
EN 1101	English I or		
EN 1111	Advanced English I	3	(3-0)
MP 1203	Elementary Functions	3	(3-0)
LA 2005	Speech	3	(3-0)
PE 1109	Physical Education I	1	(0-2)
		14	

Second Semester

CH 1203	General Chemistry II	4	(3-3)
EN 1201	English II or		
EN 1211	Advanced English II	3	(3-0)
MP 1204	Calculus I	4	(4-0)
IT 1011	Information Technology Concepts	1.5	(1.5-0)
IT 1012	Computer Applications	1.5	(1.5-0)
PE 1209	Physical Education II	1	(0-2)
		15	

Employment Program

CH 2370	Employment Program	1-2	
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Sophomore Year

First Semester

Course No.	Course Title	Credits	Hours
BA 2008	Macroeconomics	3	(3-0)
MP 2119	Physics I	4	(3-3)
CH 2120	Organic Chemistry I	4	(3-3)
MP 2121	Calculus II	4	(4-0)
CH 2131	Descriptive Environmental Chemistry	2	(1-2)
		17	

Second Semester

MP 2219	Physics II	4	(3-3)
CH 2220	Organic Chemistry II	4	(3-3)
MP 2223	Ordinary Differential Equations	3	(3-0)
EN 2028	Introduction to Literature	3	(3-0)
LA 3032	American History and Government Since 1933	3	(3-0)
		17	

Employment Program

CH 2370	Employment Program	1-2	
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Junior Year**First Semester**

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>	<u>Hours</u>
CH 3122	Radioisotope Techniques* or		
MP 3124	Physics IIIc	3	(3-0)
CH 3130	Analytical Chemistry	5	(3-6)
CH 3125	Physical Chemistry I	4	(3-3)
CH 3156	Advanced Techniques— Computers*	2	(1-2)
	Philosophy/Psychology/ Sociology Area	3	(3-0)
		17	

Second Semester

CH 3224	Physical Chemistry II	4	(3-3)
CH 3223	Instrumental Analysis	5	(3-6)
CH 3157	Synthesis Laboratory	2	(1-2)
MP 3231	Statistics for Research* or		
CH 3220	Advanced Organic Chemistry	3	(3-0)
LA 2040	Modern History of Western Societies	3	(3-0)
		17	

*Students may substitute courses of equal credits in the sciences, computers, mathematics, or Business Administration with permission of Advisor and Department Chairperson.

Senior Year**First Semester**

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>	<u>Hours</u>
CH 4117	Organic Analysis	4	(3-3)
CH 4126	Advanced Inorganic Chemistry	3	(3-0)
CH 3122	Radioisotope Techniques* or		
MP 3124	Physics IIIc	3	(3-0)
LA 4037	Non-Western Societies	3	(3-0)
LA 4038	Cultural Enrichment Elective	1 3	
		17	

Second Semester

CH 2203	Biochemistry or		
CH 4205	Advanced Biochemistry	4	(3-3)
CH 4201	Seminar	1	(1-0)
CH 3220	Advanced Organic Chemistry or		
MP 3231	Statistics for Research*	3	(3-0)
CH 4241	Advanced Physical Chemistry	3	(3-0)
LA 1060	Introduction to the Arts	3	(3-0)
		14	

Course Descriptions**CH 0011 Basic Chemistry**

A non-credit lecture and laboratory course designed to prepare students for General Chemistry I and II. Energy, matter, and change with appropriate problem-solving applications will be emphasized. Formulas, equations, and descriptive chemistry will be covered in the laboratory. 3 hours Lecture and 3 hours Laboratory—0 credits

CH 1001 Chemistry Fundamentals

This course presents basic chemical concepts to non-scientists. Students will develop some familiarity with laboratory skills and techniques as well as the foundations of chemical knowledge so they can make informed personal and professional decisions.

Lecture topics include structure, bonding and reactivity, water and solutions, and bio-organic and environmental chemistries.

This course does not satisfy the requirement for General Chemistry I. 3 hours Lecture and 3 hours Laboratory—4 credits

CH 1103 General Chemistry I

General Chemistry I, an introduction to principles of chemistry, covers atomic structure, chemical bonding, the mole concept, states of matter, periodic relationships, thermochemistry, acids and bases, and properties of solutions. Prerequisite: high school chemistry. 3 hours Lecture & 3 hours Laboratory—4 credits

CH 1203 General Chemistry II

General Chemistry II deals with kinetics, gaseous and ionic equilibria, metals and nonmetals, electrochemistry, environmental, and nuclear chemistry, and special topics. The laboratory's experimental sequence is designed to enhance the student's understanding of chemical concepts and to develop laboratory technique. A large part of General Chemistry II laboratory is devoted to qualitative analysis of cations and anions. Prerequisite: General Chemistry I. 3 hours Lecture & 3 hours Laboratory—4 credits

CH 2003 Principles of Organic Chemistry

This course surveys both aliphatic and aromatic classes of compounds with their traditional subclasses. Basic reaction mechanisms are introduced and special topics, such as fats, and oils, detergents, carbohydrates, proteins, heterocyclic compounds, vitamins, and hormones are covered briefly. Prerequisite: General Chemistry I and II. 3 hours Lecture and 3 hours Laboratory—4 credits

CH 2007 Introduction to Forensic Science

This lecture/laboratory course is designed to acquaint the student with the principles of forensic science, to introduce the student to the different areas of forensic science, and to introduce the student to some applications of biological, chemical and physical methods in the forensic sciences. Proper evidence handling is also discussed. Prerequisites: successful completion of at least one semester of college chemistry. 3 hours Lecture and 3 hours Laboratory-4 credits

CH 2120-CH 2220 Organic Chemistry I and II

The first semester begins with a discussion of bonding, acid/base chemistry, and functional groups. This is followed by in-depth coverage of the nomenclature, properties, synthesis, and reactions of aliphatic hydrocarbons, halides, alcohols, and ethers. Basic concepts of reaction mechanisms, polymers, stereochemistry, and infrared spectroscopy are also introduced.

The second semester begins with the concept of aromaticity, and the nomenclature and reactions of aromatic compounds. The topic of IR spectroscopy is expanded to include aromatics, and UV and NMR spectroscopy are introduced. Aliphatic and aromatic aldehydes, ketones, acids, acid derivatives, and amines are then discussed. Special topics include organometallics, lipids, and organic chemicals in the environment.

The lab portion of the course sequence begins with a study of the basic organic manipulative techniques. This is followed by selected synthetic reactions using both micro and semi-micro glassware. Chromatographic and spectroscopic techniques are introduced as appropriate and are used in a number of succeeding experiments. During three weeks of the second semester students may, with faculty approval, select and/or design their own experiments. Prerequisites: General Chemistry I and II and Organic Chemistry I for Organic Chemistry II. 3 hours Lecture and 3 hours Laboratory each—4 credits each

CH 2155-CH 2256 Selected Topics I and II

A discussion and laboratory course dealing with modern chemical concepts. The student, with concurrence from the instructor, will investigate in depth a topic of his/her choice. Example topics include inorganic syntheses, glassblowing, radiochemistry, and symmetry. Elective for Chemistry sophomores, juniors or seniors with permission of Department Chairperson. 3 hours Laboratory and Instruction each—1 credit each

CH 2201 Chemical Literature

This course includes a discussion of the content and the usage of the various sources of chemical information. Emphasis is placed both on locating specific facts and on on-line literature searches. Regular library assignments are given, and the class as a whole visits a large chemical library in the area. Prerequisite: At least sophomore standing. 1 hour Lecture—1 credit

CH 2203 Biochemistry

A study of the chemistry and metabolism of proteins, carbohydrates, lipids, nucleic acids, and other biologically important compounds. Prerequisite: Principles of Organic Chemistry or Organic Chemistry I. 3 hours Lecture and 3 hours Laboratory—4 credits

CH 3001 Introductory Biomedical Instrumental Methods

A survey, in both theory and practice, of the various types of instrumentation used in the biomedical and pharmaceutical research fields. Laboratory work includes gaining experience with various types of spectroscopic, chromatographic, colorimetric, radiochemical and radiographic equipment. Prerequisites: General Chemistry I and II. Organic Chemistry and Biochemistry are also desirable. 2 hours Lecture and 3 hours Laboratory—3 credits

CH 3122 Radioisotope Techniques

Introductory lecture course dealing with the properties of radiation, elementary radioisotope calculations, and chemical, medical and biological uses of radioisotopes. Prerequisite: Permission of Instructor. 3 hours Lecture and Discussion—3 credits

CH 3125 Physical Chemistry I

Covers the general areas of equations of state for real gases, the laws of thermodynamics and their applications, thermochemistry, homogeneous equilibria, phase equilibria, and electrochemistry. Prerequisites: Calculus II and Physics II or Permission of Instructor. 3 hours Lecture and 3 hours Laboratory—4 credits

CH 3130 Analytical Chemistry

This course includes gravimetric and volumetric methods of analysis as well as an introduction to colorimetric, electro-analytical, and chromatographic techniques. Prerequisites: General Chemistry I and II. 3 hours Lecture and 6 hours Laboratory—5 credits

CH 3220 Advanced Organic Chemistry

Organic reaction mechanisms and their modification by inductive, resonance, and steric effects are covered in depth. Also discussed are methods of determining reaction mechanism, stereochemistry, orbital symmetry relationships, and selected topics in synthesis. Prerequisites: Organic Chemistry II and Physical Chemistry II. 3 hours Lecture—3 credits

CH 3223 Instrumental Analysis

A survey of the sources of chemical signals, and their detection and amplification by instrumental methods. Laboratory work includes visible-ultraviolet and infrared spectroscopy, gas chromatography, polarography, potentiometry, coulometry, and liquid chromatography. Prerequisites: Analytical Chemistry, and Physical Chemistry I or Permission of Instructor. 3 hours Lecture & 6 hours Lab—5 credits

CH 3224 Physical Chemistry II

This course covers kinetics, elementary quantum mechanics and its application to bonding theories. Basic theory of spectroscopy and diffraction and use in molecular structure determination including Fourier transforms, adsorption and heterogeneous catalysis, as well as transport mechanisms and dipole moments are also covered. Prerequisites: Physical Chemistry I and Ordinary Differential Equations or Permission of Instructor. 3 hours Lecture and 3 hours Laboratory—4 credits

CH 4025 Polymer Chemistry Introduction

This course provides a fundamental understanding of terms and procedures employed in the polymer section of industry. Topics to be covered include polymer structure, synthesis and behavior; processing; environmental effects; and special materials, such as composites and biopolymers. Prerequisites: Organic Chemistry I and II. 3 hours Lecture—3 credits

CH 4041 Senior Research

Selected seniors engage in supervised investigations involving library work and laboratory experiments related to chemistry. Requirement: Permission of Department Chairperson. 1-3 credits

CH 4117 Organic Analysis

This course teaches the identification of organic compounds through the use of physical properties, chemical tests, spectroscopic analysis, and preparation of known derivatives. Emphasis is placed on the modification of physical and chemical properties by steric and electronic effects. Infrared and ultraviolet spectrometers and a gas chromatograph are available for laboratory use. Computer simulations of compound identifications are an integral part of the program. Prerequisites: Instrumental Analysis and Organic Chemistry II or Permission of Instructor. 3 hours Lecture and 3 hours Laboratory—4 credits

CH 4126 Advanced Inorganic Chemistry

Present theories of chemical bonding are treated. These include electrostatic, valence bond, molecular orbital, and continuous solid models. From these the structures of inorganic substances are derived. Topics such as symmetry and Point Groups, nonaqueous solvent systems, secondary chemical forces, and structure and properties of transition metal complexes are treated. When time permits, a survey of organometallic chemistry is included. Prerequisite: Physical Chemistry II. 3 hours Lecture—3 credits

CH 4201 Seminar (Chemistry)

Student-led, in-depth discussions on specific chemical questions. 1 hour Lecture and Discussion—1 credit

CH 4205 Advanced Biochemistry

A presentation of modern biochemical topics, including the chemistry of cellular compounds, energy transformation in living organisms, and the synthesis and properties of macromolecules. Prerequisites: Organic Chemistry I and II and Physical Chemistry I and II or Permission of Instructor. 3 hours Lecture & 3 hours Lab—4 credits

CH 4241 Advanced Physical Chemistry

A study of the physical chemistry of polymers with emphasis on polymerization kinetics, structure of polymers, and their physical properties and characterization methods. Prerequisite: Physical Chemistry II or Permission of Instructor. 3 hours Lecture—3 credits

*Students may substitute courses of equal credits in the sciences, computers, mathematics, or Business Administration with permission of Advisor and Department Chairperson.

Specialized Methods and Techniques

Each major department offers a series of courses designed to acquaint the student with various applications of the professional specialty.

CH 2004 Fire Protection Chemistry

This course provides the student with the knowledge of the chemistry of materials and their physical properties as these subjects relate to fire. 1 hour Lecture and Discussion—1 credit

CH 2005 Chemistry of Hazardous Materials

This course covers the unique requirements in handling hazardous materials when they are encountered in a chemical emergency. 1 hour Lecture and Discussion—1 credit

CH 2006 Safety in the Laboratory

This course deals with the hazards associated with handling chemicals that have acute or chronic toxicities and/or physical hazards in the research laboratory setting. Prudent practices will be emphasized. 1 hour Lecture and Discussion—1 credit

CH 2131 Descriptive Environmental Chemistry

Surveys inorganic chemistry with an environmental emphasis, geochemical cycles, aqueous equilibria, redox, bacterial processes, heavy metals, and atmospheric chemistry. Prerequisites: General Chemistry I and II. 1 hour Lecture & 2 hours Laboratory—2 credits

CH 3156 Advanced Techniques—Computers

A variety of computer applications likely to be encountered by a practicing chemist are surveyed with emphasis placed on report writing using desktop publishing software, chemical calculations using a spreadsheet, data bases, molecular modeling, and molecular graphics. Basic word processing skills and familiarity with MS-DOS are assumed. 1 hour Lecture and 2 hours Laboratory—2 credits

CH 3157 Inorganic Synthesis Laboratory

Inorganic and organometallic compounds are prepared using a variety of synthetic techniques and apparatus not encountered in the lower division laboratory courses. Students may select syntheses from the course collection or may suggest new ones from other sources such as the current literature. The course emphasizes the writing of a legal laboratory notebook. Prerequisites: Organic Chemistry I and II. Weekly individual laboratory conference and 3 hours Laboratory—2 credits

Employment Program**CH 2370 Employment Program**

Each student in Chemistry and Biochemistry is required to spend 24 weeks (960 hours) in approved jobs related to the student's major. Registration for each Employment Program must occur prior to the beginning of a relevant experience. Registration materials are available from Career Services, located in Segal Hall. 24 weeks of On-the-Job Training—4 credits

***Biotechnology and Biochemistry Minors
(for Chemistry Majors)***

Students majoring in Chemistry may enroll in an interdisciplinary minor including the following recommended courses. Substitutions may be arranged in advance with permission of the Department Chairperson. Check course description for prerequisite requirements.

Biochemistry

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>	<u>Hours</u>
BY 2003	Genetics	3	(2-1)
BY 3002	General Microbiology	4	(3-3)
BY 4155	Molecular Biology	4	(3-3)
CH 4205	Advanced Biochemistry	4	(3-3)
		15	

Biotechnology

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>	<u>Hours</u>
BY 2003	Genetics	3	(2-1)
BT 3000	Introduction to Biotechnology	3	(3-0)
BY 3002	General Microbiology	4	(3-3)
FS 3122	Food Engineering I	3	(2-2)
FS 4004	Industrial Fermentations	3	(3-0)
		16	

Biotechnology

BT 3000 Introduction to Biotechnology

An interdisciplinary course designed to provide increased familiarity with the concepts, objectives, techniques, ethical and regulatory considerations in the developing areas of biotechnology. Topics include molecular genetics, bacteria, viruses, and applications in biological, medical, food, plant and animal sciences. Prerequisites: Biology II, or Biological Science II, and Biochemistry or Permission of Instructor. Meets the requirements for certification in Education, General Science and Biology minors. Does not substitute for Molecular Biology. Offered in Fall Semester. 3 hours Lecture and Discussion—3 credits