

CHEMISTRY

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Gertrude B. Elion Professor: Goss

Professors:

Alexandratos, Dannenberg, Diem, Grohmann, Massa, Mills, Mootoo, Quigley, Santoro, Sweeney

Associate Professors:

Drain, Francesconi, Matsui

Assistant Professors:

Kawamura, Krishnamachari, Phillips, Kleiman, Xu

Advisers:

Pamela Mills, William Sweeney

HEGIS Code: 1905

Majors Offered	Options in Major	Number Credits	Recommended/Required GER	Prereq	Recommended Minor
BA in Chemistry	Major I	41 + 26 cr of math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 Cr) – or – CHEM 111-113 (11 Cr)	No minor
	Major II option 1: preparation for the chemical industry	26 + 23 cr of math and physics (12 credits of these can be used as the minor)	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-113 (11 Cr)	Any combination of the required physics and math courses, totaling 12 credits, may be used as a minor. If students prefer a different minor, they must consult with the department adviser or chair
	Major II option 1: QUEST	26 + 23 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-113 (11 Cr)	Childhood education (30 cr.) is collateral major. See School of Education
	Major II option 1: Adolescence Education	26 + 23 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-113 (11 Cr)	Adolescence education (23 cr.) is the appropriate minor. See School of Education
	Major II option 2: biochemistry option for pre-professional students	24 + 30.5 cr of biology, math and physics – or – 27 + 26 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-113 (11 Cr)	Any combination of the required physics and math courses, totaling 12 credits, may be used as a minor. If students prefer a different minor, they must consult with the department adviser or chair
	Major II option 2: QUEST	24 + 26 cr of biology, math and physics – or – 27 + 26 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-113 (11 Cr)	Childhood education (30 cr.) is collateral major. See School of Education
	Major II option 2: Adolescence Education	24 + 26 cr of biology, math and physics – or – 27 + 26 cr of biology, math and physics	FL: GERMAN or RUSS	CHEM 102-105 (9 cr) – or – CHEM 111-113 (11 Cr)	Adolescence education (23 cr.) is the appropriate minor. See School of Education
BA/MA in Chemistry/Adolescence Education: Chemistry		Minimum 24 cr in chemistry Minimum 29 cr in auxiliary courses Minimum 14 graduate level chemistry cr Total minimum required credits=134	FL: GERMAN or RUSS	Permission of dept.	

The Department of Chemistry offers courses to prepare the science major for professional work and further study in chemistry and other fields of pure and applied science. Courses for the non-science major are designed to present those essentials of chemical fact and theory which will contribute to the student's understanding of present-day scientific knowledge.

MAJOR

There are two chemistry majors: Major I, a 41-credit concentration in addition to a 9-credit general chemistry core, is designed to prepare the student with intensive training for professional research and graduate study. Major II consists of two options: Option 1 for students interested in the chemical industry; and Option 2 (the biochemistry option) for students interested in the pharmaceutical industry, medicine, dentistry, veterinary medicine or physical therapy. Major II includes a minimum concentration of 26 credits (Option 1) or 24 credits (Option 2) in 200-level and above chemistry courses, in addition to a 9-credit general chemistry core. Both Options 1 and 2 are appropriate for students pursuing teacher education programs.

Students considering a chemistry major should consult the departmental adviser during

their first semester to plan the proper sequence of courses, and they are urged to consult with the adviser at least once each succeeding semester. General Chem lecture I and II and General Chem Labs 1 and 2 are prerequisites for admission to both Major I and Major II.

Chemistry Major I

General Chemistry Core: CHEM 102-105 or CHEM 111-113.

The requirements for this major consist of 41 credits in chemistry. There is no allied minor. This major is recommended for students preparing for admission to graduate school or for careers in chemical research. It will also be useful to students seeking a position in the chemical or allied industries, as it is accredited by the Committee on Professional Training of the American Chemical Society.

The 41-credit major consists of CHEM 222-223, 224-225, 249, 349, 352, 354 or 356 with 355, 357, 366, 376 and 390. One further laboratory course must be chosen from 291.02 (research), 491.02 (honors research) or 378. In addition, one additional lecture course must be chosen from among the following: CHEM 322, 345, 354, 356, or 377. Also acceptable for completion of Major I are PHYS 330, PHILO 362 or 379. Students should be aware, however, that if either of the philosophy courses is used to complete the Major I requirements, the major will not be eligible for accreditation by the American Chemical Society. One year of physics, PHYS 111 and 121, and four semesters of mathematics, MATH 150, 155, 250 and 254 or 260 are also required for this major; CHEM 249, MATH 150 and 155, and PHYS 121 are prerequisites for CHEM 352 and should be completed by the end of the sophomore year. College Russian or German sufficient to meet Hunter's GER require-

ment in foreign languages is recommended.

Major I is required of all students who wish to be considered for certification by the American Chemical Society upon graduation. It is recommended for all students intending to enter the profession of chemistry through either graduate study or employment in industry or government. Students who can attend only in the evenings should consult the department adviser regarding the feasibility of completing Chemistry Major I.

Chemistry Major II

General Chemistry Core: CHEM 102-105 or CHEM 111-113.

Option 1:

For students interested in a career in the chemical industry. It consists of a minimum of 26 credits in chemistry above the introductory level and a 9-credit general chemistry core for a total of 35 credits of chemistry. One year of physics and three semesters of calculus are also required for Major II.

Required chemistry courses: CHEM 222-225, 249, 352, 354, or 356, 355, and 357

Required elective course: Any chemistry course at the 300 level or above.

Required allied courses: MATH 150, 155, 250, and PHYS 111, 121

Option 2 (Biochemistry option):

For students preparing for admission to medical, dental, veterinary schools or physical therapy programs, or for students interested in a career in the pharmaceutical industry. It consists of a minimum of 24 credits above the introductory level and a 9-credit general chemistry core for a total of 33 credits of chemistry. One year of physics, one year of biology and one year of calculus are also required.

Required chemistry courses: CHEM 222-225, 350, 376-378

Required elective course: Any chemistry course at the 200-level or above (excluding CHEM 291 and 295) or BIOL 200 or 202

Required allied courses: BIOL 100, 102, MATH 150, 155, and PHYS 110, 120

Minors for Major II

Any combination of the required physics and math courses, totaling 12 credits, may be used as a minor. If students prefer to elect a different minor, they must consult with the department adviser or chair.

Minor for Non-Majors

Students wishing to minor in chemistry should consult their major adviser for appropriate course recommendations.

Honors Work

Opportunity for an individual research experience is provided by an honors course, CHEM 491 (Introduction to Research).

Electives

Advanced lecture courses in special areas of chemistry, and lab courses providing training in inorganic and organic chemistry and in research techniques, are offered as electives for Major I and are open to students enrolled in Major II who have fulfilled the course prerequisites.

Graduate Study

Qualified chemistry majors may be admitted to 700-level courses in the graduate program. Permission of the department is required.

Preparation for Teaching

In cooperation with the School of Education, the Department of Chemistry provides opportunities for students to prepare for careers in teaching at the elementary and secondary level in the area of chemistry. Chemistry Major II, Option I (35 credits) and Option 2 (33 credits) both satisfy the requirements for New York State certification for teachers of chemistry in Childhood Education (Grades 1-6) and Adolescence Education (Grades 7-12). For students pursuing certification as chemistry teachers at the secondary level, the 23-credit adolescence education sequence is an appropriate minor. Students who want to qualify for New York City licensing and New York State certification for teaching in secondary schools should consult the Education section of this catalog for additional requirements.

Five-Year BA/MA Degree in Chemistry and Adolescence Education: Chemistry

An accelerated program leading to a BA in Chemistry and an MA in Adolescence Education: Chemistry. Undergraduates admitted to the program start graduate courses during their senior year and will be able to complete the MA degree one year after they complete the requirements for the BA degree. Students interested in the program should speak to a chemistry department adviser during their sophomore year to review the curriculum path for the five-year program. A minimum of 134 credits is required for the dual degree.

COURSE LISTINGS

Note: No student may receive credit for both CHEM 100-101 and 102-103 or 111; no student may receive credit for both CHEM 120-121 and 222-223.

CHEM 100 Essentials of General Chemistry

Lecture
GER 2/E

Essential facts, laws, and theories of general chemistry. Note: Core credit awarded only if CHEM 100 and CHEM 101 are completed. *Primarily for nursing, nutrition and food science and community health education students.*

4 hrs (3 lec, 1 rec), 3 cr.

CHEM 101 Essentials of General Chemistry

Laboratory
GER 2/E

Experiments designed to illustrate fundamental laws and techniques of general chemistry. Note: Core credit awarded only if CHEM 100 and CHEM 101 are completed. *Primarily for nursing, nutrition and food science and community health education students.*

pre- or coreq: CHEM 100
4 hrs (3 lab, 1 rec), 1.5 cr.

CHEM 102 General Chemistry I

GER 2/E

In-depth introduction to stoichiometric calculations, atomic and molecular structure and chemical bonding. Note: Core credit awarded only if CHEM 102 and CHEM 103 are completed. *Primarily for pre-med, medical laboratory sciences and science majors.*

pre- or coreq: MATH 125, 126 or equiv.
4 hrs (3 lec, 1 rec), 3 cr.

CHEM 103 General Chemistry Laboratory I

GER 2/E

Study of experiments designed to illustrate fundamental laws and techniques of chemistry. Note: Core credit awarded only if CHEM 102 and CHEM 103 are completed. *Primarily for pre-med, medical laboratory sciences and science majors.*

pre- or coreq: CHEM 102
4 hrs (3 lab, 1 rec), 1.5 cr.

CHEM 104 General Chemistry II

GER 2/E

In-depth introduction to thermodynamics, redox reactions, electrochemistry and chemical equilibrium. Note: Core credit awarded only if CHEM 104 and CHEM 105 are completed. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereq: CHEM 102 and 103 or CHEM 100 with perm chair
4 hrs (3 lec, 1 rec), 3 cr.

CHEM 105 General Chemistry Laboratory II

GER 2/E

Laboratory experiments illustrating and applying theory of solutions to qualitative analysis. Note: Core credit awarded only if CHEM 104 and CHEM 105 are completed. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereq: CHEM 103
pre- or coreq: CHEM 104
3 hrs, 1.5 cr.

CHEM 111 Chemical Principles

GER 2/E

In-depth introduction to chemical principles including measurement, stoichiometric calculations, inorganic nomenclature, gas laws, equilibrium, and acids and bases. Emphasis is placed on problem-solving, oral presentations, and collaborative work. Laboratory and coursework emphasize analysis and evaluation of data. *Primarily for pre-med, medical laboratory sciences and science majors.*
pre- or coreqs: MATH 125 or equiv, MATH 126 9 hrs (3 hrs lec, 3 hrs lab, 1 hr rec, 2 hrs workshop), 4.5 cr.
offered fall

CHEM 112 Thermodynamics and Solution Chemistry

GER 2/E

The study of aqueous solution chemistry, acids and bases, kinetics, electrochemistry, and thermodynamics. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereq: CHEM 111

9 hrs (3 hrs lec, 3 hrs lab, 1 hr rec, 2 hrs workshop), 4.5 cr.
offered spring

CHEM 113 Atomic Structure, Chemical Bonding and Spectroscopy

Introduction to quantum theory, atomic structure, periodic properties of the elements, and modern theories of chemical bonding. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereq: CHEM 112

4 hrs (2 hrs lec, 2 hrs workshop), 2 cr.
offered fall

CHEM 115 Introductory Chemistry

An introduction to the fundamental concepts in chemistry including atomic and molecular structure, chemical bonding, stoichiometry, and solution chemistry. This course is appropriate for students who have had no prior coursework in chemistry.

pre- or coreq: MATH 125

4 hrs (3 lec, 1 rec), 3 cr.

CHEM 120 Essentials of Organic Chemistry Lecture

GER 2/E

Course presents essential facts, laws and theories of organic chemistry. Note: Core credit awarded only if CHEM 120 and CHEM 121 completed. *Primarily for nursing, nutrition and food science and community health education students.*

prereq: CHEM 100

4 hrs (3 lec, 1 rec), 3 cr.

CHEM 121 Essentials of Organic Chemistry Laboratory

GER 2/E

Experiments designed to illustrate fundamental laws and techniques of organic chemistry. Note: Core credit awarded only if CHEM 120 and CHEM 121 completed. *Primarily for nursing, nutrition and food science and community health education students.*

prereq: CHEM 101*pre- or coreq:* CHEM 120

4 hrs (3 lab, 1 rec), 1.5 cr.

CHEM 130 Preprofessional Science: Core 1

The chemistry component of the first semester of a four-semester, fully integrated course in general chemistry, general physics, and mathematical functions and graphs. Topics include properties of linear functions and their graphs, mechanics, introductory thermodynamics and stoichiometry. *Primarily for pre-med, medical laboratory sciences and science majors.*

coreqs: MATH 130, PHYS 130, PHYSC 130 Lab 2 hrs, 1.5 cr.

CHEM 131 Preprofessional Science: Core 2

The chemistry component of the second semester of a four-semester, fully integrated course in general chemistry, general physics, and mathematical functions and graphs. Topics include properties of polynomial, rational, exponential, and logarithmic functions and their graphs, chemical equilibrium, electrochemistry and further topics in thermodynamics. Completion of CHEM 130 and 131 is equivalent to completion of CHEM 102. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereqs: MATH 130, PHYS 130, CHEM 130, PHYSC 130 Lab

coreqs: MATH 131, PHYS 131, PHYSC 131 Lab 2 hrs, 1.5 cr.

CHEM 132 Preprofessional Science: Core 3

The chemistry component of the third semester of a four-semester, fully integrated course in general chemistry, general physics, and mathematical functions and graphs. Topics include trigonometric functions, topics in analytic geometry, waves, the structure of the atom, and chemical bonding. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereqs: MATH 131, PHYS 131, CHEM 131, PHYSC 131 Lab

coreqs: MATH 132, PHYS 132, PHYSC 132 Lab 2 hrs, 1.5 cr.

CHEM 133 Preprofessional Science: Core 4

The chemistry component of the fourth semester of a four-semester, fully integrated course in general chemistry, general physics, and mathematical functions and graphs. Topics include trigonometric identities, applications of trigonometry, chemical kinetics, electricity and magnetism, optics and nuclear physics. Completion of CHEM 132 and 133 is equivalent to completion of CHEM 104. *Primarily for pre-med, medical laboratory sciences and science majors.*

prereqs: MATH 132, PHYS 132, CHEM 132, PHYSC 132 Lab

coreqs: MATH 133, PHYS 133, PHYSC 133 Lab 2 hrs, 1.5 cr.

CHEM 150 Peer-Led Teaching in Chemistry

Students learn to become peer-leaders for workshops held in either Essentials of Chemistry, General Chemistry, or Organic Chemistry. Topics include: multiple intelligences and differences in learning styles; basic theory of learning; issues related to race, class and gender.

prereq: CHEM 120, CHEM 104, or CHEM 112 and perm dept.

2 hrs, 1 cr.

CHEM 222, 224 Organic Chemistry Lectures I and II

GER 3/B

Structure, bonding, and reactions of organic molecules. Synthesis, stereochemistry, spectroscopy, reaction mechanisms.

prereq for CHEM 222: CHEM 104*prereq for* CHEM 224: CHEM 222

4 hrs (3 lec, 1 rec), 3 cr. each

CHEM 223 Organic Chemistry Laboratory I

GER 3/B

Various organic syntheses, crystallization, distillation, extraction, chromatography, qualitative analysis, spectroscopy.

prereq: CHEM 105*pre- or coreq:* CHEM 222

5 hrs, 2.5 cr.

CHEM 225 Organic Chemistry Laboratory II

GER 3/B

Continuation of CHEM 223.

prereqs: CHEM 222, 223*pre- or coreq:* CHEM 224

5 hrs, 2.5 cr.

CHEM 249 Quantitative Analysis

GER 3/B

A set of laboratory experiments, performed by individual students, covering important areas of quantitative analysis such as pH and metal ion titrations, spectroscopic analysis including gas chromatography, electronic absorption, and fluorescence.

prereqs: CHEM 104, 105

5 hrs (4 lab, 1 rec), 3 cr.

*offered fall***CHEM 291 Chemical Investigations**

GER 3/B

Original chemical investigations under supervision of faculty member. Written report required. Enrollment for maximum of two semesters.

prereqs: CHEM 224, perm chair

4 hrs, 1 cr. or 8 hrs, 2 cr.

CHEM 295 Introduction to Planning and Teaching of Laboratory Work in Chemistry

Participate in supervised teaching experiments that demonstrate important principles of chemistry.

prereqs: CHEM 104 CHEM 105, two letters

from faculty who have taught the student

5 hrs (2 planning, 3 lab), 2 cr.

CHEM 322 Organic Chemistry Lecture III

GER 3/B

Selected topics such as advanced synthesis, reaction mechanisms, MO theory, natural products, NMR spectroscopy.

prereqs: CHEM 224, perm instr.

3 hrs, 3 cr.

CHEM 345 Computers in Chemistry

GER 3/B

Laboratory data acquisition, reduction, instrument control, graphics. Hands-on laboratory. No previous programming experience necessary.

prereq: CHEM 352 or perm instr.

5 hrs (2 lec, 3 lab), 3 cr.

CHEM 349 Instrumental Analysis

GER 3/B

Principles of modern instrumental techniques; emphasis on spectroscopic and electrometric methods.

prereq: CHEM 354 or 356 with 355
8 hrs (2 lec, 6 lab), 5 cr.
offered fall

CHEM 350 Biophysical Chemistry

GER 3/B

Essential physical chemical principles as applied to biological problems. Emphasis on kinetics, thermodynamics, and equilibria.

prereqs: CHEM 224, BIOL 102, MATH 150
4 hrs, 4 cr.
offered fall

CHEM 352 Physical Chemistry I

GER 3/B

Ideal and real gases. Laws of thermodynamics with applications to properties of solutions and phase equilibria in general.

prereqs: CHEM 249, MATH 155, PHYS 121
3 hrs, 3 cr.
offered fall

CHEM 354 Physical Chemistry II – F

GER 3/B

Selected topics from statistical thermodynamics, electrochemistry, kinetic theory and rate processes.

prereqs: CHEM 352, MATH 250
3 hrs, 3 cr.
offered fall

CHEM 355 Physical Chemistry Laboratory I

GER 3/B

Laboratory course involving experiments based on topics covered in CHEM 352 on chemical systems.

prereq: CHEM 249
pre- or coreq: CHEM 352
3 hrs, 1.5 cr.
offered fall

CHEM 356 Physical Chemistry II – S

GER 3/B

Selected topics from quantum chemistry, molecular structure, and spectroscopy.

prereqs: PHYS 121, CHEM 249, MATH 155
3 hrs, 3 cr.
offered spring

CHEM 357 Physical Chemistry Laboratory II

GER 3/B

Laboratory course involving experiments based on topics covered in CHEM 356 on chemical systems.

prereq: CHEM 249 or *perm chair*
pre- or coreq: CHEM 356
3 hrs, 1.5 cr.
offered spring

CHEM 366 Inorganic Chemistry

GER 3/B

Treatment of structure, bonding and reactivity of inorganic compounds.

prereq: CHEM 352
3 hrs, 3 cr.
offered fall

CHEM 376 Biochemistry I

GER 3/B

Chemical aspects of protein structure and function, fundamentals of bioenergetics, biochemical mechanisms of gene replication and expression.

prereq: CHEM 224
3 hrs, 3 cr.
offered fall

CHEM 377 Biochemistry II

GER 3/B

Biosynthesis of lipids, amino acids, carbohydrates. Muscle contraction, hormones, immune response, DNA sequencing.

prereq: CHEM 376 or BIOL 300 or *perm instr.*
3 hrs, 3 cr.
offered spring

CHEM 378 Biochemistry Laboratory

GER 3/B

A set of laboratory experiments, performed by individual students, covering important areas of biochemistry such as protein analysis, enzyme purification, enzymatic assays, recombinant DNA and the polymerase chain reaction.

prereqs: CHEM 223 and CHEM 376 or CHEM 640
5 hrs (4 lab, 1 rec), 3 cr.

CHEM 388 Topics of Current Interest in Chemistry

GER 3/B

Offered subject to adequate student interest and enrollment. Taught by specialists from department faculty. The specific topic will be listed in the schedule of classes for a given semester.

pre- or coreqs: CHEM 352 and CHEM 356 or *perm instr.*
3 hrs, 3 cr.

CHEM 390 Current Laboratory Methods in Chemistry

GER 3/B

Offered subject to adequate student interest and enrollment. Taught by specialists from department faculty. The specific topic will be listed in the Schedule of Classes for a given semester.

pre- or coreq: CHEM 357 or *perm instr.*
4 hrs, 2 cr.

HONORS COURSE**CHEM 491 Introduction to Research**

GER 3/B

Open to Jr/Sr only. Similar to CHEM 291. Written report required. Fulfills requirement for departmental honors course.

prereqs: CHEM 224, 354, 349, *perm chair*
4 hrs, 1 cr. or 8 hrs, 2 cr.

