Chemistry

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Secondary School Preparation
It is suggested that students proposing to major in chemistry have the following high school preparation: one year of chemistry (preferably with laboratory work), one year of physics, and 3 1/2 years of mathematics (including elementary algebra, plane geometry, intermediate algebra, and trigonometry).

Department Writing Requirement
Students meet the department writing requirement by passing Chemistry 352, Chemistry Senior Seminar.
For further information, please contact your advisor or Dr. Geiger, the Department Chair. For information on writing requirements for "double" or "triple" majors, consult the Undergraduate Bulletin under "Multiple Majors" or the Office of the Dean of the College.

Bachelor of Arts Degree
The Bachelor of Arts in Chemistry is recommended for those pursuing adolescent teaching certification or who do not intend to pursue graduate work in chemistry.

Minimum Competency Requirement
Students must attain a grade of C- or better in all required chemistry courses. A grade of C- must be achieved in any course before it can be used as a prerequisite for another course.

Total credit hours required to complete major:

Requirements			41 semester hours
	CHEM 116	Chemistry I Lecture	3
	CHEM 118	Chemistry II	3
	CHEM 119	N/Introductory Chemistry Laboratory	2
	CHEM 209	Intermediate Chemistry Laboratory	2
	CHEM 211, 216, 213	Organic Chemistry I and Lab & Organic Chemistry II	8
	CHEM 313	Lab Tech in Organic Chemistry I	2
	CHEM 320, 322	Physical Chemistry I and II OR	
	CHEM 324	Principles of Physical Chemistry	3-6
	CHEM 330	Inorganic Chemistry I	3
	CHEM 340	Modern Analytical Chemistry	3
	CHEM 342	Modern Analytical Chemistry Laboratory	2
	CHEM 351	Current Topics in Chemistry *Students working toward Adolescent Certification in Chemistry and General Science may substitute INTD 300 – Topics in Secondary Education: Science	1
	CHEM 352	Chemistry Senior Seminar	1
	CHEM 361	Modern Physical Chemistry Laboratory	2

	An additional 3 credit 300-level chemistry course must be taken if the CHEM 320/322 option is taken OR two additional 3 credit 300-level chemistry courses must be taken if the CHEM 324 option is used.	3-6

Related Requirements		16 semester hours
MATH 221, 222	Calculus I and II	8
PHYS 123, 114, 125, 116	Analytical Physics I and II	8

Bachelor of Science Degree: American Chemical Society Certified

The ACS certified BS in Chemistry is recommended for those intending to pursue graduate work or those who wish to pursue interdisciplinary study and obtain a degree certified by a professional organization (e.g., environmental chemistry, biochemistry or chemical physics).

Minimum Competency Requirement

Students must attain a grade of C- or better in all required chemistry courses. A grade of C- must be achieved in any course before it can be used as a prerequisite for another course.

Requirements		
Chemistry		51 semester hours
CHEM 116	Chemistry I Lecture	3
CHEM 118	Chemistry II	3
CHEM 119	Introductory Chemistry Laboratory	2
CHEM 209	Intermediate Chemistry Laboratory	2
CHEM 211, 216, 213	Organic Chemistry I & II Lectures and Laboratories	8
CHEM 300 OR CHEM 302	Principles of Biochemistry OR Biochemistry I	3
CHEM 301	Biochemistry Lab	2
CHEM 313	Lab Techniques in Organic Chemistry	2
CHEM 320, 322	Physical Chemistry I and II	6
CHEM 330	Inorganic Chemistry I	3
CHEM 331	Lab. Techs. in Inorganic Chemistry	2
CHEM 340	Modern Analytical Chemistry	3
CHEM 342	Modern Analytical Chemistry Laboratory	2
CHEM 351	Current Topics in Chemistry	1
CHEM 352	Chemistry Senior Seminar	1
CHEM 361	Modern Physical Chemistry Laboratory	2

One advanced course from the following list if CHEM 302 is selected and two advanced courses from the following list if CHEM 300 is chosen: CHEM 304, 315, 318, 329, 334, 338, 341, 399 (with permission); BIOL 300; and PHYS 344 and 352.

Related Requirements		16
Physics		8 semester hours
PHYS 123, 114, 125, 116	Analytical Physics I and Laboratory, Analytical Physics II and Laboratory.	8
Mathematics		8 semester hours
MATH 221 MATH 222	Calculus I and Calculus II.	8

Certification in Adolescence Education (7-12): Chemistry and General Science

Students seeking Initial Certification in Adolescence Education (7-12) must complete the requirements for either a BA or the American Chemical Society Certified – BS in Chemistry in addition to the requirements set forth in the School of Education program description. Those students who choose to complete a BA degree with certification may use INTD 300 in place of CHEM 351. Students who choose to complete the BS degree with certification will need at least one additional semester to complete the requirements.

Preparation for Chemical Engineering (Five-Year [3-2] Program)

This program, described in the advising guide at the end of this section, allows students to earn either a Bachelor of Arts or a Bachelor of Science degree (in chemistry) from Geneseo and a Bachelor of Science in Chemical Engineering degree from the State University of New York at Buffalo, Clarkson College, or Columbia University.

Minimum Competency Requirement: Students must attain a grade of C- or better in all required chemistry courses. A grade of C- must be achieved in any course before it can be used as a prerequisite for another course.

Minor in Chemistry

A minimum of 21 semester hours, distributed as follows:

Area	Course Numbers	Semester Hours
General Chemistry	CHEM 116, 118, 119	8
Organic Chemistry	CHEM 211, 216, 213	8
Physical Chemistry	CHEM 324 or CHEM 320, 322	3-6
Electives	CHEM 300, 302, 318, 330, or 340	0-3

(If the CHEM 320, 322 physical chemistry option is selected, no further electives are required. If CHEM 324 is taken, 3 hours of electives are required.)

Minimum Competency Requirement: Students must attain a grade of C- or better in all required chemistry courses. A grade of C- must be achieved in any course before it can be used as a prerequisite for another course.

Chemistry Courses

CHEM 100 Chemistry First Year Experience
This course serves as an introduction to the chemistry and biochemistry programs at Geneseo and is intended for those considering a chemistry or biochemistry major. Topics include career opportunities, the literature of the chemist and biochemist, research opportunities, software used in the chemistry curriculum, and strategies for success. Credits: 1(1-0) Offered every fall.

CHEM 103 N/Chemistry and Society
A terminal one-semester course designed to acquaint non-science students with how chemistry and science affect their lives. Chemical principles are applied to problems of current interest, such as energy and pollution. Methods which chemists and other scientists use in their attempts to solve such problems are illustrated. Not available for credit to science majors. Credits: 4(3-2) Offered every spring

CHEM 116 Chemistry I
An introduction to some of the fundamental principles of chemistry. Topics include introduction to chemistry, stoichiometric principles, atomic structure and nature of the periodic table, chemical bonding, reactions

in solutions, solution stoichiometry, thermochemistry, and trends in the physical and chemical properties of elements and their compounds. (Primarily designed for science majors and potential science majors.) CHEM 119 must accompany this course for natural science general education credit. Credits: 3(3-0) Offered every fall

CHEM 118 Chemistry II
A continuation of CHEM 116. Topics to be covered include thermodynamics and reaction spontaneity, chemical kinetics, chemical equilibrium, properties of acids and bases, aqueous solution equilibria, electrochemistry, molecular structure and bonding theories, transition metals and their coordination compounds, and chemical properties of selected elements. Prerequisites: CHEM 116. Co-requisite: CHEM 119. Credits: 3(3-0) Offered every spring

CHEM 119 N/Introductory Chemistry Lab
An introduction to the experimental techniques and methodology used to explore matter and chemical reactivity. Experiments include the synthesis and characterization of a compound, identification of unknown substances, an exploration of the gas laws, volumetric and gravimetric analysis, structure and bonding, and acid/base chemistry. Prerequisites: or Co-requisite: CHEM 116. Credits: 2(0-4).

CHEM 120 General Chemistry I
Fundamental principles of chemistry covering stoichiometry, types of chemical reactions, thermochemistry, properties of gases, atomic structure, periodicity, molecular structure and bonding, nature of liquids and solids, and physical properties of solutions. CHEM 121 must accompany this course for natural science general education credit. Credits: 3(3-0) Offered when demand is sufficient

CHEM 121 N/General Chemistry I Laboratory
An introduction to the experimental techniques and methodology used by chemists. Experiments include an examination of physical properties, preparation of an inorganic compound, calorimetry, stoichiometry and molar volume of an ideal gas, qualitative analysis, and molecular weight determination by freezing point depression. Prerequisites: or Co-requisite: CHEM 120. Credits: 1(0-3) Offered when demand is sufficient

CHEM 122 General Chemistry II
A continuation of CHEM 120. Topics include chemical equilibrium, acids and bases, precipitation reactions, equilibria involving complex ions, electrochemistry and redox reactions, thermodynamics, kinetics, modern bonding theories, chemistry of selected elements including transition metals and coordination compounds. Prerequisites: CHEM 120. Co-requisite: CHEM 119. Credits: 3(3-0) Offered when demand is sufficient

CHEM 209 Intermediate Chemistry Laboratory
This course serves as a bridge to advanced chemistry laboratory courses at Geneseo. Students will learn how to perform quantitative measurements and techniques for the synthesis and characterization of compounds. Safety in the laboratory environment and experimental design are emphasized. Prequisites: CHEM 119. Credits: 2(0-4) Offered every spring semester

CHEM 211 Organic Chemistry I
An introduction to modern organic chemistry using a functional group approach. Topics include structure/reactivity relationships, reaction mechanisms, stereochemistry, and spectroscopy. Prerequisites: CHEM 122 or CHEM 118, CHEM 119. Credits: 3(3-0) Offered every fall

CHEM 213 Organic Chemistry II
Continuation of CHEM 211 with emphasis on the biochemically important alcohol, amine, carbonyl and aromatic functional groups. Structure elucidation by spectroscopic methods is also explored. Prerequisites: CHEM 211. Credits: 3(3-0) Offered every spring

CHEM 216 Organic Chemistry Laboratory
Laboratory practices in representative organic preparations and procedures. Pre-

requisites: /Corequisite: CHEM 211. Credits: 2(0-4) Offered every fall and spring

CHEM 300 Principles of Biochemistry
A one-semester survey of the chemistry of living organisms. Topics studied include enzymes and enzyme kinetics, proteins, nucleic acids and protein synthesis, oxidative phosphorylation, photosynthesis, metabolism of carbohydrates, lipids, and nitrogen-containing compounds. Prerequisites: CHEM 213 and CHEM 216. Credits: 3(3-0) Offered every spring

CHEM 301 Biochemistry Laboratory
Students will be introduced to a selection of standard biochemical procedures such as DNA and protein purification, chromatographic separation, gel electrophoresis, dialysis, enzyme assay, and DNA analysis techniques. Prerequisites: CHEM 216 and CHEM 213. Co-requisites: CHEM 300 or CHEM 302. Credits: 2(0-4)

CHEM 302 Biochemistry I
Introduction to the chemistry of living organisms. Structure-to-function relationships of proteins, nucleic acids, carbohydrates, and lipids are explored, with an emphasis on molecular interactions. Other topics include enzyme kinetics, catalytic mechanism, and modes of regulation, as well as, application of protein function such as oxygen transport, muscle contraction, the immune response, membrane transport, and biological signaling. Credit cannot be received for both this course and CHEM 300. Preference for enrollment given to Biochemistry and Chemistry majors. Prerequisites: CHEM 213. Credits: 3(3-0) Offered every fall

CHEM 304 Biochemistry II
Continuation of the chemistry of living organisms. The chemistry of nucleic acids is explored in depth and these principles are applied to understanding the tools that biochemists use in the laboratory. Regulation of genes and the molecular interactions of protein-DNA complexes are also investigated. The last part of the course focuses on the chemistry of metabolism and biosynthesis, along with the mechanisms of regulation of these processes. Prerequisites: CHEM 302. Credits: 3(3-0) Offered every spring

CHEM 313 Laboratory Techniques in Organic Chemistry I
A laboratory course devoted to the synthesis, separation, and identification of organic compounds, utilizing modern instrumental methods. Prerequisites: CHEM 216 and CHEM 213. Credits: 2(0-4) Offered every fall

CHEM 315 Bioorganic Chemistry
This course will survey several main classes of natural products (secondary metabolites), their biosynthesis, typical structures, biological properties, and structural elucidation. Special attention will be paid to mechanistic aspects of biosynthesis. The social and historical uses of natural products will also be considered. Prerequisites: 1 year of organic chemistry and 1 semester of biochemistry. Credits: 3(3-0) Offered when demand is sufficient

CHEM 318 Advanced Organic Chemistry
Organic synthesis: Introduction to retrosynthetic analysis including a detailed study of methods of introducing stereo control. Mechanistic organic chemistry: conformational analysis, transition state theory, kinetics and reaction mechanism, computer modeling, and other topics of contemporary interest. Prerequisites: CHEM 213. Co-requisite: CHEM 324 or CHEM 320 or permission of the instructor. Credits: 3(3-0) Offered when demand is sufficient

CHEM 320 Physical Chemistry I
An introduction to the principles of chemical thermodynamics and the application of these principles to ideal and non-ideal chemical systems. Topics include the properties of gases and gas mixtures, thermochemistry, the laws of thermodynamics, entropy and free energy functions, chemical and phase equilibria, properties of solutions of nonelectrolytes and electrolytes, and electrochemistry. Computer software and/or programming will be used in this course. Prerequisites: CHEM 213, MATH 222 and PHYS 125 and PHYS 116; or permission of the instruc-

tor. Credits: 3(3-0) Offered every fall

CHEM 322 Physical Chemistry II
A continuation of CHEM 320. Covers two areas of modern physical chemistry: quantum chemistry and chemical kinetics. Topics in quantum chemistry include waves and particles, postulates of quantum mechanics, Schroedinger equation, applications with exact solutions, approximation methods, atomic structure, molecular structure, and spectroscopy. Topics in chemical kinetics include empirical laws, reaction mechanisms, and reaction rate theories. Prerequisites: CHEM 320. Credits: 3(3-0) Offered every spring

CHEM 324 Principles of Physical Chemistry
An introduction to physical chemistry. Topics include the gas laws, the laws of thermodynamics, chemical and physical equilibria, properties of solutions, electrolytes, electrochemical cells, chemical kinetics, enzyme kinetics, and transport processes. Prerequisites: CHEM 118 and PHYS 113/114 and PHYS 115/116 and MATH 222 or MATH 228. Credits: 3(3-0) Offered every spring

CHEM 329 Topics in Physical Chemistry
An in depth study of one or more selected topics in advanced physical chemistry with emphasis on modern concepts and recent developments. Topics for this course could include chemical thermodynamics, statistical thermodynamics, physical chemistry of solutions, atomic spectroscopy and structure, molecular spectroscopy and structure, chemical applications of group theory, quantum chemistry, kinetic molecular theory, chemical kinetics, advanced instrumental techniques. This course may be repeated for credit whenever new topics are offered. Prerequisites: CHEM 322 and/or permission of the instructor. Credits: 3(3-0) Offered when demand is sufficient

CHEM 330 Inorganic Chemistry I
An introduction to modern inorganic chemistry. Topics include current models used to describe periodicity, bonding, and structure, acid-base chemistry, coordination chemistry, inorganic reaction mechanisms, and an introduction to organometallic chemistry. Prerequisites: /Co-requisite: CHEM 322 or CHEM 324 or permission of instructor. Credits: 3(3-0) Offered every spring

CHEM 331 Laboratory Techniques in Inorganic Chemistry
This course serves to familiarize students with modern synthetic and instrumental techniques used in the preparation, characterization, and study of inorganic compounds. Prerequisites: /Co-requisite: CHEM 330. Credits: 2(0-4) Offered every spring

CHEM 334 Bioinorganic Chemistry
This course examines the chemistry of inorganic elements in biological systems. Topics include the role of metals in proteins and enzymes, the use of metals in drug catalytic sites or as probes for biomolecular study, metals in migration and direction sensing, minerals in nutrition and toxicity, and the biochemical effects of radioactive elements. Prerequisites: CHEM 300 or CHEM 302 or BIOL 300. Credits: 3(3-0) Offered when demand is sufficient

CHEM 338 Inorganic Chemistry II
Areas of current interest in the field of inorganic chemistry are explored. Topics covered include an introduction to chemical applications of group theory, organometallic compounds and catalysis, metal-metal bonding, clusters, inorganic photochemistry, and bioinorganic chemistry. Prerequisites: CHEM 330 and CHEM 322 or CHEM 324. Credits: 3(3-0) Offered when demand is sufficient

CHEM 340 Modern Analytical Chemistry
A course to familiarize students with the theory of analytical chemistry. Particular emphasis is given to the use of instrumental methods for quantitative analysis. Topics include calibration methods, error analysis, electroanalytical chemistry, optical and mass spectroscopy, and separation methods. Prerequisites: CHEM 216 and CHEM 213. Credits: 3(3-0) Offered every fall

CHEM 341 Modern Analytical Methods
A lecture course intended to acquaint the stu-

dent with the theoretical and applied aspects of modern methods of instrumental analysis, and separation. Prerequisites: CHEM 213, CHEM 216, and CHEM 322 or CHEM 324 or permission of the instructor. Credits: 3(3-0) Offered when demand is sufficient

CHEM 342 Modern Analytical Chemistry Laboratory
A course to familiarize students with the practice of modern analytical chemistry. Particular emphasis is given to experiments using instrumental methods for quantitative analysis. Experiments will include calibration methods, error analysis, and applications of electroanalytical chemistry, optical and mass spectroscopy, and separation methods. Prerequisites/Corequisite: CHEM 340. Credits: 2(0-4) Offered every fall

CHEM 351 Current Topics in Chemistry
Participants prepare for and attend seminars presented by visiting speakers. Short written and oral reports on topics related to the speaker's area of expertise will be developed from the current literature. Methods for chemistry information retrieval and effective reading of the chemical literature will be covered. Students will receive information about career choices in the field. Prerequisites: Senior status in Chemistry. Credits: 1(1-0) Offered every fall

CHEM 352 Chemistry Senior Seminar
A seminar course designed to give students advanced scientific writing experience while preparing and formally presenting a scientific paper and demonstrating basic chemical knowledge. Prerequisites: CHEM 351 or senior status in Adolescence Certification (7-12) in Chemistry and General Science program. Credits: 1(1-0) Offered every spring

CHEM 361 Modern Physical Chemistry Laboratory
An introduction to, and application of a variety of physico-, electro- and spectro-chemical techniques currently used for the determination of physical and molecular properties and for chemical analysis. Use of modern instrumentation, including computerized data analysis, will be stressed. Prerequisites: CHEM 322 or CHEM 324 or permission of instructor. Credits: 2(0-4) Offered every spring

CHEM 385 Biochemistry Seminar
A seminar focusing on a topic or related group of topics in biochemistry. Papers from current literature will be discussed. Participants will explore the research literature and report their findings to the seminar group in the form of a paper and oral report. Prerequisites: CHEM 302 and CHEM 304 or permission of instructor. Credits: 1(1-0)

CHEM 393 Honors Research
Research with a member of the Chemistry Department. A thesis that includes a statement of the research goals, pertinent background information, experimental procedures, analysis of data, and a discussion of the results is submitted at the completion of the project. After the thesis is accepted, the student gives an oral presentation. Enrollment is by invitation of the Department. The student must have completed a minimum of 22 hours in chemistry with a GPA of 3.3 and an overall GPA of 3.0. Students registered for CHEM 393 are not required to register for CHEM 352. Prerequisites: CHEM 322. Credits: 4(1-9) Offered by individual arrangement

CHEM 399 Directed Study
Prerequisites: permission of department chair. (1 to 3 semester hours). Offered by individual arrangement

B.A. in Chemistry

Sample Program Outline/Advising Guide

FIRST YEAR			
Fall	Hours	Spring	Hours
CHEM 116 & 119	5	CHEM 118	3
INTD 105 or Elective		CHEM 209	2
MATH 221	4	MATH 222	4
S/U/ or Foreign Language	3	INTD 105 or elective	3
		M/ or Foreign Language	3
Total	15	Total	15
SECOND YEAR			
CHEM 211 & 216	5	CHEM 213 & 313	5
PHYS 123, 114	4	PHYS 125, 116	4
HUMN 220	4	HUMN 221	4
S/ or Foreign Language	3	F/	3
Total	16	Total	14-16
THIRD YEAR			
CHEM 320 or elective*	3	CHEM 322 or CHEM 324*	3
CHEM 340 and 342	5	N/	4
F/	3	CHEM 330	3
Electives or S/	3	Electives or M/	6
Total	14	Total	16
FOURTH YEAR			
CHEM 351**	1	CHEM 352	1
Electives	13	CHEM 361	2
		Electives	11
Total	14	Total	14
Total Semester Hours — 120			

*Students meet the Physical Chemistry requirement by taking either CHEM 320 and 322 (Physical Chemistry I and II) or CHEM 324 (Principles of Physical Chemistry). An additional 3 credit 300-level chemistry course must be taken if the CHEM 320/322 option is used. Two additional 3 credit 300-level chemistry courses must be taken if the CHEM 324 option is used.

**Students working toward Adolescent Certification in Chemistry and General Science may substitute INTD 300 Topics in Secondary Education: Science for CHEM 351.

Note: Where no prerequisities apply, some variation in the order or semester in which courses are taken is possible. Students should consult their academic advisors for additional information.

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B.S. in Chemistry, American Chemical Society Certified

Sample Program Outline/Advising Guide

FIRST YEAR			
Fall	Hours	Spring	Hours
CHEM 116	3	CHEM 118	3
CHEM 119	2	CHEM 209	2
MATH 221	4	MATH 222	4
		INTD 105	3
S/U/ and Foreign Language or electives	6	F/ or Foreign Language	3
Total	15	Total	15
SECOND YEAR			
CHEM 211 & 216	5	CHEM 213 & 313	5
HUMN 220	4	HUMN 221	4
PHYS 123, 114 and S/F/or Foreign Language	7	PHYS 125, 116 and S/F/M or Foreign Language	7
Total	16	Total	16
THIRD YEAR			
CHEM 320	3	CHEM 322	3
CHEM 340 & CHEM 342	5	CHEM 330, CHEM 331	5
S/F/M and elective	6	CHEM elective* and electives	6
Total	14	Total	14
FOURTH YEAR			
		CHEM 361	2
CHEM 351	1	CHEM 352	1
CHEM 302, 301, or elective	5	*CHEM 300, 301, or electives*	5
CHEM elective* or electives	9	CHEM elective* or electives	7
Total	15	Total	15
			Total Semester Hours — 120

*Choose two advanced courses from the following list of electives: CHEM 304, 315, 318, 329, 334, 338, 341, 399 (with permission); BIOL 300; and PHYS 344 and 352 to meet the degree requirements. Recommended electives for students interested in Biochemistry include CHEM 304 and BIOl 300. Students interested in chemical physics are advised to take Phys 344 and 352. Students interested in environmental chemistry should consider CHEM 341 and CHEM 304 or CHEM 315. Chemistry and other electives should be chosen in consultation with your academic advisor.

Note: Where no prerequisites apply, some variation in the order or semester in which courses are taken is possible. Students should consult their academic advisors for additional information.

Chemistry/3-2 Engineering

Sample Program Outline/Advising Guide

FIRST YEAR (Geneseo)			
Fall	Hours	Spring	Hours
CHEM 116	3	CHEM 118	3
CHEM 119	2	CHEM 119	2
MATH 221	4	MATH 222	4
CSCI 119, 120	4	F/	3
Non-Science elective* or Foreign Language	3	INTD 105	3
		S/U/ or Foreign Language	3
Total	16	Total	18
SECOND YEAR (Geneseo)			
CHEM 211 & 216	5	CHEM 213 & 313	5
CHEM 340 & CHEM 342	5	HUMN 220	4
MATH 223	4	MATH 326	3
PHYS 123, 114	4	PHYS 125, 116	4
Total	18	Total	16
THIRD YEAR (Geneseo)			
CHEM 320	3	CHEM 322	3
HUMN 221	4	CHEM 330	3
S/ or Foreign Language	3	Non-Science Elective	3
Non-Science Elective	3	M/	3
PHYS 223	3	Elective*	3
Total	16	Total	15
Total Semester Hours (Geneseo) -- 99			

*Non-science electives may include 9 hours of computer science (in addition to CSCI 121) and courses from areas other than natural science and mathematics. Foreign languages are non-science electives that also meet the SUNY-Buffalo Foreign Languages and Cross-Cultural Areas general education requirement.

Students who select the B.S. degree in Chemistry with A.C.S. Certification , usually take CHEM 331 although this requirement may be waived if an appropriate course is taken at engineering school.

Note: Where no prerequisites apply, some variation in the order or semester in which courses are taken is possible. Students should consult their advisors for additional information.