

- 4420 Natural History of the Vertebrates. (3-3) Environmental relationships and natural history of vertebrates. Emphasis is upon taxonomy, speciation and biotic provinces. The laboratory will include field trips for the study and collection of animals in their natural habitats. Students will assemble a representative collection of animals. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher and permission of instructor required for non-wildlife majors. (WI)
- 4421 Ornithology. (3-3) Introduction to anatomy, behavior, ecology and identification of birds of Texas. Laboratory will emphasize field studies of birds and their habitat requirements. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4422 Mammalogy. (3-3) The taxonomy, distribution, ecology, behavior and evolution of mammals with particular emphasis on wild animals of the southwest. Laboratory will emphasize anatomy, identification, preparation of specimens and field exercises in the methods of population analysis. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher. BIO 4416 is also recommended.
- 4423 Wildlife Management. (3-3) Applications of the principles of ecology and natural history to the management of wildlife habitats and control of wildlife populations. Laboratory will involve demonstrations and practice exercises with wildlife management techniques and instrumentation and field trips to observe wildlife management projects. Prerequisites: BIO 2410, 2411, and 2450 with a grade of "C" or higher. BIO 4416, 4421, or 4422 is also recommended. (WI)
- 4425 Biometry. (3-3) Basic principles of statistical methods as applied to biological problems such as sampling techniques, analysis of data, experimental design and population dynamics. Emphasis will be on practical application. Prerequisites: BIO 2450 with a grade of "C" or higher; MATH 1315.
- 4426 Immunology. (3-4) A study of the immune response, antigen/antibody reactions, major histocompatibility complex, and immunopathology. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. One semester of organic chemistry is recommended. (WI)
- 4434 Herpetology. (3-3) A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. Emphasis will be placed on North American species and those groups inhabiting Texas. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4435 Techniques in Wildlife Management. (3-3) The basic methodology of practical wildlife management. This involves techniques in monitoring and data collection related to population dynamics and habitat parameters of wildlife species. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher and permission of instructor required for non-wildlife majors.
- 4441 Cellular Physiology. (3-3) Advanced cellular biology, including membrane physiology, thermodynamics, energy transduction and distribution, and cellular movement in non-muscle and muscle cells. Laboratory includes discussion of current research and exercises in cellular physiology. Prerequisites: BIO 2450 with a grade of "C" or higher; one semester of organic chemistry. (WI)
- 4442 Experimental Techniques. (3-3) Use of methods and instruments applicable to biological investigations, including colorimetry; UV-spectrophotometry; fluorescence; flame and atomic absorption spectrophotometry; paper, gas, gel filtration and ion exchange chromatography; radioactive counting; and electrophoresis. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4445 Pathogenic Microbiology. (3-4) Pathogenic bacteria and their relationship to disease, emphasizing identification of selected groups of pathogens, epidemiology and the biological basis for resistance. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. (WI)
- 4446 Microbial Ecology. (3-4) This course will illustrate the wide variety of bacteria in nature, their interactions with other organisms and the environments, and their roles in global cycling of elements such as carbon, nitrogen, and sulfur. The laboratories will feature enrichments for selected groups of microorganisms (sulfate reducers, nitrogen fixers) and analysis of these isolates by microscopy, gas chromatography and radiochemical substrate utilizations. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. (WI)
- 4447 Microbial Physiology and Genetics. (3-3) This course will cover fundamental concepts in bacterial physiology and genetics, including central and specialized metabolism, and unique aspects of bacterial genetics. Prerequisites: BIO 2400, 2450; CHEM 2142, 2342 with a grade of "C" or higher. (WI)
- 4450 Physiological Ecology of Animals. (3-3) This course brings together the principal concepts of environmental physiology of animals inhabiting the major ecological realms of the earth (land, air, sea, and fresh water). The biological problems associated with living in the various ecological realms will be discussed, and the biochemical and physiological adaptations of animals to their diverse habitats will be studied. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4454 Plant Ecology. (3-3) Physiological ecology and community structure and function in the organization of terrestrial plant ecosystems. Quantitative vegetational sampling and the use of field and laboratory physiological equipment are included in the laboratory. This course or BIO 4416 is required of all Biology majors. Prerequisite: BIO 2450 with a grade of "C" or higher. (WI)
- 4464 Vertebrate Anatomy. (3-3) This course is a comparative study of vertebrate anatomy. Fossil histories are evaluated to understand how vertebrate radiation occurred in the geological past, along with changes in structure of organs and organ systems. Lab includes dissection of representative members of each major vertebrate group. Prerequisite: BIO 2450. (MC) (WI)
- 4465 General Entomology. (3-3) Principles of morphology, physiology and taxonomy of insects. Laboratory time will be devoted to a taxonomic study of the common orders and families of insects. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4470 Limnology. (3-3) The physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnological sampling methods, chemical, and biological analysis of samples and hydrographic surveying are included in the laboratory. Prerequisites: BIO 2450 with a grade of "C" or higher; one year of chemistry. (WI)
- 4472 Animal Behavior. (3-3) This course presents all the major facets of the study of animal behavior, giving special attention

to its evolution and ecological significance. We will discuss major conceptual models guiding past and present research in the field. Laboratories will emphasize experimental techniques and statistical analysis. Prerequisites: BIO 2450; BIO 2400, 2410, or 2411 with a grade of "C" or higher. (WI)

- 4480 Cytology and Microtechnique. (3-3) A study of cellular structure and microscopic technique. The lecture portion of the course presents cytology of all cell types and theoretical aspects of microscopy including light and electron-based technologies. The laboratory portion of the course provides training in standard light and electron microscopy, laser scanning confocal microscopy, and digital microscopy. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4481 Internship in Biological Laboratory Technologies. (0-15) The student will participate in the work of a selected biology unit (private, commercial, or governmental). A research paper, reporting the internship experience conducted at the biological unit under the supervision of a faculty member, will be required. This course may be credited toward a biology major with prior approval of the Biology Department advisor and chair. Prerequisite: BIO 2450 with a grade of "C" or higher.

Courses in General Science (GS)

- 3310 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of chemistry and earth space science. Non-creditable for science majors. A required course for Elementary EC-4 Generalist certification, grades 4-8 Science certification, and grades 4-8 Mathematics/Science certification. Prerequisites: PHYS 1310, 1320, and 1110 or PHYS 1315/1115 or 1410, PHYS 1325/1125 or 1420 completed with a grade of "C" or higher. (MP)
- 3320 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of biological science. Non-creditable for science majors. A required course for Elementary EC-4 Generalist certification, grades 4-8 Science certification, grades 4-8 Mathematics/Science certification. Prerequisite: BIO 1320, 1421, BIO 1330/1130 or 1430, or BIO 1331/1131 or 1431 completed with a grade of "C" or higher.

Department of Chemistry and Biochemistry

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DEGREE PROGRAMS OFFERED

- Bachelor of Science (BS), major in Biochemistry
Bachelor of Science (BS)/ Master of Science (MS), major in Biochemistry
Bachelor of Science (BS), major in Chemistry
Bachelor of Science (BS), major in Chemistry (Chemistry Teacher Certification)
Bachelor of Science (BS), major in Chemistry (Physical Science Teacher Certification)
Bachelor of Science (BS)/ Master of Science (MS), major in Chemistry

MINORS OFFERED

- Biochemistry
Chemistry

Chemistry is the central science and the study of chemistry provides the essential knowledge needed to address many of society's most pressing needs, such as feeding, clothing, and housing the peoples of the world; tapping new sources of energy; improving health and conquering disease; providing renewable substitutes for dwindling resources; strengthening our national security; and monitoring and protecting our environment. Basic research in chemistry will help future generations address their evolving needs and ensure a higher quality of life.

Chemists and biochemists can work in almost any field and find careers in teaching, research, production, quality control, technical services, and/or sales. Graduates from the Department of Chemistry and Biochemistry have an excellent record of job placement in industrial, academic, and government positions. Many also seek advanced degrees or pursue careers in medicine, dentistry, or pharmacy.

Chemistry and biochemistry majors gain skills in quantitative thinking and problem solving. Majors can work as laboratory instructors for lower division courses or as research assistants in faculty research laboratories. Students often participate in internships and research programs both on and off campus during the summer. The faculty, facilities, library holdings, and chemistry curriculum of the Department of Chemistry and Biochemistry have been accredited by the American Chemical Society. Recipients of a BS in Chemistry or BS in Biochemistry, who have fulfilled the minimum requirements for professional chemists, are awarded certificates by the American Chemical Society. Receipt of the ACS certificate is recommended as preparatory training for work in industry or for continued graduate studies in chemistry or biochemistry.

Students seeking a BS in Chemistry begin their studies taking foundation courses in chemistry, physics and mathematics. After

completion of the foundation courses, students take advanced courses and laboratories in physical chemistry, analytical chemistry, inorganic chemistry and organic chemistry. A minor is required for this degree.

Students seeking a BS in Biochemistry begin their studies taking foundation courses in chemistry, biology, physics and mathematics. After completion of the foundation courses, students take advanced courses and laboratories to gain knowledge and experience in the modern techniques of biochemistry and molecular genetics. The Biochemistry curriculum meets the standards set by the American Society for Biochemistry and Molecular Biology. A minor is required for this degree.

Qualified chemistry or biochemistry majors completing their junior year of chemistry courses who plan to pursue advanced studies have the opportunity to complete both a BS and MS degrees with one additional year of course work and research after receipt of a BS degree. Students must be active in undergraduate research prior to their senior year to be eligible for the program.

Pharmacy

Pharmacy is a six-year program, two years of which may be taken at Texas State. The six pharmacy schools in Texas (The University of Texas at Austin, University of Houston, Texas Southern University, Texas A&M Health Science Center, Texas Tech University Health Science Center, and University of the Incarnate Word) all require

two years of prerequisite courses in chemistry, biology, math, physics, English, humanities and social sciences, but the exact courses required vary by school. Consequently, it is imperative that pre-pharmacy students consult with an advisor prior to and during their pre-pharmacy program. For more information contact the Department of Chemistry and Biochemistry pre-pharmacy advisor.

Teacher Certification

Students may earn either a Chemistry or Physical Science (Texas Grades 8-12) certification in Texas Grades 8-12 while pursuing a BS in Chemistry. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student. Students interested in certification are strongly encouraged to see the Science Advisor early in their undergraduate program or certification process.

Students who are seeking teacher certification within their major and are not in the College of Science and Engineering may add a second teaching field in Chemistry or Physical Science (Texas Grades 8-12). The requirements for Chemistry are: CHEM 1341/1141, 1342/1142, 2341/2141, 2342/2142, 3410, 4295, and 4375. The requirements for Physical Science are: CHEM 1141, 1341, 1142, 1342, 2141, 2341, 2142, 2342, 3410, 3 hours of advanced CHEM; PHYS 1430, 2425, 2435, 3312, 4295, 6 hours of advanced PHYS.

Bachelor of Science (BS) Major in Biochemistry Minimum required: 120 semester hours							
General Information:							
1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.							
2. See the Academic Services section of this catalog for general education core curriculum requirements.							
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.							
4. One semester of CHEM 4299 is highly recommended and required for the optional certification of the degree as approved by the American Chemical Society.							
5. Minor and electives should be chosen in consultation with the departmental or academic advisor. Recommended minor is biology.							
Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
BIO 1130/1330 or 1430	4	BIO 1131/1331 or 1431	4	MATH 2472	4	BIO 2450	4
US 1100	1	MATH 2471	4	PHYS 1430	4	PHYS 2425	4
ENG 1310	3	ENG 1320	3	ENG Literature (see gen. req. 5)	3	COMM 1310	3
PHIL 1305 or 1320	3					PFW one course	1
Total	15	Total	15	Total	15	Total	16
Junior Year - 1st Semester		Junior Year - 2nd Semester		Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3341	3	CHEM 3390	3	CHEM 4360	3	CHEM 4385	3
CHEM 3375	3	CHEM 3380	3	CHEM 4481	4	CHEM 4282	2
BIO 2400	4	CHEM 3275	2	Minor Advanced Elective (see gen. req. 1 & 5)	3	Minor Advanced Elective (see gen. req. 1 & 5)	4
HIST 1310	3	HIST 1320	3	Minor Advanced Elective (see gen. req. 1 & 5)	3	req. 1 & 5)	4
POSI 2310	3	POSI 2320	3	Social Science Component (see gen. req. 2)	3	ART, DAN, MU, or TH 2313	3
		PFW one course	1				
Total	16	Total	15	Total	16	Total	12

Bachelor of Science and Master of Science (BS/MS)

Major in Biochemistry

(Early-Entry Combined program)

Minimum required: 154 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required for the BS degree. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, **then no additional language hours will be required for the degree.** In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. Students should consult a departmental or academic advisor before selecting an undergraduate minor. A minor in biology is recommended.
5. Students completing 124 semester hours will be eligible for graduation with a BS degree. The MS degree will be awarded only after the completion of all required courses and the successful defense of a research thesis.
6. The graduate-level courses taken in the senior year are CHEM 5110, 5395, 5399A, and a 3-hour elective approved by the graduate advisor. After admission to the Graduate College, 20 additional graduate hours (including a research thesis) and successful completion of a comprehensive examination is required for the MS degree.
7. Students may be admitted to the MS program without entrance qualification exams if they have a 3.00 GPA or higher in all chemistry and biochemistry courses, have completed CHEM 3275, 3380, and two semesters of CHEM 4299, have taken the Graduate Record Exam, and have been accepted by a graduate thesis advisor. Applicants will be evaluated by the Graduate Evaluation Committee to determine their suitability to enter the program. The application process is the same as for other graduate applicants to the Graduate College. Graduate status is provisional until the BS degree is awarded. The BS degree will be certified as approved by the American Chemical Society.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
BIO 1130/1330 or 1430	4	BIO 1131/1331 or 1431	4	MATH 2472	4	BIO 2450	4
US 1100	1	MATH 2471	4	PHYS 1430	4	PHYS 2425	4
ENG 1310	3	ENG 1320	3	ENG Literature (see gen. req. 2)	3	COMM 1310	3
PHIL 1305 or 1320	3					PFW one course	1
Total	15	Total	15	Total	15	Total	16

Junior Year - 1st Semester		Junior Year - 2nd Semester		Junior Year - Summer I		Junior Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3341	3	CHEM 3390	3	HIST 1310	3	HIST 1320	3
CHEM 3375	3	CHEM 3380	3	POSI 2310	3	POSI 2320	3
CHEM 4299	2	CHEM 3275	2				
BIO 2400	4	CHEM 4299	2				
Minor Advanced Elective (see gen. req. 1 & 4)	4	Minor Advanced Elective (see gen. req. 1 & 4)	3				
		PFW one course	1				
Total	16	Total	14	Total	6	Total	6

Senior Year - 1st Semester		Senior Year - 2nd Semester		Fifth Year - 1st Semester		Fifth Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 4360	3	CHEM 4385	3	CHEM 5110	1	CHEM 5110	1
CHEM 4481	4	CHEM 4282	2	Graduate level CHEM Electives	6	Graduate level CHEM electives	6
Minor Advanced Elective (see gen. req. 1 & 4)	3	ART, DAN, MU, or TH 2313	3	CHEM 5370	3	CHEM 5399B	3
CHEM 5110	1	CHEM 5399A	3				
CHEM 5395	3	Graduate level CHEM Elective	3				
Social Science Component (see gen. req. 2)	3						
Total	17	Total	14	Total	10	Total	10

**Bachelor of Science (BS)
Major in Chemistry
Minimum required: 120 semester hours**

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. CHEM 4299 must be taken twice for credit and is required for certification of the degree as approved by the American Chemical Society.
5. Students should consult a departmental or academic advisor before selecting a minor.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
US 1100	1	ENG 1320	3	MATH 2472	4	PHYS 2425	4
COMM 1310	3	HIST 1310	3	PHYS 1430	4	ART, DAN, MU, or TH 2313	3
ENG 1310	3	MATH 2471	4	ENG Literature (see gen. req. 2)	3	PHIL 1305 or 1320	3
POSI 2310	3	PFW one course	1			Electives (see gen. req. 1 & 5)	3
PFW one course	1						
Total	15	Total	15	Total	15	Total	17

Junior Year - 1st Semester		Junior Year - 2nd Semester		Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3330	3	CHEM 3340	3	CHEM 3341	3	CHEM 4341	3
CHEM 3410	4	CHEM 3245	2	CHEM 4331	3	CHEM 4241	2
HIST 1320	3	POSI 2320	3	CHEM 4231	2	CHEM Advanced Elective (see gen. req. 4)	3-4
Elective (see gen. req. 1 & 5)	3	Social Science Component (see gen. req. 2)	3	CHEM 4375	3	Electives (see gen. req. 1 & 5)	3
Minor Advance Elective (see gen. req. 1 & 5)	3	Minor Advance Elective (see gen. req. 1 & 5)	3	Minor Advanced Elective (see gen. req. 1 & 5)	3	Electives (see gen. req. 1 & 5)	2-3
Total	16	Total	14	Total	14	Total	14

**Bachelor of Science (BS)
Major in Chemistry
(Chemistry Teacher Certification)
Minimum required: 120 semester hours**

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. CHEM 4299 must be taken twice for credit and is required for certification of the degree as approved by the American Chemical Society.
5. A minor in Secondary Education is required.
6. Minor and electives should be chosen in consultation with the departmental or academic advisor.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Freshman Year - Summer I		Freshman Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
MATH 2471	4	MATH 2472	4				
US 1100	1	PHYS 1430	4				
ENG 1310	3	ENG 1320	3				
PHIL 1305 or 1320	3						
Total	15	Total	15	Total	4	Total	4

Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester		Sophomore Year - Summer I		Sophomore Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3330	3	CHEM 3340	3	HIST 1310	3	HIST 1320	3
CHEM 3410	4	CHEM 3245	2	POSI 2310	3	POSI 2320	3
PHYS 2425	4	ART, DAN, MU, or TH 2313	3				
ENG Literature (see gen. req. 2)	3	COMM 1310	3				
		PFW one course	1				
Total	14	Total	12	Total	6	Total	6

Junior Year - 1st Semester		Junior Year - 2nd Semester		Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3341	3	CI 4332	3	Social Science Component (see gen. req. 2)	3	EDST 4681	6
CHEM 4331	3	CHEM 4341	3	CI 4370	3		
CHEM 4231	2	CHEM 4241	2	CI 4343	3		
CHEM 4375	3	CI 3325	3	RDG 3323	3		
CHEM 4295	2	Electives (see gen. req. 1, 3, & 6)	1	PFW one course	1		
Total	13	Total	12	Total	13	Total	6

Bachelor of Science (BS)
Major in Chemistry
(Physical Science Teacher Certification)
Minimum required: 133 semester hours

General Information:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. CHEM 4299 must be taken twice for credit and is required for certification of the degree as approved by the American Chemical Society.
5. A double minor in Secondary Education and Physics is required.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Freshman Year - Summer I		Freshman Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
MATH 2471	4	MATH 2472	4				
US 1100	1	PHYS 1430	4				
ENG 1310	3	ENG 1320	3				
PHIL 1305 or 1320	3						
Total	15	Total	15	Total	4	Total	4

Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester		Sophomore Year - Summer I		Sophomore Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3330	3	CHEM 3340	3	HIST 1310	3	HIST 1320	3
CHEM 3410	4	CHEM 3245	2	POSI 2310	3	POSI 2320	3
PHYS 2425	4	PHYS 2435	4				
ART, DAN, MU, or TH 2313	3	Social Science Component (see gen. req. 2)	3				
		COMM 1310	3				
Total	14	Total	15	Total	6	Total	6

Junior Year - 1st Semester		Junior Year - 2nd Semester		Junior Year - Summer I		Senior Year - 1st Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3341	3	CHEM 4341	3	ENG Literature (see gen. req. 2)	3	CHEM 4295	2
CHEM 4331	3	CHEM 4241	2	CHEM 4375	3	CI 4370	3
CHEM 4231	2	CI 3325	3			CI 4343	3
CI 4332	3	PHYS 3411	4			RDG 3323	3
PHYS 3312	3	PHYS 4320 or 4321	3			PFW one course	1
PFW one course	1						
Total	15	Total	15	Total	6	Total	12

Senior Year - 2nd Semester	
Course	Hr
EDST 4681	6
Total	6

Bachelor of Science and Master of Science (BS/MS)

Major in Chemistry

(Early-Entry Combined program)

Minimum required: 150 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required for the BS degree. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, **then no additional language hours will be required for the degree.** In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. The graduate-level courses taken in the senior year are CHEM 5110, 5395, 5399A, and a 3-hour elective approved by the graduate advisor. After admission to the Graduate College, 20 additional graduate hours (including a research thesis) and successful completion of a comprehensive examination is required for the MS degree.
5. Students should consult a departmental or academic advisor before selecting an undergraduate minor or electives.
6. Students completing 120 semester hours will be eligible for graduation with a BS degree. The MS degree will be awarded only after the completion of all required courses and the successful defense of a research thesis.
7. Students may be admitted to the MS program without entrance qualification exams if they have a 3.00 GPA or higher in all CHEM courses, have completed two semesters of CHEM 4299, have taken the Graduate Record Exam, and have been accepted by a graduate thesis advisor. Applicants will be evaluated by the Graduate Evaluation Committee to determine their suitability to enter the program. The application process is the same as for other graduate applicants to the Graduate College. Graduate status is provisional until the BS degree is awarded. The BS degree will be certified as approved by the American Chemical Society.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
US 1100	1	MATH 2471	4	MATH 2472	4	PHYS 2425	4
ENG 1310	3	ENG 1320	3	PHYS 1430	4	ART, DAN, MU, or TH 2313	3
POSI 2310	3	HIST 1310	3	ENG Literature (see gen. req. 2)	3	COMM 1310	3
PHIL 1305 or 1320	3	PFW one course	1			Electives (see gen. req. 1 & 3)	2
PFW one course	1						
Total	15	Total	15	Total	15	Total	16

Junior Year - 1st Semester		Junior Year - 2nd Semester		Junior Year - Summer I		Junior Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3330	3	CHEM 3340	3	HIST 1320	3	POSI 2320	3
CHEM 3410	4	CHEM 3245	2	Electives (see gen. req. 1 & 3)	3	Electives (see gen. req. 1 & 3)	3
CHEM 4299	2	CHEM 4299	2				
Electives (see gen. req. 1 & 3)	3	Social Science Component (see gen. req. 2)	3				
Minor Advanced Elective (see gen. req. 1 & 5)	3	Minor Advanced Elective (see gen. req. 1 & 5)	3				
Total	15	Total	13	Total	6	Total	6

Senior Year - 1st Semester		Senior Year - 2nd Semester		Fifth Year - 1st Semester		Fifth Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
CHEM 3341	3	CHEM 4341	3	CHEM 5110	1	CHEM 5110	1
CHEM 4331	3	CHEM 4241	2	Graduate level CHEM Electives	6	Graduate level CHEM Electives	6
CHEM 4231	2	CHEM 5399A	3	CHEM 5370	3	CHEM 5399B	3
CHEM 4375	3	Graduate level CHEM Elective	3				
CHEM 5110	1	Minor Advanced Elective	3				
CHEM 5395	3						
Total	15	Total	14	Total	10	Total	10

Minor in Chemistry

A minor in Chemistry requires CHEM 1141 and 1341, 1142 and 1342, 2141 and 2341, 2142 and 2342, 3410, and one advanced course with a minimum of 3 advanced hours, not to include CHEM 4299.

Minor in Biochemistry

A minor in Biochemistry requires CHEM 1141 and 1341, 1142 and 1342, 2141 and 2341, 2142 and 2342, 3276, either 3375 or 4375, and either 4360 or 4385.

Courses in Chemistry (CHEM)

- 1141 (CHEM 1111) General Chemistry Laboratory I. (0-3) First of two laboratory courses in general chemistry for science-related majors. Course introduces the students to the basics of experimental measurements, including density, separation techniques, formula determinations, titrations, thermodynamics, gas laws, and descriptive chemistry. Prerequisite or Co-requisite: CHEM 1341 or CHEM 1310.
- 1142 (CHEM 1112) General Chemistry Laboratory II. (0-3) Second of two laboratory courses in general chemistry. Laboratory techniques are emphasized, and applied to both qualitative and quantitative analysis. Prerequisites: CHEM 1341, 1141. Prerequisite or Co-requisite: CHEM 1342.
- 1310 (CHEM 1305) Introductory Chemistry for Non-Science Majors. (3-0) A one semester principles courses for students in non-science related majors. Course covers the major concepts of chemistry and the role of chemistry in contemporary society. Students will not receive credit for both CHEM 1310 and CHEM 1341. Must be followed by CHEM 1430 for general education credit.
- 1341 (CHEM 1311) General Chemistry I. (3-0) Initial lecture course in general chemistry for science-related majors, covering atomic and molecular structure, bonding, states of matter, solutions, and descriptive chemistry. Students will not receive credit for both CHEM 1310 and CHEM 1341. Concurrent registration in CHEM 1141 is recommended. Prerequisite: Mathematics ACT score of at least 24 (SAT re-centered 520) or MATH 1315 with a grade of "C" or higher.
- 1342 (CHEM 1312) General Chemistry II. (3-0) Second of two lecture courses in general chemistry for science-related majors, covering equilibrium processes, acid-base chemistry, and kinetics, and electrochemistry. A basic knowledge of algebra is needed. Concurrent enrollment in CHEM 1142 is recommended. Prerequisite: CHEM 1341 with a grade of "C" or higher.
- 1430 (CHEM 1407) Chemistry for Non-Science Majors. (3-3) A one semester course which surveys organic and biochemistry and may include petro-chemistry, nuclear chemistry, synthetic and natural polymers. Prerequisite: CHEM 1310 or 1341.
- 2130 Laboratory Technique in Organic Chemistry. (0-3) An optional laboratory to accompany CHEM 2330, covers experimental techniques of preparation, purification, and determination of physical and chemical properties of organic compounds. Prerequisites: CHEM 1342/1142. Co-requisite: CHEM 2330.
- 2141 (CHEM 2123) Organic Chemistry Laboratory I. (0-3) This laboratory introduces the student to the general techniques of organic chemistry. Prerequisites: CHEM 1342 with a grade of "C" or higher, CHEM 1142. Prerequisite or Co-requisite: CHEM 2341.
- 2142 (CHEM 2125) Organic Chemistry Laboratory II. (0-3) This laboratory involves the study of typical organic reactions. Prerequisites: CHEM 2341 with a grade of "C" or higher, CHEM 2141. Prerequisite or Co-requisite: CHEM 2342.
- 2150 Biochemistry & Metabolism Lab. (0-3) An optional laboratory to accompany CHEM 2350. This laboratory examines the physical properties and chemistry of carbohydrates, amino acids, proteins, lipids and nucleotides. Course is designed for students majoring in nutrition, clinical laboratory science and agriculture. Prerequisites: CHEM 2330/2130 or 2342/2142. Co-requisite: CHEM 2350.
- 2330 Fundamentals of Organic Chemistry. (3-0) A one-semester course which covers nomenclature, structure and reactions of organic compounds with an introduction to bioorganic molecules. Course is designed for students majoring in nutrition, clinical laboratory sciences and agriculture. Prerequisites: CHEM 1342/1142.
- 2341 (CHEM 2323) Organic Chemistry I. (3-0) This course covers the nomenclature, reactions and reaction mechanisms of the hydrocarbons and the alkyl halides. Prerequisites: CHEM 1342 with a grade of "C" or higher. Pre- or Co-requisite: CHEM 1142.
- 2342 (CHEM 2325) Organic Chemistry II. (3-0) This course covers the nomenclature, reactions and reaction mechanisms of the major functional groups. Prerequisite: CHEM 2341 with a grade of "C" or higher. Prerequisite or Co-requisite: CHEM 2141.
- 2350 Biochemistry & Metabolism. (3-0) A one-semester study of carbohydrate, proteins, lipids and nucleotides which presents both structure and intermediary metabolism along with an introduction to the function of enzymes and coenzymes. Course is designed for students majoring in nutrition, clinical laboratory science and agriculture. Prerequisites: CHEM 2330/2130 or CHEM 2342/2142.
- 3245 Physical Chemistry Laboratory. (1-4) Experiments illustrating principles and methods of physical chemistry are performed. Written reports on the experiments are prepared. Prerequisites: CHEM 3330 with a "C" or better and 3410. Prerequisite or Co-requisite: CHEM 3340. (WI)
- 3275 Biochemical Techniques. (1-4) [Course introduces biochemistry majors to the fundamental techniques used in analytical and physical biochemistry. Weekly experiments will reinforce concepts presented in pre- and co-requisite courses and utilize modern instrumentation. Experimental design, interpretation of results, analysis, and reporting of experimental data will be emphasized.](#) Prerequisite: CHEM 3375 with a grade of "C" or higher. Co-requisite: CHEM 3380. (WI)
- 3276 Experimental Biochemistry. (1-4) Course introduces biochemistry minors to the fundamental techniques used in modern biochemistry. Experiments use the essential techniques employed in the study of proteins, enzymes and nucleic acids with emphasis on the use of modern instrumentation and the manipulation and analysis of experimental data. Prerequisites: CHEM 3375 or 4375 with a grade of "C" or higher.
- 3330 Physical Chemistry I. (3-0) The course covers principles of

- thermodynamics and thermochemistry, phase equilibria, electrochemistry and elementary kinetics including rate laws and mechanisms. Prerequisites: CHEM 1142; CHEM 1342 and MATH 2472 with a grade of "C" or higher.
- 3340 Physical Chemistry II. (4-0) The course covers kinetics, quantum mechanics, spectroscopy, and other selected topics. Prerequisites: CHEM 3330 with a "C" or better; MATH 2472 with a "C" or better; and PHYS 2425 with a "C" or better.
- 3341 Descriptive Inorganic Chemistry. (3-0) An analysis of atomic, molecular, and solid state bonding and structure with an emphasis on coordination compounds and bioinorganic chemistry. Representative compounds and reactions of the elements will be surveyed. Prerequisite: CHEM 2342 with a grade of "C" or higher.
- 3375 Principles of Biochemistry. (3-0) Course provides biochemistry majors and minors with a rigorous introduction to biochemistry. Topics include the chemical function and structure of proteins, nucleic acids, lipids and carbohydrates; enzyme mechanisms, kinetics and regulation. Students may not receive credit for both CHEM 3375 and CHEM 4375. Prerequisites CHEM 2342 with a grade of "C" or higher.
- 3380 Analytical Biochemistry. (3-0) This course is designed to acquaint the student with the chemical and physical principles of modern biochemical methods. Emphasis is placed upon the application of the methods to current problems in biochemistry and molecular biology and the interpretation of data. Prerequisite: CHEM 3375 with a grade of "C" or higher.
- 3390 Physical Chemistry for Biochemists. (3-0) A study of the theories and laws of physical chemistry as it relates to biochemistry. The topics covered include ideal and real gases, classical thermodynamics, reaction kinetics, phase equilibria, electrochemistry, quantum mechanics, spectroscopy and statistical mechanics. Prerequisite: CHEM 3375 and MATH 2472 with a "C" or better.
- 3410 Quantitative Analysis. (3-6) Course covers the general theory and practice of typical methods of gravimetric and volumetric analysis, satisfies the quantitative analysis requirements for chemistry majors, minors, pre-medical and pharmacy students. Prerequisites: CHEM 1342 with a grade of "C" or higher, CHEM 1142.
- 4231 Advanced Laboratory I. (2-4) An advanced integrated lab illustrating a variety of chemical techniques for the preparation, characterization and analysis of organic and inorganic materials. Prerequisites: CHEM 3245, 3340, 3410. Prerequisite or Co-requisite: CHEM 4331. (WI)
- 4241 Advanced Laboratory II. (2-4) An advanced integrated lab illustrating a variety of chemical techniques for the preparation, characterization and analysis of inorganic and organic materials. Prerequisites: CHEM 4331, 4231. Prerequisite or Co-requisite: CHEM 4341. (WI)
- 4282 Advanced Biochemistry Research Laboratory. (2-4) The second of two laboratory courses providing instruction in the modern techniques of biochemistry. Students will perform independent research projects involving isolation, manipulation and characterization of biomolecules. Results of these experiments and the scientific literature investigations will be used to prepare formal written reports and oral presentations. Prerequisite: CHEM 4481.
- 4295 Laboratory Development and Practice. (1-2) This course develops the laboratory instructional abilities of students seeking either 8-12 Chemistry or 8-12 Physical Science Teaching Certification. Topics include both traditional laboratory techniques and guided inquiry techniques, safety, laboratory management, pedagogical theory and practical knowledge of laboratory experiments. Prerequisite: Junior standing and an overall GPA of 2.5 or higher.
- 4299 Undergraduate Research. (0-4) This course is available to undergraduate chemistry or biochemistry majors only. It may be repeated for credit but a maximum of four semester hours are applicable toward advanced chemistry electives. Prerequisite: Permission of department.
- 4331 Instrumental Analysis. (3-0) The theory and methodology associated with the quantitative analysis of materials, i.e., electronics, spectroscopy, electrochemistry and chromatography are presented. Prerequisite: CHEM 3340.
- 4333 Spectroscopy. (3-0) The study of various spectrometric techniques in qualitative and structural analysis of chemical substances. Prerequisite: CHEM 2342 with a grade of "C" or higher.
- 4341 Advanced Inorganic Chemistry. (3-0) Chemical bonding, coordination chemistry compounds, acid-base concepts, and other topics are included along with some descriptive chemistry. Prerequisite: CHEM 3341.
- 4350 Modern Molecular Modeling. (3-0) A study of the application of computational techniques to molecular modeling. Topics covered include quantum mechanical modeling, forcefield based molecular modeling, molecular energy minimization, molecular dynamics, vibrational spectra, solution of crystalline structures, diffraction patterns, molecular blends, phase equilibria, crystal morphology, physical property prediction and mesoscale modeling. Prerequisite: CHEM 3340.
- 4351 Introduction to Polymers. (3-0) This course is designed to develop the student's general understanding of polymer history and importance as well as terminology, structure, and synthesis. The overall scope of the course will be to develop the student's general knowledge of polymer synthesis and structure. Prerequisite: CHEM 2342 with a grade of "C" or higher.
- 4360 Advanced Biochemistry and Molecular Biology. (3-0) This course provides Biochemistry majors and minors with advanced knowledge of the field of molecular biochemistry. Topics include gene expression (transcription and translation of genes in bacteria and higher organisms), post-translational modification of proteins, chromosomal DNA replication, cell cycle checkpoint controls, DNA damage and repair, as well as theories of cancer and aging. Prerequisite: CHEM 3375 or 4375. (WI)
- 4371 Directed Study. (3-0) Independent study on a particular subject area in chemistry or biochemistry. The specific study area, resource material, goals, and achievements will be approved by the instructor. May be repeated once for additional credit. Prerequisites: CHEM 2342 with a C or better and permission of department.
- 4375 Biochemistry. (3-0) Course provides Chemistry majors and minors with an overview of biochemistry topics. Topics include a description of the structure and function of proteins, enzymes, nucleic acids, lipids and carbohydrates.