**397, 398 Topics**
This course will examine in detail a small focused set of questions arising from one or more areas of the interdisciplinary program in Catholic Studies. Topics will vary from year to year but will not duplicate existing courses. The selection in any given semester will depend upon the interest of the students and instructors and on the availability of community resources (for example, guest lecturers). Some examples of subject matter include: Is Christian tragedy possible? Does Catholic belief conflict with the findings of modern science? What is the relationship of Catholicism to various economic systems? The odd number is used if the course fulfills a core curriculum requirement.

**483, 484 Seminar** **2 credits**
**485, 486 Seminar**
See the description of these courses at the beginning of the "Curricula" section of this catalog.

**487, 488 Topics** **2 credits**
**489, 490 Topics**
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available at www.stthomas.edu/registrar/onlineschedule.html.

**491, 492 Research** **2 credits**
**493, 494 Research**
See the description of these courses at the beginning of the "Curricula" section of this catalog.

**495, 496 Individual Study** **2 credits**
497, 498 Individual Study
See the description of these courses at the beginning of the "Curricula" section of this catalog.

## Chemistry (CHEM)

Boyd (chair), Bilek, Borgerding, Brom, Glorvigen, Hartshorn, Ippoliti, Mabbott, Marsh, Olson; Cain, Krueger, Ojala, Ovechka

The Department of Chemistry offers two degree programs in the field of chemistry: a Bachelor of Science (B.S.) degree and a Bachelor of Arts (B.A.) degree. The department is on the list of schools approved by the American Chemical Society (ACS) for the professional training of chemists, and the B.S. degree is certified by the American Chemical Society. The B.S. has either a chemistry or a biochemistry concentration option. This degree is recommended for students who plan to pursue graduate study in chemistry in preparation for college teaching or advanced research in academic, industrial or government laboratories.

The B.A. degree requires fewer chemistry courses and offers the possibility of completing a double major if students have a strong interest in another field. Both degrees offer some latitude in the selection of upper level courses, thus allowing the student some flexibility to pursue an interest in a particular area of chemistry. Students graduating with either the B.S. or the B.A. may also qualify for departmental honors.

Students graduating with a major in chemistry will have the necessary knowledge to prepare them for a career in chemistry or for graduate school, and the confidence and skill to succeed. They will have the ability to read, understand, write and speak with clarity and understanding in technical areas. They will constantly apply critical thinking to their readings in the technical literature. They will have developed good laboratory skills and be familiar with modern instrumentation and with the use of computers in technical fields. They will have developed the skills necessary to analyze their data and to draw conclusions from it.

Chemistry is an excellent major for students interested in biochemistry, food science, forensic science, medicine, medicinal chemistry, dentistry, pharmaceutical chemistry, pharmacology, pharmacy, patent law, polymer science, chemical engineering, environmental science, materials science and other interdisciplinary fields. The major is also suited to students with a complementary interest in other sciences, or in computers, education, economics or business.

Students interested in teacher licensure should consider the various combinations of science education in the Department of Teacher Education in this catalog.

The Departments of Chemistry and Biology jointly offer a B.S. degree in biochemistry. The curriculum for this degree may be found under "Interdisciplinary Programs" in this catalog.

All graduating senior majors are required to take an achievement test for purposes of assessment of the major and College accreditation.

In order to receive a degree in chemistry from the University of St. Thomas, transfer students must complete a minimum of sixteen credits in chemistry at the university in addition to the two-credit seminar sequence.

The department offers a number of courses for non-majors to fulfill the laboratory science component of the core curriculum.

**Graduation with Honors in Chemistry**
Students graduating with a B.A. or B.S. degree in chemistry may also qualify for departmental honors. Students interested in this designation must consult with the department chair one year (or more) prior to their graduation date. Requirements include:

1. a minimum cumulative GPA of 3.25 and a major field GPA of 3.50;
2. completion of four credits in research (CHEM 491-494); (participation in one summer of research in chemistry at St. Thomas may be applied in place of two credits; research must be completed at least one semester before graduation);
3. preparation of a written thesis in the format of the primary literature;
4. successful defense of the thesis before a panel composed of:
   thesis director (chair of committee)
   two additional UST chemistry faculty
   one UST faculty member outside the chemistry department
   one faculty member from another institution selected in consultation with the thesis adviser (while off-campus examiners are typically chemists, committee members from other disciplines such as biochemistry and physics may be employed when appropriate).
5. presentation of research at an off-campus meeting such as the Minnesota Section ACS Undergraduate Research Symposium, Minnesota Academy of Sciences, NCUR, regional ACS meeting, or national ACS meeting.
6. All requirements must be completed by April 20 for spring commencement, or similarly early enough to allow for notification of the registrar and academic dean.

### Major in Chemistry (B.S.) (ACS-certified)

111 General Chemistry I
*and*
112 General Chemistry II
*or*
115 Accelerated General Chemistry

*Plus:*
201 Organic Chemistry I
202 Organic Chemistry II
300 Quantitative Analysis
320 Instrumental Analysis
331 Chemical Thermodynamics and Reaction Dynamics
332 Quantum Chemistry and Molecular Spectroscopy
340 Organic Spectroscopy (2 credits)
400 Advanced Inorganic Chemistry
440 Biochemistry I
481-484 Student Seminar Sequence (2 credits total)
491 Research (2 credits) (or a summer research project sponsored by the department)

*Plus four credits from:*
250 Organometallic Chemistry (2 credits)
296 Topics (2 credits)
298 Topics
391, 392 Research (1 credit)
420 Bioanalytical and Forensic Chemistry (2 credits)
430 Polymer Chemistry (2 credits)
442 Biochemistry II*
488 Topics (2-credits)
491, 492 Research (2 credits)
493, 494 Research
*required for a B.S. in Chemistry with a biochemistry concentration, plus a research project in biochemistry

**Allied requirements**
MATH 113 Calculus I (or equivalent)
MATH 114 Calculus II
PHYS 111 Introduction to Classical Physics I
PHYS 112 Introduction to Classical Physics II

*Strongly recommended:*
MATH an additional course numbered 200 or above

**Course Sequence**
All chemistry majors are advised to take General Chemistry (CHEM 111-112 or CHEM 115) and MATH 113-114 (Calculus) during the freshman year, then CHEM 201-202 and PHYS 111-112 (Introductory Physics) during the sophomore year. (Note that PHYS 109-110 is not acceptable for the chemistry major). Other sequences of math and physics are much less desirable. If necessary, MATH 113 can be started in the second semester of freshman year; then MATH 114 can be taken concurrently with PHYS 111 during first semester sophomore year.

## Major in Biochemistry (B.S.)

*See College of Arts and Sciences Interdisciplinary Programs*

## Major in Chemistry (B.A.)

The minimum requirement for a major is 38 credits as specified below; 30 credits (including seminar) comprise the core.

111 General Chemistry I
*and*
112 General Chemistry II
*or*
115 Accelerated General Chemistry

*Plus:*
201 Organic Chemistry I
202 Organic Chemistry II
300 Quantitative Analysis
320 Instrumental Analysis
481-484 Seminar (2 credits total)

*Plus one of:*
331 Chemical Thermodynamics and Reaction Dynamics
332 Quantum Chemistry and Molecular Spectroscopy

*Plus at least eight credits in courses chosen from the following list:*
250 Organometallic Chemistry (2 credits)
331 Chemical Thermodynamics and Reaction Dynamics
340 Organic Spectroscopy (2 credits)
391, 392 Research (1 credit)
400 Advanced Inorganic Chemistry*
*Note:* 332 is a prerequisite for 400
420 Bioanalytical and Forensic Chemistry (2 credits)
430 Polymer Chemistry (2 credits)
440 Biochemistry I
442 Biochemistry II
491, 492 Research (2 credits)
493, 494 Research
*Note:* Only 4 credits of research may be applied to the degree.

**Allied requirements**
MATH 113-114 Calculus I and II*
PHYS 111-112 Introductory Physics I-II

*Students not placing into MATH 113 must take MATH 108, 109 and 114 in order to satisfy the overall calculus requirement.

*Note:* Math and physics requirements are as specified above plus MATH 200 and/or 201 are highly recommended. The ACS also requires familiarity with computer programming; although many chemistry courses make use of computers, the interested student is well-advised to take an additional course in quantitative methods and computer science.

## Teacher Licensure

Elementary Education with a Co-major in Science and Mathematics for Elementary Education
Elementary Education with a Specialty in Science (5-8)
Co-major in Science (5-8) – Chemistry (9-12) and a Co-major in Secondary Education
*See School of Education Department of Teacher Education*

## Minor in Chemistry

A minimum of 8 credits in chemistry must be successfully completed at St. Thomas to earn a minor in the field.

111 General Chemistry I
*and*
112 General Chemistry II
*or*
115 Accelerated General Chemistry

*Plus:*
201 Organic Chemistry I

*Plus sufficient credits from the following to yield a total of 24:*
*Note:* Some of these courses have prerequisites beyond the core, or require permission of the instructor.
202 Organic Chemistry II
250 Organometallic Chemistry (2 credits)

296 Topics (2 credits)
298 Topics
300 Quantitative Analysis
320 Instrumental Analysis
331 Chemical Thermodynamics and Reaction Dynamics
332 Quantum Chemistry and Molecular Spectroscopy
340 Organic Spectroscopy (2 credits)
420 Bioanalytical and Forensic Chemistry (2 credits)
430 Polymer Chemistry (2 credits)
440 Biochemistry I
442 Biochemistry II
491, 492 Research (2 credits)
493, 494 Research*

*A student may take four credits of research for the minor with the approval of the department chair. No special approval is needed for 491 or 492 (2 credits).

**100 Chemistry in Our World (111, 115)**
An introduction to chemistry and its applications to modern society and personal life. The course is intended for non-majors and satisfies a general requirement for one semester of a laboratory science course. The chemistry studied includes the structure of matter, elements and compounds, chemical bonding, reactions, energy changes and an introduction to organic chemistry. The emphasis in the course is the relevance of chemistry in everyday life, and the applications studied will include various topics such as environmental problems, energy resources, chemistry and health, and consumer chemistry. Lecture plus three laboratory hours per week.

**101 Environmental Chemistry**
An introduction to chemistry with particular emphasis on environmental science. Basic chemistry topics covered include the structure of matter, elements, compounds, reactions, energy and energy changes. These topics lead to studies of topical environmental problems and their proposed solutions, including the depletion of ozone in the stratosphere, the Greenhouse Effect and global warming, acid rain, smog, waste disposal, water pollution and the study of energy resources, both renewable and non-renewable. Lectures and laboratory. This course satisfies the lab science requirement in the core curriculum for non-majors.

**111 General Chemistry I (100, 115)**
This course and its sequence 112 provide a two-semester introduction to chemistry. Topics include atomic structure, molecular structure, chemical bonding, the periodic table, states of matter, reaction types, stoichiometry, thermochemistry, intermolecular forces, and properties of the common elements and their ions in aqueous solution. Lecture plus four laboratory hours per week.
Prerequisite: Math placement at 108 or above

**112 General Chemistry II (115)**
This course continues the study of chemistry begun in 111. Topics include thermodynamics, kinetics, equilibrium, acid-base chemistry, electrochemistry, and nuclear chemistry. Lecture plus four laboratory hours per week.
Prerequisite: A minimum grade of C- in 111

**115 Accelerated General Chemistry (100, 111, 112)**
A one semester general chemistry class that blends significant topics from CHEM 111 and 112 for very strong students interested in majoring in science or engineering. Approximately one-third of the course content is drawn from CHEM 111 with the balance coming from CHEM 112. Topics include atomic theory, stoichiometry, gas laws, phases of matter, atomic and molecular structure, bonding, kinetics, thermodynamics, equilibrium, electrochemistry, nuclear chemistry, and descriptive chemistry. Lecture plus four laboratory hours per week.
Prerequisite: Math placement at the 113 level, high school chemistry, and satisfactory performance on the chemistry placement examination.

**201 Organic Chemistry I**
Study of the various families of organic compounds. Emphasis is placed on structure determination, reaction mechanisms, stereochemistry and spectroscopy in addition to a survey of various reaction types. An introduction to biochemical topics is included. Lecture plus four laboratory hours per week.
Prerequisite: A minimum grade of C- in 112 or 115

**202 Organic Chemistry II**
Continuation of 201.
Prerequisite: A minimum grade of C- in 201

**250 Organometallic Chemistry** **2 credits**
A study of the structure, bonding, and reactions of compounds that contain direct metal-carbon bonds. Emphasis is placed on the role these compounds play as stoichiometric and catalytic reagents in organic and inorganic synthesis. Additional topics include electronic and structural theory, reaction mechanisms, and the role of

organometallics in biochemistry and material science.
Prerequisite: 201

**295, 296 Topics** **2 credits**
**297, 298 Topics**
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available at www.stthomas.edu/registrar/onlineschedule.html.

**300 Quantitative Analysis**
An introduction to quantitative chemical analysis. Topics include sample treatment, the statistical handling of data, equilibria governing acid/base relationships, complexation and redox reactions and the fundamentals underlying titrimetry, spectrophotometry, luminescence and potentiometric methods of analysis. Lecture plus four laboratory hours per week. This course fulfills the second-level Computer Competency requirement in the core curriculum.
Prerequisite: A minimum grade of C- in 112 or 115

**320 Instrumental Analysis**
Principles and techniques of operation of modern chemical instrumentation. Topics include the capabilities, limitations and data interpretation of HPLC, GC, capillary electrophoresis, voltammetry, and mass spectrometry. Fundamentals of signal processing, basic circuitry and optical components are also included. The laboratory consists of both structured exercises and a student designed project and report based on an analysis problem of interest to the student. Lecture plus four hours of lab each week.
Prerequisites: 202, 300

**331 Chemical Thermodynamics and Reaction Dynamics**
Physical chemical introduction to the fundamentals of kinetic-molecular theory, statistical thermodynamics, classical thermodynamics, and chemical reaction dynamics. Emphasis on the in-depth study of chemical reaction equilibria, phase equilibria, and chemical reaction kinetics in gaseous, liquid and solid systems. Laboratory work involves modern computational methods in physical chemistry, as well as physicochemical measurements related to thermodynamics and reaction dynamics. Lecture plus six laboratory hours per week. This course fulfills the second level Computer Competency requirement in the core curriculum.
Prerequisites: 202, MATH 114 and PHYS 111

**332 Quantum Chemistry and Molecular Spectroscopy**
Study of chemical systems from the point of view of molecular theory. Introduction to the fundamentals of quantum chemistry and atomic/molecular spectroscopy. Laboratory work involves computational methods in molecular quantum mechanics and spectroscopic measurements of atomic/molecular systems. Lecture plus six laboratory hours per week. This course fulfills the second level Computer Competency requirement in the core curriculum.
Prerequisites: 202, MATH 114 and PHYS 112

**340 Organic Spectroscopy** **2 credits**
A more detailed study of various spectroscopic methods, especially as they are employed to determine structures of organic molecules. Coverage includes H-1, F-19, and C-13 NMR, mass spectrometry, ultraviolet and visible and infrared spectroscopies.
Prerequisite: A minimum grade of C- in 202

**391 Research** **1 credit**
Work on a problem under the direction of the staff. Primarily literature work.
Prerequisite: Permission of the department chair

**392 Research** **1 credit**
Work on a problem under the direction of the staff. Primarily laboratory work.
Prerequisite: 391

**400 Advanced Inorganic Chemistry**
A study of the preparation, structure, bonding and reactions of inorganic compounds. Selected topics include group theory, periodicity, catalysis, bonding theories; main group, coordination, solid state and organometallic chemistry. Lecture plus four laboratory hours per week.
Prerequisites: 202 and 332 or permission of the instructor

**420 Bioanalytical and Forensic Chemistry** **2 credits**
The chemistry behind criminal investigations as well as some developments in analysis of biologically important molecules. Topics to be covered include enzyme and DNA analysis, the detection and identification of explosives and fire accelerants, methods of connecting the suspect to the scene of a crime (analysis of fingerprints, fibers, glass fragments, soil and gunshot residue), the analysis of drugs and poisons, and the detection of forgeries using ink, paint and materials analysis. The course is designed to have a lab component that uses both instrumental and "wet chemical" methods of analysis. The culminating examination is a mystery that the students will work

in teams to solve. It requires some lab work as well as a written report that interprets the information for the "district attorney's office." Offered in January term in even-numbered years.
Prerequisite: 201

**430 Polymer Chemistry** **2 credits**
An introduction to the science associated with polymers accomplished by discussing some of the fundamental aspects of polymer science and engineering. Three general subject areas will be addressed: 1) polymer synthesis and characterization, 2) polymer structure including melt, glassy, semicrystalline, rubbery, and solution states, and 3) selected physical properties (e.g. viscoelasticity, toughness, failure, permeability) and processing characteristics.
Prerequisite: 202

**440 Biochemistry I**
The chemistry of biological molecules. Emphasis on the structure, energetics, kinetics and mechanisms of biologically important molecules. Topics include: protein structure; enzyme kinetics, mechanisms and regulation; anabolic and catabolic pathways; structure, organization and regulation of nucleic acids; bioenergetics; protein synthesis; and student-chosen special topics. Laboratory integrated with lecture topics: protein isolation and characterization, enzyme kinetics, DNA isolation, cloning, and protein overexpression. Lecture plus four laboratory hours per week.
Prerequisite: A minimum grade of C- in 202

**442 Biochemistry II**
Continuation of Biochemistry I (440). Lecture plus four laboratory hours per week.
Prerequisite: A minimum grade of C- in 440

**475, 476 Experiential Learning** **2 credits**
**477, 478 Experiential Learning**
See the description of these courses at the beginning of the "Curricula" section of this catalog.

**481, 484 Student Seminar** **1 credit each**
**482, 483 Student Seminar** **0 credit**
This sequence of courses is begun first semester of the junior year and progresses for a total of four semesters. The first (481) and last (484) courses are each one credit and are graded on the usual letter grade scale. The interior two courses (482, 483) are no credit and are graded on a pass-fail basis (S/R). Throughout all four courses meetings are held with seminars given by guest speakers. UST faculty also present seminars on their own research. In 481, juniors are introduced to the chemical literature and search techniques including use of computer databases and write a short paper based on literature research. In 483, seniors meet in small groups with faculty and discuss articles from the chemical literature. In 484, seniors research a topic from the chemical literature and present it in both written and oral formats. Information about career opportunities for students holding a chemistry degree is presented throughout the seminar sequence. Required of all chemistry majors.

**487, 488 Topics** **2 credits**
**489, 490 Topics**
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available at www.stthomas.edu/registrar/onlineschedule.html.

**491, 492 Research** **2 credits**
**493, 494 Research**
See the description of these courses at the beginning of the "Curricula" section of this catalog.

**495, 496 Individual Study** **2 credits**
**497, 498 Individual Study**
See the description of these courses at the beginning of the "Curricula" section of this catalog.

## Communication Studies (COMM)

Armada (chair), Bruess, Cook, Cragan, Friedline, Petersen, K. Sauter, Scully

The Department of Communication Studies fosters in students an understanding of the nature of human communication by examining the processes by which people create, send, receive and are affected by symbolic messages.

This is done by exploring and analyzing verbal and nonverbal communication in a number of settings including political campaigns, small groups, work and volunteer organizations, personal and family relationships and intercultural situations. Students analyze communication through the study of rhetorical theory and social science methodology, both developing their skills as communicators, and understanding ways to investigate how the communication process works.

The department also emphasizes the production of electronically mediated communication, looking at how to communicate effectively using mediated communication, as well as the ways in which mediated communica-