

**971 Emerging Topics in Chemistry**  
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to doctoral students in the Chemistry or Chemical Physics major.

Discussion of a research topic of emerging interest in chemistry. Preparation of a proposal for funding of research.

**987 Selected Topics in Physical Chemistry I**  
Fall. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to doctoral students or approval of department.

Topics such as kinetics and photochemistry, macromolecular and surface chemistry, molecular spectroscopy, electric and magnetic properties of matter, or applications of statistical mechanics to chemical problems.

**988 Selected Topics in Physical Chemistry II**  
Spring. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to doctoral students or approval of department.

Topics such as analysis and interpretation of molecular spectra, advanced molecular structure theory, magnetic resonance, X-rays and crystal structure, scientific analysis of vacuum systems, or problems in statistical mechanics.

**991 Quantum Chemistry and Statistical Thermodynamics I**  
Fall. 3(3-0) R: Open only to graduate students in College of Natural Science or College of Engineering.

Principles and applications of quantum chemistry. Partition functions, spectroscopic measurements, and thermodynamic applications.

**992 Quantum Chemistry and Statistical Thermodynamics II**  
Spring. 3(3-0) P:NM: (CEM 991)

Analytical and numerical methods for solving quantum chemical problems. Statistical mechanics of solids and liquids.

**993 Advanced Topics in Quantum Chemistry**  
Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to graduate students in the College of Natural Science or the College of Engineering.

Spectroscopic theory, properties of atoms and molecules in electric and magnetic fields, intermolecular forces. Many-body theory, molecular electronic structure, solid state chemistry, or molecular reaction dynamics.

**994 Advanced Topics in Statistical Mechanics**

Spring of even years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to graduate students in the College of Natural Science or the College of Engineering.

Nonequilibrium statistical mechanics and thermodynamics. Correlation functions and spectroscopy, light scattering, magnetic relaxation, transport properties of fluids and gases, or statistical mechanics of chemical reactions.

**998 Physical Chemistry Seminar**

Fall, Spring. 1(1-0) A student may earn a maximum of 3 credits in all enrollments for this course. R: Open only to graduate students in Chemistry.

Advances in physical chemistry reported by graduate students.

**999 Doctoral Dissertation Research**  
Fall, Spring, Summer. 1 to 20 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to doctoral students in Chemistry and Chemical Physics.

Doctoral dissertation research.

## CHINESE

## CHS

### Department of Linguistics and Germanic, Slavic, Asian and African Languages College of Arts and Letters

**101 Elementary Chinese I**  
Fall. 5(5-0) Not open to students with credit in CHS 112.

Pronunciation, writing system, and basic vocabulary and sentence patterns, with emphasis on conversation.

**102 Elementary Chinese II**  
Spring. 5(5-0) P:M: (CHS 101) Not open to students with credit in CHS 105.

Further work on conversation, character writing, and comprehension, with increasing emphasis on vocabulary building and grammar.

**105 Introductory Chinese with Business Emphasis**  
Summer. 5(5-0) SA: CHS 111, CHS 112 Not open to students with credit in CHS 101.

Beginning-level speaking, listening comprehension, and reading for Chinese in business-related contexts. Economic conditions and business culture in China.

**201 Second-Year Chinese I**  
Fall. 5(5-1) P:M: (CHS 102) R: Approval of department.

Intermediate-level work on skills in conversation, comprehension, and grammar. Practice in composition.

**202 Second-Year Chinese II**  
Spring. 5(5-0) P:M: (CHS 201) R: Approval of department.

Further intermediate-level work on skills in conversation, comprehension, and grammar. Continued practice in composition.

**301 Third-Year Chinese I**  
Fall. 4(4-0) P:M: (CHS 202)

Advanced-level work on speaking, listening comprehension, reading, and writing skills, based on materials of cultural interest.

**302 Third-Year Chinese II**  
Spring. 4(4-0) P:M: (CHS 301)

Advanced-level work on speaking, listening comprehension, reading, and writing skills, based on materials of cultural interest.

**350 Studies in the Chinese Language**  
Spring. 3(3-0) P:M: (CHS 201)

Grammatical structures of modern Chinese. Grammar review, sound system, word formation, sentence and discourse structures, historical evolution of the Chinese language, dialects, sociolinguistics.

**401 Fourth-Year Chinese I**  
Fall. 3(3-0) P:M: (CHS 302)

Reading, discussion, and writing of advanced materials, including classical texts of broad cultural interest.

**402 Fourth-Year Chinese II**  
Spring. 3(3-0) P:M: (CHS 401)  
Further reading, discussion and writing based on original materials, including classical texts of broad cultural interest.

**499 Senior Thesis Research**  
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department.

An individual research project supervised by a faculty member that demonstrates the student's ability to do independent research and submit or present a major paper.

## CIVIL ENGINEERING CE

### Department of Civil and Environmental Engineering College of Engineering

**271 Engineering Surveying**  
Fall, Spring. 4(3-3) P:M: (MTH 104 or MTH 116 or MTH 120 or MTH 124 or MTH 132 or LBS 117 or LBS 118)

Application of surveying and error analysis to civil engineering problems. Earth work. Calculations. Layout and management of construction sites.

**280 Introduction to Environmental Engineering**  
Fall, Spring. 3(3-0) P:M: (CEM 141 or CEM 151 or LBS 165) and (MTH 132 or concurrently or LBS 118 or concurrently) and (CSE 101 or concurrently or CSE 131 or concurrently or CSE 231 or concurrently or LBS 125 or concurrently or LBS 126 or concurrently or LBS 127 or concurrently)

Elements of hydrology. Groundwater and surface water supply and contamination. Treatment systems for drinking water, wastewater, air, and solid and hazardous waste. Noise and radiation pollution.

**305 Structural Analysis**  
Fall, Spring. 3(3-0) P:M: (MSM 211) R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering.

Determinate and indeterminate plane structures. Linearity, stability, determinacy. Virtual-work calculation of forces and displacements. Flexibility and stiffness methods in plane structures.

**312 Soil Mechanics**  
Fall, Spring. 3(2-3) P:M: (MSM 211) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering or in the Biosystems Engineering major.

Engineering properties of soil and their measurement. Effective-stress concept. Permeability and seepage. Compaction. Consolidation, shear strength and stress-strain behavior.