

- 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: 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-numbered 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 College of Natural Science or 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-numbered 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 College of Natural Science or 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.

CHINESE

CHS

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

- 101. Elementary Chinese I**
Fall. 4(4-1)
Pronunciation, writing system, and basic vocabulary and sentence patterns, with emphasis on conversation.
- 102. Elementary Chinese II**
Spring. 4(4-1)
P: CHS 101 or approval of department.
Further work on conversation, character writing, and comprehension, with increasing emphasis on vocabulary building and grammar.

- 201. Second-Year Chinese I**
Fall. 4(4-1)
P: CHS 102 or approval of department.
Intermediate-level work on skills in conversation, comprehension, and grammar. Practice in composition.
- 202. Second-Year Chinese II**
Spring. 4(4-1)
P: CHS 201 or 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: 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: 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: CHS 201 or approval of department.
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: 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: 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: MTH 120.
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: CEM 141 or CEM 151, MTH 132, CPS 130 or CPS 131.
Elements of hydrology. Groundwater and surface water supply and contamination. Treatment systems for drinking water, wastewater, air, and solid and hazardous waste. Introduction to noise and radiation pollution.
- 305. Structural Analysis**
Fall, Spring. 3(2-3)
P: MSM 211, CE 390 or concurrently. R: Open only to Civil Engineering majors.
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: MSM 211. R: Open only to Civil Engineering and Agricultural Engineering majors. Completion of Tier I writing requirement.
Engineering properties of soil and their measurement. Effective-stress concept. Permeability and seepage. Compaction. Consolidation, shear strength and stress-strain behavior.
- 321. Introduction to Fluid Mechanics**
Fall, Spring. 4(3-2)
P: MTH 235 or concurrently. R: Open only to Civil Engineering and Biosystems Engineering majors. Completion of Tier I writing requirement. Not open to students with credit in ME 332.
Fluid properties, fluid statics, fluids in motion. Conservation of mass, energy and momentum. Dimensional analysis and similitude. Internal and external flows. Applications.
- 337. Civil Engineering Materials I**
Fall, Spring. 4(3-3)
P: MSM 211 or concurrently. R: Open only to Civil Engineering majors.
Common civil engineering construction and paving materials: aggregates, inorganic cements, asphalts, concretes, wood and steel. Composition, structure, physical and mechanical properties, tests, and production mix design.
- 346. Transportation**
Fall, Spring. 3(3-0)
P: MTH 133. R: Open only to Civil Engineering, Engineering Arts, and Urban Planning students.
Planning, design, and evaluation of transportation systems. Transportation demand, capacity, delay, and service quality. Elements of geometric design.
- 370. Engineering Economics**
Fall, Spring. 3(3-0)
P: MTH 133. R: Open only to College of Engineering students.
Economic decision making in the context of evaluation of engineering projects. Net present worth and related methods of analysis. Depreciation. Before- and after-tax analysis. Sensitivity analysis, inflation, expected value.
- 373. Construction Estimating and Scheduling**
Fall. 3(3-0)
R: Open only to College of Engineering and Building Construction Management majors.
Estimating quantities and costs for construction projects. Optimal scheduling of personnel and equipment subject to constraints and uncertainty.