Descriptions — Chemistry
of Courses

998. Physical Chemistry Seminar
Fall, Spring, 1(1-4) 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

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

101. Elementary Chinese I
Fall, 5(5-0)
Pr: CHS 101 or approval of department. Further work on conversation, character writing, and comprehension, with increasing emphasis on vocabulary building and grammar.

102. Elementary Chinese II
Spring, 5(5-0)
Pr: 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, 5(5-1)
Pr: 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, 5(5-0)
Pr: 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)
Pr: 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(4-4)
Pr: 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)
Pr: 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)
Pr: 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)
Pr: 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

Department of Civil and Environmental Engineering
College of Engineering

271. Engineering Surveying
Fall, 4(3-3)
Pr: MTH 120. Application of surveying and error analysis to civil engineering problems. Earth work calculations. Layout and management of construction sites.

290. Introduction to Environmental Engineering
Fall, 3(3-0)
Pr: CHS 141 or CHS 151, MTH 122, CPS 101 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.

386. Structural Analysis
Fall, Spring, 3(3-0)
Pr: MMP 211. 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)

311. Introduction to Fluid Mechanics
Fall, Spring, 4(3-2)
Pr: 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 MTH 332. Fluid properties, fluid states, fluids in motion. Conservation of mass, energy and momentum. Dimensional analysis and similarity. Internal and external flows. Applications.

337. Civil Engineering Materials I
Fall, Spring, 4(3-3)
Pr: MTH 211 or concurrently. R: Open only to Civil Engineering and Biosystems Engineering majors. Common civil engineering construction and paving materials: aggregates, inorganic cements, asphaltics, concretes, wood and steel. Composition, structure, physical and mechanical properties, tests, and production mix design.

400. Structural Mechanics
Fall, 3(3-0)

405. Design of Steel Structures
Fall, 3(3-0)
Pr: CE 305. R: Open only to Civil Engineering majors. Design of steel beams, columns, tension members and connections. Stability and plastic strength.

406. Design of Concrete Structures
Spring, 3(3-0)
Pr: CE 305, CE 307. R: Open only to Civil Engineering majors. Design of reinforced concrete beams, slabs, columns and footings.

418. Geotechnical Engineering
Fall, 4(4-0)
Pr: CE 312. R: Open only to Civil Engineering majors. Shallow foundation design including bearing capacity, stress distribution, and settlement analysis. Pile foundations. Design of retaining structures including rigid walls, braced excavations, and sheet-pile walls. Stability of slopes and embankments.

421. Engineering Hydrology
Fall, 3(3-0)
Pr: STT 351, CE 312 or concurrently. R: Open only to College of Engineering, College of Natural Science, and Crop and Soil Sciences majors. Hydrologic cycle, streamflow, precipitation, evapotranspiration, infiltration, ground water. Quantitative methods of analysis: probability, net hydrograph, routing, and flow nets. Groundwater supply development, well flows.

422. Applied Hydraulics
Spring, 3(2-2)
Pr: CE 321 or ME 332. R: Open only to Civil Engineering, Mechanical Engineering, and Biosystems Engineering majors. Fundamentals of open-channel flow. Rapidly and gradually varied nonuniform flow analysis. Confined flows past submerged bodies, in pipe networks, and in turbine machinery. Design applications.

431. Pavement Design and Analysis I
Fall, 4(4-0)
Pr: CE 312, CE 337. R: Open only to Civil Engineering majors. Highway and airfield pavement structural design. Performance measures. Failure mechanisms, popular design procedures, and design considerations for surface friction, pavement joints, and drainage. Design of rehabilitation and repair, design of overlays.

441. Highway Operations
Fall, 3(3-0)

442. Airport Planning and Design
Fall, 3(3-0)
Pr: Open only to Civil Engineering majors. Components of the airport system including land access facilities, aircraft characteristics, air traffic control, airport configuration, capacity analysis.

443. Advanced Airport Systems Design
Spring, 3(3-0)
Pr: CE 442. R: Open only to Civil Engineering majors. Analysis and design of airport systems using computer models. Design parameters, demand analysis. Runway orientation and capacity, airside delay, vehicle processing, Passenger processing. SA: CE 442
449. Highway Design
Fall, Spring 4(3-1)
P: CE 271. R: Open only to Civil Engineering majors.
Geometric design of highways so related to operation, capacity and safety. Alignment, drainage and pavement design. The use of CAD systems in preparing contract plans.

450. Water and Wastewater Analysis Laboratory
Fall. 1 credit.
C: CE 481 concurrently. R: Open only to majors in Civil Engineering and Environmental Engineering. Chemical and microbial analysis of water and wastewater.

451. Environmental Engineering Chemistry
Fall, Spring. 3(3-0)
P: CEM 361, CHE 201, CHE 280.
Chemistry of environmental processes including alkalinity, precipitation-dissolution reactions, chemical complications and redox reactions. Engineering applications to processing plants for water and wastewater.

452. Water and Wastewater Treatment
Fall. 3(3-0)
P: CE 280, CE 321. R: Open only to Civil Engineering majors.
Distribution of water and collection of sewage. Theory and design of water treatment processes.

453. Solid and Hazardous Waste Management
Spring. 3(3-0)
P: CE 280. R: Open only to College of Engineering majors.
Design of solid waste collection and disposal systems. Definition of hazardous waste problems and selection of treatment alternatives.

454. Microbiology for Environmental Health Engineering
Spring. 3(3-0)
P: CEM 361, CHE 201. R: Open only to College of Engineering majors.
Use and control of microorganisms for the protection of public health and the environment. Thermodynamics of microbial populations and microbial transformations.

455. Independent Study
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to Civil Engineering majors. Approval of department.
Civil engineering problem of specific interest to the student and a faculty member. May be analysis or design.

456. Civil Engineering Design Project
Fall. Spring 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to Civil Engineering majors. Approval of department. Planning, specification, and design of a civil engineering project or facility.

801. Experimental Methods for Structures and Materials
Spring of odd-numbered years. 3(2-2)
Principles of instrumentation and experimental measurement techniques for materials and structural systems. Statistical methods for design and analysis of experiments.

802. Introduction to Dynamics and Earthquake Engineering
Fall. 2 credits.
P: MSM 506. R: Not open to students with credit in ME 461.

803. Dynamics of Structures and Soils and Earthquake Engineering (MTC)
Fall. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course. C: CE 802 concurrently. Topics vary each semester. Topics such as structural dynamics, soil dynamics, and earthquake engineering.

804. Advanced Structural Mechanics I
Fall. 3(3-0)

805. Advanced Design of Steel Structures
Spring. 3(3-0)
Flexural and torsional instability of columns and beams. Slender cross-sectional elements, design of beam-columns. Torsion, plastic design, plate girders, composite steel-concrete construction, connections.

806. Advanced Concrete Materials and Structures
Spring of odd-numbered years. 3(3-0)
P: CE 406

807. Concrete Materials and Technology
Summer. 3(3-0)
Concrete properties and production, structure-property relations. Advances in concrete technology. Special engineering applications.

808. Prestressed and Fibrous Concrete
Fall of even-numbered years. 3(3-0)
P: CE 406
Analysis and design of prestressed concrete structures. Production and properties of fiber reinforced concrete. Theoretical design and testing of fiber concrete.

809. Finite Element Method
Fall. Spring. 3 credits. Interdepartmental with Materials Science and Mechanics, Civil Engineering, and Mechanical Engineering. Administered by Materials Science and Mechanics.
Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics, and stress analysis.

810. Reliability-Based Design in Civil Engineering
Fall. 3(3-0)
Probabilistic treatment of live and dead loads: earthquakes, floods, material properties and capacity. Reliability basis of design specifications, reliability index, probability of failure, design for reliability. Reliability of engineered systems.

A-33