topics including: turbulence, non-Newtonian fluids, interfacial flows, computational fluid dynamics, microelectronics, laser-assisted, drop dynamics, etc. 7110 Mathematical Methods in Chemical Engineering (3) F Review of physicalchemical problem formulation; analytical and numerical techniques for the solution of linear and nonlinear differential equation models in chemical engineering systems. 7112 Chemical Engineering Thermodynamics (3) F Thermodynamic properties, first and second laws of thermodynamics, entropy, Maxwell relations, and relationship of thermodynamics to chemical engineering. Modern methods based on computer technology to design systems or plants for accomplishing specific objectives; emphasis on producing a design project containing well-developed written and oral presentations. 7540 Advanced Computer-Aided Process Design (3) Prereq.: CHEM 4152 or permission of department. An overview of general computer-aided design process design and simulation of chemical process industries, such as chemical, petroleum, and petrochemical plants. Solution methods, algorithm selection, and programming of the computer. 7700 Advanced Topics in Chemical Engineering (3) Prereq.: CHEM 2261 or permission of instructor. One or more phases of advanced chemical engineering practice. 8000 Thesis Research (1-12 per sem.) S"TU grading. 8900 Dissertation Research (1-12 per sem.) S"TU grading. CHEMISTRY • CHEM Laboratory Expenses • Students registering for laboratory courses in chemistry are charged a laboratory usage deposit on their fees. Corequisites • A student may not continue in a course if the prerequisite course is dropped prior to the last day of the midterm examination period. General education courses are marked with stars (★). ★ 1001 Fundamental Chemicals (3) Prereq.: CHEM 1201 or equivalent. May be taken for a max. of 6 hrs. of credit with consent of department. Topics in chemical engineering analysis, such as perturbation methods, matched asymptotic expansions, vector and tensor calculus, and numerical techniques. ★ 232 Advanced Chemical Engineering Fluid Mechanics (3) Prereq.: CHEM 7110 or equivalent. May be taken for a max. of 6 hrs. of credit with consent of department. Chemical processes, such as turbomachinery, hydrodynamic stability, compressible flow, multiphase flow, chemically reacting flows, and non-Newtonian and viscoelastic fluids. ★ 2534 Advanced Chemical Engineering Heat Transfer (3) Prereq.: CHEM 1201 or equivalent. May be taken for a max. of 6 hrs. of credit with consent of department. Thermodynamic analysis of chemical processes, such as equilibrium theory, phase equilibria, and calculation of reaction mechanisms. ★ 3001 Chemical Engineering Analysis (3) Prereq.: CHEM 1201 or equivalent. May be taken for a max. of 6 hrs. of credit with consent of department. Physical approach to characterization of Organic Compounds. 4552 Instrumental Characterization of Organic Compounds (3) Prereq.: CHEM 2001 and 2462. 2461 Organic Chemistry I (3) Prereq.: a grade of "B" or "B" in CHEM 1202 or CHEM 1422. Chemistry majors who qualify should take this course. For well-prepared students with a special interest in chemistry. Credit will not be given for this course and CHEM 2060 or CHEM 2261. 4553 Instrumental Characterization of Organic Compounds (3) Prereq.: CHEM 2001, 2462 and credit or registration in CHEM 2461. Laboratory usage deposit. Credit will not be given for this course and CHEM 2463. 4554 Organic Chemistry Laboratory (2) Prereq.: CHEM 2001 or registration in CHEM 2261 or 2462. 6 hrs. or more. Same as CHEM 2463. Laboratory usage deposit. Credit will not be given for this course and CHEM 2463. Fundamental laboratory operations of organic chemistry.
For high school and junior college teachers; part of the MNS elementary and middle school curricula; selected experiences and lectures; 6 hrs. lab. For elementary and middle school instruction; hands-on experience.

6002 Chemical Principles for Teachers (3) Su.

6001 Chemistry Instruction Through Demonstrations (3) V Prereq.: CHEM 2364 or equivalent. 1 hr. lecture; 6 hrs. lab. Focus on experience.

4572 Foundations of Bioinorganic Chemistry (3) S Prereq.: CHEM 2262 or 2462. Organic and inorganic electron systems, spin, and related chemical dynamics to mechanistic studies; modern experimental techniques.

7261 Polymerization and Polycondensation Processes (4) V Prereq.: CHEM 4571 or 4591. Structure property relationships for materials such as liquid crystals; polymer blends, and block copolymers; polymer/nanocomposites and nanotechnology related materials.

7221 Chemical Dynamics and Kinetics (3) Prereq.: CHEM 4591 and 4592. Reaction rates in the gas phase and in solution; chemical dynamics; gas phase and solution kinetics; applications of kinetics and chemical dynamics to mechanistic studies; modern experimental techniques.

2720 Computational Methods in Civil and Environmental Engineering (3) V Prereq.: CE 2200, 2710, and CE 2720 (a grade of C or better is required in CE 2720). 3 hrs. lab. Measurement and calibration of hydraulic structures; flow in pipelines; velocity measurement; flow visualization; impulsive and momentary flow; work and energy; dynamics and vibration; concepts applied to structural and machine components.

2700 Introduction to Civil Engineering Practice (2) Designed for civil engineering majors; open to nonmajors by consent of department. 1 hr. lecture; 5 hrs. lab. Credit will not be given for this course and CE 2700. Students will conduct three individual projects including civil engineering construction descriptions. Basic technical and professional aspects of civil engineer practice.

2720 Computational Methods in Civil and Environmental Engineering (3) Prereq.: MAT 1550 or 1552 and PHYS 2101. Vectorial treatment of resistance, equilibrium of force systems, centroids and centers of gravity, fluid statics, friction, and energy. Dimensional analysis and simulation; applications to pipe flows.

2200 Fluid Mechanics Laboratory (4) Prereq.: CE 2200 and CHEM 1202 or CHEM 1200 and MATH 2057. 3 hrs. lab. Study of liquids and gases; control volume laws; conservation of mass, momentum, and energy; dimensional analysis and similarity; applications to pipe flows.

2550 Fluid Mechanics Laboratory (3) Prereq.: CE 2200 and CHEM 1200 or CHEM 1202. 3 hrs. lab. Study of liquids and gases; control volume laws; conservation of mass, momentum, and energy; dimensional analysis and similarity; applications to pipe flows.

2750 Advanced Organic and Inorganic Laboratory (3) Prereq.: CHEM 2364 or BIOL 4001. Concepts of coordination chemistry, biochemistry, and physical methods used in advanced graduate research. Credit may be applied toward a thesis in physical organic and inorganic chemistry.

4570 Advanced Inorganic Chemistry (3) Prereq.: CHEM 2262 or 2462. Selected topics in inorganic chemistry, reaction mechanisms, and related topics in structural and synthetic organic chemistry.

4572 Foundations of Bioinorganic Chemistry (3) Prereq.: CHEM 2262 or 2462. Selected topics in kinetics, reaction mechanisms, applications of quantum chemistry to organic chemistry, and related topics in physical-organic and inorganic chemistry.

4562 Intermediate Organic Chemistry (3) F Prereq.: CHEM 2261 or 2461. Students who have completed CHEM 2461 are eligible to complete CHEM 2261. Reaction mechanisms, reaction techniques, and related topics in structural and synthetic organic chemistry.

4561 Intermediate Physical Chemistry (3) Prereq.: CHEM 2261 or 2461. Structure property relationships for materials such as liquid crystals; polymer blends, and block copolymers; polymer/nanocomposites and nanotechnology related materials.

4557 Analytical Separations (3) Prereq.: CHEM 2364 or equivalent. Credit or registration in CHEM 3300. Applications of molecular recognition techniques. Credit or registration in CHEM 3492.

4556 Analytical Spectroscopy (3) Prereq.: CHEM 2364 or equivalent. Credit or registration in CHEM 3492. Introduction to the use of relatively sophisticated structures for molecular recognition.

*2001 Intermediate Mandarin Chinese (4) Prereq.: CE 1501, CHEM 202 and CE 2020. Continuation of the study of basic lexicon and structures of Chinese; emphasis on further development of writing, speaking, and reading skills.

*2002 Intermediate Mandarin Chinese (4) Prereq.: CHEM 2001. Continuation of the study of basic lexicon and structures of Chinese; emphasis on further development of speaking, writing, and reading skills.

2070 Chinese Cinema (3) Chinese cinema from 1896 to the present; emphasis on the New Chinese cinema since the 1980s; screening and analysis of representative films; knowledge of Chinese not required.

3102 Advanced Chinese (3) Prereq.: CHEM 2001 or equivalent. Introduction of authentic materials of increasing complexity on a variety of topics; emphasis on the use of relatively sophisticated structures for molecular recognition.

3801 Traditional East Asian Literature (3) Taught in English; knowledge of East Asian languages not required. Also offered as JAPN 3801. Introduction to the genres, themes, and representative works of traditional Chinese and Japanese literature; emphasis on critical reading.

3802 Modern East Asian Literature (3) Taught in English; knowledge of East Asian languages not required. Also offered as JAPN 3802. Introduction to the genres, themes, and representative works of modern Chinese and Japanese literature; emphasis on critical reading.

4400 Topics in Chinese Culture (3) May be taken for a max. of 6 sem. hrs. of credit when topics vary. Interdisciplinary study of Chinese culture and culture-related topics, covering such fields as literature, the arts, politics, religion, and society. All readings in English.

4970 Independent Work (1-3) Prereq.: CHEM 2461 or 2710. May be taken for a max. of 6 sem. hrs. of credit. Permission of department required. Directed readings in classical Chinese or Chinese literature.

7001 Chinese Culture and Language (Prereq.: Knowledge of Chinese not required. Introduction to Chinese culture with a focus on business; basic Chinese language skills.

CIVIL ENGINEERING • CE

3024 Mechanics of Materials III (3) F Prereq.: CHEM 2364, 2464, or 2461. Principles of macroscopic thermodynamics and application to systems of chemical relevance.

4971 Chemical Thermodynamics (3) V Prereq.: CHEM 2262 or 2462. Principles of macroscopic thermodynamics and application to systems of chemical relevance.

5090 Analytical Separations (3) Prereq.: CHEM 2364 or equivalent. Credit or registration in CHEM 3300. Applications of molecular recognition techniques. Credit or registration in CHEM 3492.

5080 Analytical Spectroscopy (3) Prereq.: CHEM 2364 or equivalent. Credit or registration in CHEM 3492. Introduction to the use of relatively sophisticated structures for molecular recognition.