

CH E-CHEMICAL ENGINEERING

CH E 2002 Introduction to Chemical Engineering Computing 2 Credit Hours

Prerequisite: MATH 1823 or 1914 or concurrent enrollment. Introduction to engineering computing and programming using prevalent engineering computing software; program design and development; computer application exercises in engineering. (F, Su)

CH E 2033 Chemical Engineering Fundamentals 3 Credit Hours

Prerequisite: CHEM 1415 or CHEM 1425 or CHEM 1435 or equivalent. Material balances involving physical equilibria and chemical reaction; energy balances; gas behavior including vapor pressure and Raoult's Law. (F)

CH E 3113 Momentum, Heat and Mass Transfer I 3 Credit Hours

Prerequisite: CH E 2033; MATH 2443 or 2934 or concurrent enrollment in 2443 or 2934; completion or concurrent enrollment in PHYS 2524 and completion or concurrent enrollment in MATH 3113. The common mathematical and physical basis of these processes is presented. Calculation methods for all three processes are developed. Design procedures of equipment for fluid flow, heat transfer and diffusional processes are given. (Sp)

CH E 3123 Momentum, Heat and Mass Transfer II 3 Credit Hours

Prerequisite: CH E 3113 and MATH 3113. The common mathematical and physical basis of these processes is presented. Calculation methods for all three processes are developed. Design procedures of equipment for fluid flow, heat transfer and diffusional processes are given. (F)

CH E 3313 Structure and Properties of Materials 3 Credit Hours

Prerequisite: CHEM 1415 or CHEM 1425, PHYS 2524, and CHE 3473 or instructor permission. The behavior of materials under various conditions and environments is correlated to atomic and molecular structure and bonding. (Sp)

CH E 3333 Separation Processes 3 Credit Hours

Prerequisite: 3123, 3473, 3723. Coverage of the fundamentals and modeling techniques of various separation processes found in the chemical process industries. Discussion of various computational approaches for binary and multicomponent separations; factors affecting efficiency, capacity and energy requirements. (Sp)

CH E 3432 Unit Operations Laboratory 2 Credit Hours

Prerequisite: CH E 3123, CH E 3333 or concurrent enrollment in CH E 3333, and CH E 3473. Experimental examination of processes involving fluid flow, heat and mass transfer, kinetics and process control. Process parameters and physical properties are measured. Results are presented in written reports and oral presentations. Laboratory. (Sp)

CH E 3440 Mentored Research Experience 3 Credit Hours

0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)

CH E 3473 Chemical Engineering Thermodynamics 3 Credit Hours

Prerequisite: CH E 2033, CH E 3113, MATH 2443 or 2934. Application of the first and second laws of thermodynamics to the analysis of phase change, solution behavior and chemical equilibria and reaction. (F)

CH E 3723 Numerical Methods for Engineering Computation 3 Credit Hours

Prerequisites: CHE 2002 (or concurrent enrollment in CHE 2002) and Mathematics 3113 or 3413. Course uses specific software applications tailored toward chemical engineering. Basic methods for obtaining numerical solutions with a digital computer. Included are methods for the solutions of algebraic and transcendental equations, simultaneous linear equations, ordinary and partial differential equations, and curve fitting techniques. The methods are compared with respect to computational efficiency and accuracy. Any student who earns credit for CH E 3723 cannot receive duplicate credit for AME 3723, C S 3723, or P E 3723. This course may not be taken for graduate credit within the College of Engineering. (F)

CH E 3960 Honors Reading 1-3 Credit Hours

1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. Covers materials not usually presented in the regular courses. (F, Sp, Su)

CH E 3970 Honors Seminar 1-3 Credit Hours

1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. The projects covered will vary. Deals with concepts not usually presented in regular coursework. (Irreg.)

CH E 3980 Honors Research 1-3 Credit Hours

1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Provides an opportunity for the gifted Honors candidate to work on a special project in the student's field. Laboratory (F, Sp, Su)

CH E 3990 Undergraduate Research Experience 1-3 Credit Hours

Prerequisite: permission of instructor. May be repeated; maximum credit six hours. Individual research projects for undergraduates in Chemical Engineering before their junior year, and for high performing undergraduates not in the Honors Program. (F, Sp, Su)

CH E G4153 Process Dynamics and Control 3 Credit Hours

Prerequisite: 4473. Formulation of first-order models for storage tanks, chemical reactors and heated, stirred tanks; transient and steady-state process dynamics; three-mode control of unit operations; higher-order systems and counter-current operations; analog simulation and digital control of chemical processes. (F)

CH E G4253 Process Design & Safety 3 Credit Hours

Prerequisite: CH E 3333, CH E 4473. Processes and process equipment design including safety considerations; technical design of units combined into plants. (F)

CH E G4262 Chemical Engineering Design Laboratory 2 Credit Hours

Prerequisite: CH E 3432 and CH E 4253 or concurrent enrollment in CH E 4253. Experimental techniques for the acquisition of pilot plant data, using unit operations equipment and reactors for use in process design. Results are presented in written reports and oral presentations. Laboratory. (F)

CH E 4273 Advanced Process Design 3 Credit Hours

Prerequisite: CH E 3333, CH E 4253, CH E 4262, CH E 4473, CH E 4153. Process and process equipment design, complete design of process plants including complete flow sheets, estimated plant costs, costs of process development, economics of investment. Results are presented in written reports and oral presentations. (Sp) [V].

- CH E 4281 Engineering Co-Op Program** **1 Credit Hour**
(Crosslisted with AME, CEES, C S, ECE, EPHY, ISE and BME 4281)
Prerequisite: Departmental permission and junior standing. May be repeated; maximum credit 6 hours. The Co-Op program provides students an opportunity to enhance their education via career exploration in related professional work experiences. Course assignments help students articulate their experiences by completing journals; mid-term paper; final paper and/or final presentation. Faculty receive an evaluation from the student's Co-Op supervisor who monitors performance. Faculty collaborate with the Co-Op supervisor to ensure student success. (F, Sp, Su)
- CH E 4473 Kinetics** **3 Credit Hours**
Prerequisite: 3473, 3723, Mathematics 3113. Fundamentals of rates, homogeneous isothermal reactions, non-isothermal reactions, reactors and design, heterogeneous reactions, fixed and fluidized bed reactors, experimental data reduction, non-ideal flow reaction systems. (Sp)
- CH E 4960 Directed Readings** **1-4 Credit Hours**
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)
- CH E 4970 Special Topics/Seminar** **1-3 Credit Hours**
1 to 3 hours. Prerequisite: Senior standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- CH E 4980 Senior Research** **1-4 Credit Hours**
1 to 4 hours. Prerequisite: senior standing, permission. Selected students work with individual faculty members on research problems. Laboratory (F, Sp, Su)
- CH E 4990 Independent Study** **1-3 Credit Hours**
1 to 3 hours. Prerequisite: Senior standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)
- CH E 5143 Multi Scale Modeling of Matter** **3 Credit Hours**
Prerequisite: graduate standing or permission of the instructor. The course is suitable for students who are already familiar with classical thermodynamics, differential and integral calculus. This course covers multiscale modeling methods at atomistic and meso scales. By a combination of method discussions and hands-on tutorials, students will learn fundamentals of structures and properties of matter. Both molecular dynamics simulation and Monte Carlo method will be discussed in detail. (F)
- CH E 5163 Heterogeneous Catalysis** **3 Credit Hours**
Prerequisite: CH E 4473; graduate standing or instructor permission. Physical characterization of heterogeneous catalysts; catalytic activity of metals, semiconductors, solid acids, and shape-selective materials. Theories of catalytic activity, catalytic reactors, basics of catalyst surface characterization and activity measurement. (F)
- CH E 5183 Graduate Transport Phenomena** **3 Credit Hours**
Prerequisite: CH E 3123, graduate standing in Chemical Engineering, or permission of instructor. Fundamentals of the theory of transport process; heat, mass, momentum transfer combined with chemical reactions; derivation of different equations to describe processes and process units; analytical and numerical solutions of systems of describing equations. (F)
- CH E 5203 Bioengineering Principles** **3 Credit Hours**
(Crosslisted with AME 5203 and BME 5203) Prerequisite: Mathematics 3113 and Physics 2524. Principles of bioengineering for the areas of the biomechanics of solids and fluids, mass transfer, biomaterials, electrical networks, imaging, and ionizing radiation as they apply to the human body. (F)
- CH E 5243 Biochemical Engineering** **3 Credit Hours**
(Crosslisted with BME 5243) Prerequisite: CH E 3123 or permission of instructor. Current bioprocesses for reaction and separation with emphasis on fundamental principles of chemical engineering, biochemistry, and microbiology. (Sp)
- CH E 5293 Transport in Biological Systems** **3 Credit Hours**
(Crosslisted with AME 5293 and BME 5293) Prerequisite: 3123 or permission of instructor. Theoretical and practical aspects of transport phenomena in living organisms and biomedical technologies. Applications include hemorheology, drug delivery, extracorporeal circulation, and artificial organs. (Irreg.)
- CH E 5373 Tissue Engineering** **3 Credit Hours**
(Crosslisted with BME) Prerequisite: graduate standing or permission of instructor. Examines the background and recent advances in the science of combining multiple cell types with an appropriate support to provide a construct that can replace or support damaged tissue. (Irreg.)
- CH E 5453 Polymer Science** **3 Credit Hours**
Prerequisite: graduate standing or permission. Nomenclature, synthesis, structure and properties of high polymers, survey of production, processing and uses of commercial polymeric materials. (Sp)
- CH E 5463 Polymer Processing** **3 Credit Hours**
Prerequisite: senior or graduate standing. The theory and practice of the production of finished polymer shapes (tubes, sheets, fibers, bottles, etc.) from polymeric raw materials. (Alt. F)
- CH E 5480 Topics in Chemical Engineering** **1-3 Credit Hours**
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated with change of content. Seminar course in specialized topics in chemical engineering. (Irreg.)
- CH E 5513 Surface Characterization** **3 Credit Hours**
Prerequisite: graduate standing or permission of instructor. Characterization of surfaces by (i) modern methods of instrumental analysis including diffraction, microscopic techniques, electron and ion spectroscopies and by (ii) absorption methods including physico- and chemisorption, combined with calorimetry, spectroscopy and temperature-programmed experiments. (Irreg.)
- CH E 5523 Advanced Mathematical Methods in Science and Engineering** **3 Credit Hours**
(Crosslisted with METR 5523) Prerequisite: graduate standing, CH E 3113 and MATH 2443 or MATH 2934. Scale and vector field theory. Ordinary and partial differential equations. Matrix algebra. Complex analysis. (F)

- CH E 5533 Materials Design for Energy Application 3 Credit Hours**
Prerequisite: graduate standing or department permission. This course is focused on electrochemical engineering and its application in several energy-related research areas such as lithium ion batteries, fuel cells, and water electrolysis and photolysis. We will introduce basic principles of electrochemistry and materials science and discuss various issues in these energy-related applications and how to address them from a materials science and engineering perspective. (Irreg.)
- CH E 5563 Properties and Applications of Porous Materials 3 Credit Hours**
Prerequisite: graduate standing or permission of instructor. Introduces the structure-properties relationships of several porous media (e.g. carbon nanotubes, zeolites, xerogels, etc.) with the intent of surveying some of the most important applications for each material. Includes discussion as to how experimental and theoretical tools are currently employed to investigate synthesis and properties of porous materials. (Irreg.)
- CH E 5643 Natural Gas Utilization 3 Credit Hours**
Prerequisite: graduate standing or permission of instructor. Covers the uses of natural gas for combustion, power, LNG, gas conversion to chemicals and fuels, and gas transportation. (Alt. F)
- CH E 5673 Colloid and Surface Science 3 Credit Hours**
(Crosslisted with CEES 5673) Prerequisite: graduate standing or permission of instructor. Capillarity, surface thermodynamics, adsorption from vapor and liquid phases, contact angles, micelle formation, solubilization, emulsions and foams. Applications to be discussed include detergency, enhanced oil recovery and adsorption for pollution control. (Irreg.)
- CH E 5823 Advanced Numerical Methods 3 Credit Hours**
Prerequisite: CH E 3723 or equivalent and CH E 2002 or other introductory programming course or Permission of the Instructor or Graduate Standing. Students will learn numerical techniques not normally covered in undergraduate numerical methods courses, such as Romberg Integration, Chebyshev interpolation, and automatic step-size adjustment for numerical integration. Students will improve their proficiency in formulating the numerical solution to a mathematical problem using Excel with Visual Basic (VB). Students will develop a self-directed project involving numerical solution of a significant problem of interest to them personally or in their research. (Irreg.)
- CH E 5843 Advanced Chemical Engineering Thermodynamics 3 Credit Hours**
Prerequisite: CH E 3473, graduate standing in Chemical Engineering, or permission of instructor. Advanced thermodynamics as applied to engineering problems and design. (F)
- CH E 5960 Directed Readings 1-3 Credit Hours**
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)
- CH E 5970 Special Topics/Seminar 1-3 Credit Hours**
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- CH E 5971 Seminar in Chemical Engineering Research 1 Credit Hour**
Prerequisite: graduate standing in Chemical Engineering or permission of instructor. May be repeated with change of content; maximum credit four hours for the master's degree, 10 hours for the doctoral degree. Speakers from academia and industry elaborate on methods and results from research in their areas of expertise to provide the student with an appreciation of the problems of current interest in chemical engineering. (F, Sp)
- CH E 5980 Research for Master's Thesis 2-9 Credit Hours**
Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. Laboratory (F, Sp, Su)
- CH E 5990 Independent Study 1-3 Credit Hours**
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)
- CH E 6723 Advanced Kinetics and Reaction Engineering 3 Credit Hours**
Prerequisite: 4473 or graduate standing. Understanding and analysis of complex kinetics and reactor systems: free radical and cracking reactions, polymerization, biokinetics and catalytic kinetics with mass heat transfer limitations. Advanced reactor systems such as a catalytic fixed bed reactors in one- and two-dimensions, equilibrium limited reaction systems, fluidized and trickle bed reactors, etc. are considered. (F)
- CH E 6960 Directed Readings 1-3 Credit Hours**
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)
- CH E 6970 Special Topics/Seminar 1-3 Credit Hours**
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit 12 hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or research and field projects. (Irreg.)
- CH E 6980 Research for Doctoral Dissertation 2-16 Credit Hours**
Laboratory (F, Sp, Su)
- CH E 6990 Special Chemical Engineering Problems 1-2 Credit Hours**
1 to 2 Hours. Prerequisite: permission. May be repeated; maximum credit four hours. Special research problems are pursued by the students either as individuals or as a group under staff direction. (F, Sp, Su)