Chemical Engineering (CHE)

Courses

CHE 102. Introduction to Chemical Engineering. 2 Credits.
An introduction to the chemical engineering profession. Also includes introduction to dimension analysis, material balances, unit operations, safety and engineering economics. Prerequisite: CEM major or permission of instructor. F.

CHE 103. Computing Tools for Chemical Engineers. 3 Credits.
Use of spreadsheets, equation-solving packages, and process simulation software to effectively communicate and solve chemical engineering problems. Introduction to chemical process engineering principles. Prerequisite: CEM major or permission of instructor. Prerequisite or Corequisite: MATH 165. S.

CHE 201. Chemical Engineering Fundamentals. 3 Credits.
Introductory principles of stoichiometry with emphasis directed to material and energy balances involved in chemical processes. Prerequisite: CHEM 122 or CHEM 254; CEM majors only or permission of instructor. F,S.

CHE 206. Unit Operations in Chemical Engineering. 3 Credits.
Application of the principles of momentum and heat transfer from a unit operations perspective. Prerequisite: CHE 201, CEM majors only or permission of instructor. S.

CHE 232. Chemical Engineering Laboratory I. 2 Credits.
The use and application of apparatus to measure the physical and chemical properties involved in chemical process material and energy balances. Prerequisite: CEM majors only or permission of instructor. Prerequisite or Corequisite: CHE 201. S.

CHE 235. Chemical Engineering Summer Laboratory I. 3 Credits.
The use and application of apparatus to measure the physical and chemical properties involved in chemical process material and energy balances and fluid flow. Prerequisite: CHE 201, CHE 206 and CHE 315; CEM majors only or permission of instructor. SS.

CHE 301. Introduction to Transport Phenomena. 4 Credits.
An analytical study of the transport of momentum, energy and mass; derivation and utilization of the differential equations of change. Prerequisite: CHE 201 with a grade of C or better; Chemical Engineering majors only or permission of instructor. Prerequisite or Corequisite: MATH 266. F.

CHE 303. Chemical Engineering Thermodynamics. 4 Credits.
Thermodynamics applied to chemical engineering with emphasis on computational work, including thermodynamic laws, chemical equilibria and pressurevolume-temperature relationships. Prerequisite: CHE 201 with a grade of C or better; Chemical Engineering majors only or permission of instructor. F.

CHE 305. Separations. 3 Credits.
Theory and application of rate-based and equilibrium-staged separations. Prerequisite: CHE 201 with a grade of C or better and CHE 303; Chemical Engineering majors only or permission of instructor. Prerequisite or Corequisite: CHE 206. S.

CHE 315. Engineering Statistics and Design of Experiments. 3 Credits.
Statistical background needed to plan, conduct, and analyze engineering experiments. Topics include propagation of error, confidence intervals, hypothesis testing, linear regression, analysis of variance, and an introduction to statistical design of experiments. Prerequisite: CEM majors only or permission of instructor. Prerequisite or Corequisite: MATH 265. S.

CHE 321. Chemical Engineering Reactor Design. 3 Credits.
Theory of chemical reaction rates. Design of batch, tubular, CSTR and catalytic chemical reactors. Prerequisite: CHE 206, MATH 266 and C or better in CHE 201; Chemical Engineering majors only or permission of instructor. S.

CHE 331. Chemical Engineering Laboratory II. 2 Credits.
Experiments illustrating physico-chemical principles and the application of fluid flow and heat transfer theory. Prerequisite: CHE 315, CHE 206, and C or better in CHE 201; Chemical Engineering majors only or permission of instructor. F.

CHE 332. Chemical Engineering Laboratory III. 2 Credits.
Experiments reinforcing physico-chemical principles, unit operations, and separations. Pre-design labs are also introduced. Prerequisite: CHE 331; Chemical Engineering majors only or permission of instructor. S.

CHE 335. Chemical Engineering Summer Laboratory II. 3 Credits.
Experiments reinforcing physico-chemical principles, unit operations, separations, and mass and energy balances. Pre-design labs are also introduced. Prerequisite: CHE 201, CHE 206, CHE 315 and either CHE 232 or CHE 235; Chemical Engineering majors only or permission of instructor. SS.

CHE 380. Service Learning. 1-3 Credits.
Design and implementation of engineering-related projects to serve the community, including K-12 STEM outreach. Hands-on design experience by the student working as an individual or part of a team. Repeatable to 9.00 credits. S/U grading. F,S.

CHE 381. Experiential Learning. 1-3 Credits.
Hands-on design experience by student teams. May include interdisciplinary work on engineering student design competitions. Repeatable to 9.00 credits. S/U grading. F,S.

CHE 397. Cooperative Education. 1-2 Credits.
A practical work experience with an employer closely associated with the student's academic area. Arranged by mutual agreement among student, department and employer. Prerequisite: Sophomore standing in the chemical engineering degree program; Cumulative GPA of 2.0 or higher. Repeatable to 12.00 credits. S/U grading. F,S,SS.

CHE 403. Molecular Thermodynamics and Kinetics. 3 Credits.
A theoretical and mathematical understanding of statistical thermodynamics, quantum mechanics and kinetic theory of gases. Focus on estimating macroscopic thermodynamic and transport properties, equilibrium constants, and kinetic rate constants from a microscopic description of matter. Prerequisite: CHE 303 and CHE 321; CEM majors only or permission of instructor. F.

CHE 404. Air Emissions: Regulation and Control. 3 Credits.
This course is designed to enable engineers to understand natural and anthropogenic sources of air pollution, their impact on health and the environment, and learn ways to minimize air emissions by application of control practices. F.

CHE 408. Process Dynamics and Control. 3 Credits.
Dynamics and control of chemical processes and of systems. Prerequisite: CHE 206, CHE 305, and CHE 321; Chemical Engineering majors only or permission of instructor. F.

CHE 411. Plant Design I: Process Design and Economics. 4 Credits.
Introduction to how projects are executed in the process industries, including an understanding of what constitutes preliminary process design, preliminary cost estimation, the fundamentals of economics as applied to process economic assessment, sustainability considerations in design, oral written communications, teamwork, and the typical drawings and other deliverables produced during the scoping phase of process plant design. There is a particular emphasis on safety considerations in design. Prerequisite: CHE 303 and C or better in CHE 201, CHE 206, CHE 305 and CHE 321; Chemical Engineering majors only or permission of instructor. F.

CHE 412. Plant Design II: Process Project Engineering. 5 Credits.
Proficiency is gained in the development of the preliminary design for a major chemical process. In addition, this course provides an introduction to the second stage of process design--the conceptual design process including an introduction to Piping and Instrument-level design development, process control design and facility layout. A variety of oral communications skills are included. Prerequisite: CHE 408 and C or better in CHE 411; Chemical Engineering majors only or permission of instructor. S.

CHE 413. Plant Design II: Preliminary Process Project Engineering. 3 Credits.
Proficiency is gained in the development of the preliminary design for a major chemical process. A variety of oral communication skills are included. Prerequisite: CHE 411 with a C or better and CHE 408; Chemical Engineering majors only or permission of instructor. S.

CHE 414. Plant Design II: Conceptual Process Project Engineering. 2 Credits.
This course provides an introduction to the second stage of process design-conceptual design. Student will complete process-related components of a conceptual design for a major chemical process including Piping and Instrument Diagrams and Plant Layout Diagrams. A variety of oral communication skills are included. Prerequisite: CHE 413; Chemical Engineering majors only or permission of instructor. SS.

CHE 416. Chemical Product Design. 3 Credits.
Introduction to the design of chemical products. Topics include product develop processes and methodologies, including StageGate and Design for Six Sigma (DFSS). Course contains both classroom and lab activities. Prerequisite: CHE 411, CHEM 340 and CHEM 340L or CHEM 341 and CHEM 341L; Chemical Engineering majors only or permission of instructor. S.

CHE 420. Capstone in Sustainable Energy. 1 Credit.
The student will work one-on-one with a faculty member to develop a concept paper on the primary issues facing the development and implementation of sustainable energy technologies. Prerequisite: Completion of 12 credit hours towards a Concentration in Sustainable Energy. S.

CHE 422. Capstone in Energetics. 1 Credit.
The student will work with a faculty mentor to develop a white paper on a major issue facing the development and implementation of energetics technologies. This will include a discussion of the technical, economic, political, and social barriers facing implementation of the selected technology(s) plus plausible methodologies of overcoming these barriers. Prerequisite: Completion of, or concurrent enrollment in, 12 credit hours towards a concentration in Energetics. S.

CHE 424. Capstone in Petroleum Engineering. 1 Credit.
The student will work with a faculty mentor to develop a white paper on a major issue facing the development and implementation of petroleum engineering technologies. This will include a discussion of the technical, economic, political, and social barriers facing implementation of the selected technology(s) plus plausible methodologies of overcoming these barriers. Prerequisite: Completion of or concurrent enrollment in 12 credit hours towards a Concentration in Petroleum Engineering; restricted to Chemical Engineering majors. S/U grading. S.

CHE 431. Chemical Engineering Laboratory IV. 3 Credits.
Laboratory study of the unit operations of Chemical Engineering. Prerequisite: CHE 305 and either CHE 332 or CHE 335; Chemical Engineering majors only or permission of instructor. F,SS.

CHE 435. Materials and Corrosion. 3 Credits.
Provides an introduction to the fundamental properties of metals and polymers, reviews the forms of metal corrosion and of polymer degradations. Prerequisite: CEM majors only or permission of instructor. S.

CHE 480. Undergraduate Research. 1-6 Credits.
Undergraduate research experience in chemical engineering under the guidance of a faculty member. Prerequisite: Consent of instructor. Repeatable to 12.00 credits. S/U grading. F,S,SS.

CHE 489. Senior Honors Thesis. 1-8 Credits.
Supervised independent study culminating in a thesis. Repeatable to 9 credits. Repeatable to 9.00 credits. F,S,SS.

CHE 493A. Special Topics. 1-3 Credits.
Special topics dictated by student request and current faculty interest. The particular course may be initiated by the students by contacting members of the faculty. Regular grading. Repeatable to 9 credits. Repeatable to 9.00 credits. On demand.

CHE 493B. Special Topics. 1-3 Credits.
Special topics dictated by student request and current faculty interest. The particular course may be initiated by the students by contacting members of the faculty. S/U grading. Repeatable to 9 credits. Prerequisite: Consent of instructor. Repeatable to 9.00 credits. S/U grading. On demand.

CHE 501. Advanced Transport Phenomena. 3 Credits.
This course is designed to give an advanced treatment of momentum, heat, and mass transfer suitable for graduate students in chemical engineering, mechanical engineering, and environmental engineering. This course will involve using advanced mathematics to model transport systems of importance in engineering science and design. Prerequisite: CHE 301 and MATH 266. S, even years.

CHE 503. Fuels Technology. 3-4 Credits.
Processing and utilization of low rank fuels.

CHE 504. Air Pollution Control. 3 Credits.
Identification of major air pollutants from stationary and mobile sources and methods of controlling their emissions; dispersion of air pollutants in the atmosphere; photochemical air pollution; federal and state regulations. Prerequisite: Background equivalent to CHEM 122, MATH 265, and PHYS 252 is expected.

CHE 505. Biochemical and Biomaterial Engineering. 3 Credits.
Principles of biochemical and biomaterial engineering and methods for the analysis, design, operation, and monitoring of biochemical engineering processes and bioreactors. Application to biochemical engineering research and application of materials science to problems in tissue engineering. Prerequisite: Background/knowledge of chemical reactor design and consent of instructor. F.

CHE 507. Advanced Unit Operations. 3-6 Credits.
One or more of the following: fluid flow, heat flow, evaporation, humidification and dehumidification, drying, gas absorption, distillation, and extraction. Prerequisite: Background equivalent to CHE 405 is expected.

CHE 508. Advanced Unit Operations. 3-6 Credits.
Continuation of the first semester's work in advanced unit operations.

CHE 509. Advanced Chemical Engineering Thermodynamics. 3 Credits.
Chemical Engineering processes from the standpoint of quantitative thermodynamics. Special emphasis on thermodynamics of chemical reactions. Prerequisite: Background equivalent to CHE 303 is expected. F, even years.

CHE 510. Advanced Chemical Process Control. 3 Credits.
Analysis and design of advanced chemical process control systems including: dead time compensation, feed forward and adaptive control, multivariable control, digital computer control and the use of Z-transforms to get the discretetime dynamic response of chemical process systems. Prerequisite: MATH 266 and CHE 408 or equivalents approved by the department.

CHE 511. Advanced Chemical Engineering Kinetics. 3 Credits.
Theory and practice of industrial chemical reactor design. Advanced topics in kinetics of industrial chemical reactors. Prerequisite: Background equivalent to CHE 421 is expected.

CHE 512. Transport Of Mass. 3 Credits.
Prerequisite: Background equivalent to CHE 305, CHE 321, and MATH 265 is expected.

CHE 515. Design of Engineering Experiments. 3 Credits.
Design and analysis of experimental data including block and factorial arrangements, significance of data, and mathematical modeling. Prerequisite: MATH 265.

CHE 520. Impurities in Combustion and Gasification Systems. 3 Credits.
This course is on the fate and behavior of fuel derived impurities in energy conversion systems and how impurities influence system design, operation and reliability. Prerequisite: CHEM 122.

CHE 525. Polymer Engineering. 3 Credits.
Basic polymer structures and characterization. Polymerization reactions and kinetics of condensation and chain growth polymerizations. Polymerization processes including bulk, suspension, solution, and emulsion polymerizations. Polymer processing technologies including extrusion, and injection molding. Prerequisite: CHE 321 and CHE 301.

CHE 530. Combustion Theory and Modeling. 3 Credits.
A theoretical and mathematical study of premixed and diffusion flames, laminar and turbulent combustion, solid fuel combustion and pollutant formation. Corequisite: CHE 301 and CHE 303. S.

CHE 531. Rocket Propulsion. 3 Credits.
A theoretical and mathematical study of space flight, the thermodynamics of rocket propulsion, classification and formulation of propellants and their combustion characteristics, and rocket motors. Prerequisite or Corequisite: CHE 303. F.

CHE 532. Explosives: Theory and Modeling. 3 Credits.
A theoretical and mathematical study of: the thermodynamics of deflagrations and detonations, classification and formulation of explosives and their combustion characteristics. Prerequisite or Corequisite: CHE 303. F.

CHE 535. Metallic Corrosion and Polymer Degradation. 3 Credits.
Reviews the forms of metal corrosion and of polymer degradation; discussion of control and mitigation techniques. F.

CHE 562. Seminar in Chemical Engineering. 1 Credit.
Conferences and reports on current developments in Chemical Engineering. Repeatable to 3.00 credits. S/U grading.

CHE 591. Research. 1-15 Credits.
Analysis, planning, and detailed study of definite problems; individual laboratory work on some selected problems to develop the power of independent investigation. Repeatable.

CHE 593A. Special Topics. 1-3 Credits.
Topics of current interest to be considered each semester. Regular grading. Repeatable to 9.00 credits.

CHE 593B. Special Topics. 1-3 Credits.
Topics of current interest to be considered each semester. S/U grading. Repeatable to 3.00 credits. S/U grading.

CHE 595. Design Project. 3-6 Credits.
A three to six credit course of engineering design experience involving individual effort and formal written report. Prerequisite: Restricted to the Master of Engineering students and subject to approval by the student's advisor.

CHE 597. Graduate Cooperative Education. 1-2 Credits.
A practical work experience with an employer closely associated with the student's academic area. Arranged by mutual agreement among student, department, and employer. Prerequisite: Approval of ChE graduate director. Repeatable to 4.00 credits. S/U grading. On demand.

CHE 996. Continuing Enrollment. 1-12 Credits.
Repeatable. S/U grading.

CHE 997. Independent Study. 2 Credits.
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CHE 998. Thesis. 1-9 Credits.
Development and documentation of scholarly activity demonstrating proficiency in Chemical Engineering at the master's level. Repeatable to 9.00 credits. F,S,SS.

CHE 999. Dissertation. 1-12 Credits.
Repeatable to 12.00 credits. F,S,SS.