CHEMICAL ENGINEERING — Description of Courses

930. Advanced Plant Ecology  
Winter of odd-numbered years. Summer of even-numbered years. Given at W. K. Kellogg Biological Station summer term. 3(2-4) Approval of department. Fundamental theories and modern research horizons.

999. Doctoral Dissertation Research  
Fall, Winter, Spring, Summer. Variable credit. Approval of department. Research in anatomy, biology, cytology, ecology, genetics, ichnology, morphology, mycology, paleobotany, pathology, physiology, and taxonomy.

BUILDING CONSTRUCTION MANAGEMENT  
See Agricultural Engineering.

CHEMICAL ENGINEERING CHE  
College of Engineering

300. Material and Energy Balances  
Fall, Winter. 4(3-2) One year general chemistry, MTH 214 or concurrently, CPS 112 or concurrently. Chemical engineering calculations. Synthesis of chemical process systems. Analysis of chemical process systems by material and energy balances. Behavior of gases. Enthalpy calculations for changes of temperature, phase changes, chemical reactions.

311. Thermodynamics for Chemical Engineering  
Winter, Spring. 3(3-0) CHE 300 or approval of department. First and second laws. Energy, enthalpy, entropy, free energy, the mathematics of property relationships. Energy conversion processes. Thermodynamics of flow.

340. Transfer Processes and Separations I  
Fall. 3(2-2) CHE 300 or concurrently, CHE 381 or concurrently or approval of department. Thermodynamics of fluid flow. Treatment of fluid flow as a momentum transfer process. Laminar and turbulent motion of compressible and incompressible fluids. Design of flow systems.

341. Transfer Processes and Separations II  

342. Transfer Processes and Separations III  

343. Transfer Processes and Separations IV  

381. Chemical Engineering Analysis  
Fall, Spring. 3(3-0) Students may not receive credit in both CHE 381 and MTH 341. MTH 310, CPS 112. Interdepartmental with the Department of Mathematics. Formulation of ordinary and partial differential equations describing chemical systems. Boundary value problems, numerical methods, matrices, and applications, to chemical engineering systems.

411. Phase and Chemical Equilibria  
Spring. 3(3-0) CEM 381, CHE 311. Properties in solutions. Deviations from ideality. Liquid-vapor equilibria. Chemical equilibria in the gas, liquid, and solid states.

423. Chemical Engineering Laboratory  
Fall, Summer. 3(1-6) CHE 428 concurrently, CHE 451 concurrently. Assigned laboratory problems, requiring team effort. Experimental work, involving momentum, heat and mass transfer, separation processes, such as distillation, filtration, and drying; reactor kinetics; automatic process control.

424. Transport Phenomena and Physical Properties Laboratory  
Fall, Spring. 3(1-6) CHE 434, CHE 342 concurrently. Experiments involving the transport processes and measurement of physical, chemical and thermodynamic properties of various materials. Comparison of theoretical and experimental results.

428. Chemical Reaction Engineering  
Fall. 4(4-0) CEM 381, CHE 311, CHE 342 concurrently. Quantitative treatment of mechanisms and rates of chemical reactions. Catalysis. Design and analysis of flow and non-flow reactors. Heterogeneous catalysis.

442. Polymer Science and Engineering  

443. Chemical Engineering of the Solid State  
Winter. 3(3-0) CEM 381. Structure and properties of inorganic and organic solids. Relation of bond type and steric configuration to mechanical, electrical, thermal, optical properties. Macroscopic structure influence on physical properties. Surface phenomena. Applications.

451. Process Systems Control  
Fall. 3(3-0) CHE 343, CHE 428 or concurrently. Foundation of control theory for chemical processes. Integration of present and developing practice with modern theory.

461. Process Selection and Optimization  
Winter. 5(5-0) CHE 343, CHE 428. Application of chemical engineering principles in design calculations. Selection of the optimum design for equipment, functional units, and for the overall process. Influence of design on capital investment, operating cost, product loss, and product quality.

462. Process Design  
Spring. 3(3-0) CHE 461. Integrated design of the complete chemical engineering process. Process engineering, project engineering, instrumentation, and layout.

465. Process Optimization Methods  
Spring. 3(3-0) MTH 310. Interdepartmental with Systems Science. Methods for determining optimum design and operating policies of systems of varying complexity. Includes classical methods, mathematical programming and modern methods. Flow sheet optimization with process simulation packages.

470. Theory of Nuclear Reactors  
Winter. 3(3-0) PHY 289, MTH 310 or approval of department. Theory and design of nuclear reactors. Nuclear transformation, fission, and energy conversion. Derivation of chain reaction design criteria, and calculation of flux power distribution. Analysis of reactor safety, reliability and economics.

481. Transport Phenomena  
Spring. 3(3-0) CHE 342, CHE 381. Fundamental treatment of momentum, energy, and mass transport. Use of partial differential equations and equations of change for chemical engineering applications. Analogies among the phenomena, dimensional analysis, and boundary layer theory.

501. Advanced Chemical Engineering Calculations I  
Fall. 3(3-0) CHE 381. Chemical engineering applications of advanced mathematical methods. Formulation and solution of mathematical equations which describe physical problems. Computer solutions.

502. Advanced Chemical Engineering Calculations II  
Winter. 3(3-0) CHE 801. Continuation of CHE 801.

506. Thermodynamics and Kinetics in Chemical Engineering  

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811. Advanced Chemical Engineering Thermodynamics I
Fall, 3(3-0) CHE 311, CHE 411. CEM 361
Advanced treatment of the laws of thermodynamics. Cryogenic processes. Corresponding state and higher parameters in computing properties of chemical compounds and solutions.

817. Advanced Chemical Reaction Engineering I
Spring, 3(3-0) CHE 428.

826. Flow of Heat I
Spring, 3(3-0) CHE 343.
Steady and unsteady state heat transfer. Conduction and convection in flow and non-flow systems.

831. Advanced Distillation
Winter, 3(3-0) CHE 343.

850. Fluid Flow and Rheology
Fall, 3(3-0) CHE 451 or approval of department.
Application of fluid dynamics to chemical engineering systems. Balance principles for fluids; Newtonian and non-Newtonian behavior; theory and practice of laminar and turbulent flows; stability.

851. Mass Transfer
Winter, 3(3-0) CHE 450.
Formulation of component material balances; Fick's first and second laws; convective mass transfer; multicomponent fluxes; boundary layer theory and interfacial mass transfer for laminar and turbulent flows.

139. Selected Topics in Introductory Chemistry
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 5 credits. Previous college chemistry, approval of department.

865. Selected Topics in Chemical Engineering
Fall, Winter, Spring, Summer. 3(3-0)
May reenroll for a maximum of 9 credits if a different topic is taken. A newly developing area of chemical engineering selected by the department for offering each term. Information on the specific topic to be covered should be obtained from the department office before registration.