CHEMICAL ENGINEERING

Department of Chemical Engineering and Materials Science
College of Engineering

201 Material and Energy Balances
Fall, Spring. 3(4-0) P: (MTH 133 or MTH 153H or LB 119) and (CEM 142 or CEM 152 or LB 172) and (CSE 231 or concurrently) or (EGR 102 or concurrently))

Chemical engineering calculations. Synthesis of chemical process systems. Analysis of chemical processes using material and energy balances. Enthalpy calculations for changes in temperature, phase transitions, and chemical reactions.

210 Modeling and Analysis of Transport Phenomena
Fall, Spring. 3(3-0) P: (MTH 235 or concurrently) or (MTH 340 or concurrently) or (MTH 341 or concurrently) and CHE 201


301 Chemical Engineering as a Profession
Spring. 1(2-0) P: (CHE 201 or concurrently) and completion of Tier I writing requirement Professional aspects of chemical engineering. Communication skills, professionalism and ethics, teamwork skills, contemporary engineering issues, career planning, project management, and industrial processes.

311 Fluid Flow and Heat Transfer
Spring. 3(4-0) P: CHE 210 or concurrently R: Open to juniors or seniors in the College of Engineering.


312 Mass Transfer and Separations
Spring. 4(5-0) P: CHE 210 or concurrently R: Open to juniors or seniors in the Chemical Engineering Major.


316 Laboratory Practice and Statistical Analysis
Spring. 4(2-0) P: (CHE 311 and (CHE 312 or concurrently)) and (CHE 321 or concurrently) and CHE 431 and completion of Tier I writing requirement R: Open to juniors or seniors in the Chemical Engineering Major.

Practical experience with unit operations equipment, including separations processes, reactor systems, and chemical processes requiring analysis of heat, mass and momentum transport. Laboratory assignments requiring teamwork. Engineering statistics with focus on model building, experimental design, and statistical quality control.

321 Thermodynamics for Chemical Engineering
Spring. 4(5-0) P: CHE 201


431 Chemical Reaction Engineering
Spring. 4(5-0) P: CHE 210 or concurrently R: Open to juniors or seniors in the Chemical Engineering Major.


432 Process Analysis and Control
Spring. 3(3-0) P: CHE 431 R: Open to seniors or juniors in the Chemical Engineering Major.


433 Process Design and Optimization I
Spring. 4(5-0) P: CHE 311 and CHE 321 and CHE 326 and CHE 431 and completion of Tier I writing requirement R: Open to seniors in the Chemical Engineering Major.

Applications of chemical engineering principles in design calculations. Selection of optimum design. Influence of design on capital investment, operating cost, product loss and quality. Mathematical programming methods for optimization.

434 Process Design and Optimization II
Spring. 2(4-0) P: CHE 433


468 Biomass Conversion Engineering
Spring. 3(3-0) Interdepartmental with Bio- systems Engineering, Administered by Chemical Engineering. P: (BE 351 or CHE 321) and (BE 360 or CHE 431)

Physicochemical and biological pretreatment. Bio- mass conversion to alcohols, biodiesel, bio-oil, syn- gas, and other value-added products using advan- taged biological, chemical, and thermochemical treatments.

469 Sustainable Bioenergy Systems
Spring. 3(3-0) Interdepartmental with Bio- systems Engineering, Administered by Bio- systems Engineering. P: (BE 230 or CHE 201) and (BE 351 or CHE 321)) or (ME 201 and ENE 481) RB: CSS 467 and CHE 468 R: Open to juniors or seniors in the College of Engineering.

Bioenergy information and system design. Life cycle assessment to evaluate sustainability of bioenergy systems. Current policy regulating the bioeconomy and system economics. Product commercialization.

CHEMICAL ENGINEERING

472 Composite Materials Processing
Spring. 3(2-3) P: CHE 311 or ME 323 or CE 321

Manufacturing processes for thermoset and thermo- plastic matrix composites. Mechanical and thermal evaluation of composites. Rheology and molding of fiber-filled materials.

473 Chemical Engineering Principles in Polymers and Materials Systems
Spring. 3(3-0) P: CHE 311 and CHE 321 and CHE 431 and CEM 352 SA: CHE 371

Application of chemical engineering principles to polymer and materials systems. Structures and properties of metals, ceramics and polymers. Thermodynamics, synthesis, rubber elasticity, viscoelasticity, kinetics, rheology, and processing of polymers systems. Application of statistics and problem-solving skills to materials systems.

481 Biocatalysis Engineering
Spring. 3(2-3) P: (BMB 401 or (BMB 461 and BMB 462)) and CHE 431

Applications of microbiology and biochemistry to biochemical engineering. Kinetics and thermodynamics of biochemical reactors. Transport phenomena in biological systems. Bioreactor design and scale-up.

482 Science and Technology of Wine Production
Spring. 3(2-3) Interdepartmental with Chemistry and Food Science. Administered by Chemistry. P: CEM 143 or CEM 251 or CEM 351 RB: Must be at least 21 years of age. R: Open to seniors or graduate stu- dents in the Department of Biosystems and Agricultural Engineering or in the Depart- ment of Chemical Engineering and Materi- als Science or in the Department of Chem- istry or in the Department of Food Science and Human Nutrition or in the Department of Agriculture or in the Department of Mi- crobiology and Molecular Genetics or in the Lyman Briggs Chemistry Coordinate Major. Approval of department.


483 Brewing and Distilled Beverage Technology
Spring. 3(2-3) Spring: Uncle John's Fruithouse Winery and Brewing Company, East Lansing. Interdepartmental with Food Science. Administered by Chemical Engi- neering. P: CHE 311 or (ME 410 or concur- rently) or BE 429 or (BE 429 or concurrently) or (FSC 325 or concurrently) RB: Major in Chemical Engineering. Biosystems Engineering or Food Science. Must be at least 21 years of age. R: Approval of depart- ment.

Raw materials for fermentation and basics of alcohol fermentation, beer and cider production; basics of distillation; brandy and eau de vie production; whis- key production; vodka, gin and flavored spirits pro- duction; flavor chemistry

490 Independent Study
Fall, Spring. Summer. 1 to 3 credits. A stu- dent may earn a maximum of 6 credits in all enrollments for this course. R: Open to stu- dents in the Chemical Engineering Major. Approval of department. Theoretical or experimental studies of current re- search topics in chemical engineering. Individual in- teraction with faculty adviser.
CHE—Chemical Engineering

491 Selected Topics in Chemical Engineering
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to students in the College of Engineering. Approval of department. Study of newly developing or non-traditional chemical engineering topics in a classroom environment.

801 Advanced Chemical Engineering Calculations
Spring. 3(3-0) Formulation of differential equations modeling physical phenomena in chemical engineering. Application of analytical and numerical solution methods. Interpretation of solutions.

802 Research Methods
Spring, 1(0-2) Interdepartmental with Materials Science and Engineering. Administered by Chemical Engineering. R: Open to graduate students in the Department of Chemical Engineering and Materials Science. Skills required for graduate research. Critically reviewing the literature, defining a fundamental research problem, effective oral and written technical presentations.

804 Foundations in Chemical Engineering I

805 Foundations in Chemical Engineering II

821 Advanced Chemical Engineering Thermodynamics
Spring, 3(3-0) R: Open only to Chemical Engineering majors. Laws of thermodynamics, unsteady state processes. Prediction and correlation of phase equilibria for nonelectrolytes. Relation of quantum theory and statistical mechanics to thermodynamic properties.

822 Advanced Transport Phenomena

831 Advanced Chemical Reaction Engineering
Spring, 3(3-0) Characterization of solid catalysts. Heterogeneous reaction rate expressions. Simultaneous mass and heat transport and chemical reaction in porous catalysts. Design of fixed-bed and fluidized-bed reactors. Industrial catalytic reactions.

869 Life Cycle Assessment for Bioenergy and Bioproduct Systems
Spring. 3(3-0) Interdepartmental with Biosystems Engineering. Administered by Biosystems Engineering. R: Open to graduate students in the College of Engineering or in the Department of Biosystems and Agricultural Engineering or approval of department. Not open to students with credit in BE 469. Life cycle assessment to evaluate the environmental impacts of biological and chemical conversion processes. Biomass supply chain economics and technoeconomics for biomass conversion. Current policy considerations impacting the adoption of bioenergy and bioproduct systems.

871 Material Surfaces and Interfaces
Spring of odd years. 3(3-0) Interdepartmental with Materials Science and Engineering. Administered by Materials Science and Engineering. R: Open to graduate students in the Department of Medical Engineering and Materials Science. Structured growth models. Non-ideal bioreactor performance. Biomass supply chain economics and technoeconomics for biomass conversion. Current policy considerations impacting the adoption of bioenergy and bioproduct systems.

872 Polymers and Composites: Manufacturing, Structure and Performance
Spring of even years. 3(3-0) R: Open only to graduate students in the College of Engineering or the Department of Chemistry. Structure-Property Relations of Polymers, Fibers, Fabrics and Composites, Material Selection, Manufacturing Processes, Process Induced Microstructure, Prediction of Composite Mechanical Properties, Dimensional Stability, Design of Cure Cycles, Mold Design.

882 Advanced Biochemical Engineering

883 Multidisciplinary Bioprocessing Laboratory
Spring of odd years. 3(1-4) R: (CHE 481) or graduate work in engineering, biosciences or related disciplines. Mentored research project conducted in multidisciplinary team. Bioprocessing research methods. Teamwork skills.

890 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 Chemical Engineering majors. Approval of department. Supervised individual investigation of a problem in chemical engineering.

891 Selected Topics
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to Chemical Engineering majors. Physical and mathematical analysis of phenomena such as swirling flows or stability of reactions and transport processes.

892 Seminar
Fall, Spring. 1(0-2) A student may earn a maximum of 2 credits in all enrollments for this course. Interdepartmental with Materials Science and Engineering. Administered by Chemical Engineering. R: Open to master's students in the Chemical Engineering Major or in the Materials Science and Engineering Major. Presentations of detailed studies of specialized aspects of chemical engineering and materials science.

899 Master's Thesis Research
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 24 credits in all enrollments for this course. R: Open only to Chemical Engineering majors. Master's thesis research.

972 Viscoelasticity and Flow of Polymeric Materials
Spring of odd years. 3(3-0) Time dependent and steady flow properties of polymeric materials related to molecular and structural parameters. Examples of polymeric blends and composites with thermoplastic and thermoset components.

992 Seminar
Fall, Spring. 1(0-2) A student may earn a maximum of 5 credits in all enrollments for this course. Interdepartmental with Materials Science and Engineering. Administered by Chemical Engineering. R: Open to doctoral students in the Chemical Engineering Major or in the Materials Science and Engineering Major. Presentations of detailed studies of specialized aspects of chemical engineering and materials science.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open to graduate students in the Chemical Engineering Major. Doctoral dissertation research.