CHEMICAL ENGINEERING (CHE)

Subject-area course lists indicate courses currently active for offering at the University of Louisville. Not all courses are scheduled in any given academic term. For class offerings in a specific semester, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm).

500-level courses generally are included in both the undergraduate- and graduate-level course listings; however, specific course/section offerings may vary between semesters. Students are responsible for ensuring that they enroll in courses that are applicable to their particular academic programs.

Course Fees

Some courses may carry fees beyond the standard tuition costs to cover additional support or materials. Program-, subject- and course-specific fee information can be found on the Office of the Bursar website (http://louisville.edu/bursar/tuitionfee/).

CHE 502. Biochemical Engineering **3 Units**
Term Typically Offered: Occasionally Offered
Prerequisite(s): CHE 433 (or concurrent) and CHE 441 (or concurrent).
Description: Engineering principles related to operations involving biological processes, e.g., fermentation. Basic microbiology and biochemistry; biochemical reaction mechanisms, kinetics, rate processes, and separation techniques. Applications to foods, pharmaceuticals, and waste treatment, including system design.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 503. Fundamentals of Engineering Examination Review **2 Units**
Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): 4th-year standing.
Description: Review of topics covered on eight-hour NCEES Fundamentals of Engineering examination. Not to be counted towards meeting the requirements for a degree.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 509. Environmental Processes and Systems **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CEE 309 or CHE 401.
Description: This course examines scientific and engineering aspects of environmental problems, stressing important issues, existing technical solutions and new solutions. The course presents engineering approaches to natural systems and describes techniques to treat/eliminate environmental problems.
Note: Cross-listed with CEE 509.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 520. Modeling and Transport Phenomena **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): CHE 433 and CHE 441.
Description: An introduction to the interrelationship of momentum, heat and mass transport focusing on the development of the equations of change through the use of shell balances and their relation to earlier courses in fluids,heat and mass transfer. Some focus will be placed on this using material in the modeling of basic chemical engineering systems.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 532. Advanced Material Science **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): 90 or more credit hours.
Description: Advanced study of materials science. Topics may include the electronic and atomic structure of materials; properties characterized by electron motion; properties associated with atomic motion; applications and synthesis of fundamentals to several real problems; science of thin films; or other topics selected by the instructor.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 533. Chemical Engineering Safety and Health **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): 90 or more credit hours.
Description: Overview of regulations and industrial practices, emphasizing chemical hazards, including: industrial hygiene, toxicology, controls and hazards analysis. Safety considerations in process design.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 534. Industrial Waste Management **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): 90 or more credit hours.
Description: A survey of regulations, generation, control and management of industrial wastes and environmental hazards: airborne, aqueous, solids and hazardous wastes. Course includes guest speakers, site visits and a term project. Design of waste treatment facilities.
Note: Cross-listed with CEE 534.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 535. Pollution Prevention **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): 90 or more credit hours.
Description: Multimedia pollution prevention and waste minimization of hazardous and non-hazardous wastes and emissions: toxics use reduction; source reduction; reuse, reclamation and recycling; product life-cycle analysis; economic evaluation; assessments; planning and management.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 550. Kinetics of Polymer Reactions **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CHE 441 and CHEM 341.
Description: Kinetic expressions are developed for several polymer reaction mechanisms including chain, step, ionic and emulsion reactions; copolymerization; polymer reaction engineering; molecular weight distributions; structural considerations; design considerations.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 551. Polymer Science **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CHEM 341.
Description: Introduction to polymer science and engineering. Polymer synthesis, kinetics, structure, and properties; commercial polymers; polymer processing; equipment design.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 562. Process Control Laboratory **1 Unit**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CHE 461.
Description: A laboratory course demonstrating computer simulation and the characteristics of sensing and control devices and their interactions when incorporated into process control systems.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 572. Plant Process and Project Design - CUE **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): CHE 471.
Description: The design and economic evaluation of a chemical plant, from process definition and flow sheet construction to a cash position diagram and measures of profitability.
Course Attribute(s): CUE - This course fulfills the Culminating Undergraduate Experience (CUE) requirement for certain degree programs. CUE courses are advanced-level courses intended for majors with at least 90 earned credits/senior-level status., CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 574. Techniques of Research **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): 90 or more credit hours.
Description: The design, analysis, and interpretation of experimental results to obtain the desired information within reasonable constraints of time and expense. Testing predictions and making reliable decisions utilizing graphical, numerical, and statistical techniques.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 581. Chemical Vapor Deposition and Processing **3 Units**
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): CHE 253, CHE 441 and CHE 435 or the consent of the instructor.
Description: Theoretical and experimental concepts involved with chemical vapor desposition and processing of advanced and nanomaterials.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 593. Independent Study in Chemical Engineering **1-6 Units**
Term Typically Offered: Fall, Spring, Summer
Description: Independent research conducted with the approval and supervision of a faculty member.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 594. Special Topics in Chemical Engineering **3 Units**
Term Typically Offered: Fall, Spring, Summer
Description: An examination of one or more specific areas of Chemical Engineering. Details announced each semester.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 595. Master of Engineering Seminar in Chemical Engineering **1 Unit**
Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): Fifth-year standing.
Description: Presentation and/or discussion of topics of current interest. This course is available to students enrolled in the professional school, division of higher studies or the Graduate School.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 602. Graduate Internship in Chemical Engineering **2 Units**
Grading Basis: Pass/Fail
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): Admission to Graduate Study, Permission of Department Chair, and Permission of Director of Career Services.
Description: Supervised professional experience in industry at the graduate level. This course provides the structure and focus for the graduate intern field assignment to ensure that the assignment is appropriate and consistent with the intern's graduate course of study and professional development. May be repeated for credit.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 603. Tissue Engineering **3 Units**
Prerequisite(s): Graduate/Professional School standing and BIOL 329, or consent of instructor.
Description: This is an advanced elective course to satisfy the requirements for a graduate level degree in chemical engineering. This course presents an introduction to tissue engineering with an emphasis on the role of biomaterials and bioreactor design.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 610. Advanced Thermodynamics **3 Units**
Description: A comprehensive study of physical and chemical equilibrium, with special emphasis on nonideality.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 612. Nonequilibrium Thermodynamics **3 Units**
Description: The extension of classical thermodynamics to include systems in which transport processes are taking place. Examples from the areas of engineering, chemistry, and biological systems are examined.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 618. Computational Chemistry and Molecular Simulation **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): Senior or Graduate Standing in Engineering.
Description: Theory and applications of computational chemistry and molecular simulations. Concepts in statistical mechanics and statistical thermodynamics. Connection of electronic and molecular structure to thermodynamic and transport properties. Prediction of chemical and material properties using modern scientific software.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 620. Transport Phenomena I **3 Units**
Description: An integrated study of momentum, thermal energy, and mass transport by molecular and convective mechanisms, with and without generation, for steady-state and unsteady-state conditions, in laminar, boundary-layer, or turbulent flow. Molecular theories of transport properties.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 621. Transport Phenomena II **3 Units**
Prerequisite(s): CHE 620.
Description: Consideration of advanced theories and applications of transport properties as related to heat, mass, and momentum transfer.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 624. Introduction to Rheology **3 Units**
Description: Principles and applications of the rheology of polymeric materials. Kinematics of shear and extentional flows. Properties of polymer melts; experimental rheometry. Property predictions based on a variety of generalized Newtonian, linear viscoelastic, co-rotational, and co-deformational models.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 630. Computational Fluid Dynamics **3 Units**
Term Typically Offered: Fall Only
Prerequisite(s): Senior or Graduate Standing in Engineering.
Description: Simulate and visualize fluid flow using applied computational fluid dynamics. Mesh generation, quality check, and resolution. Solver convergence and stability for steady state and un-steady state problems; single and multi-phase systems; heat transfer; laminar and turbulent flows. Post processing and flow visualization.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 631. Homogeneous Fluid Dynamics **3 Units**
Description: Advanced study of momentum transfer in homogeneous fluids. Conservation of matter, momentum, and mechanical energy; ideal flow, creeping flow, laminar flow, turbulent flow, and boundary layer approximations; non-Newtonian fluids.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 632. Heterogeneous Flow **3 Units**
Description: Analysis of two-phase flows of gases, liquids, and solids. Single-particle and multiparticle systems, fluidized beds, bubble beds, drop beds; slug flow, annular flow.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 633. Heat Transfer **3 Units**
Description: Advanced problems in the fields of conductive and convective heat transfer.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 637. Advanced Stagewise Processes **3 Units**
Description: Methods of calculations for complex binary and multicomponent mixtures. Consideration is also given to the design of equipment for these separations.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 638. Advanced Absorption **3 Units**
Description: An examination of absorption as a portion of general mass transfer phenomena. Theoretical and generalized relationships are applied to industrial problems of design.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 640. Chemical Kinetics and Catalysis **3 Units**
Description: A study of catalytic reaction mechanisms and solid catalysts with applications to cracking, reforming, hydrotreatment of fuels, synthesis gas conversion and partial oxidation reactions. Design of catalysts and catalytic reactors for specific applications.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 641. Advanced Reactor Design **3 Units**
Description: Reactor design and performance with emphasis on non-ideal behavior. Includes study of non-isothermal, non-ideal flow homogeneous and heterogeneous reactors. Introduction to heterogeneous catalysis and biochemical reactors. Extensive application of digital computers.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 650. Membrane Separations **3 Units**
Description: Qualitative and quantitative description of membrane separation processes including reverse osmosis and ultrafiltration; membrane synthesis; industrial applications including wastewater treatment, continuous systems, liquid membranes and gas separations. Design of membranes, membrane modules and membrane separation processes.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 653. Polymer Processing **3 Units**
Description: Introduction to polymer melt rheology. Simple model flows. Analysis, modeling, design and control of polymer melt processes such as extrusion, calendering, fiber spinning, film blowing, injection molding, and blow molding.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 654. Engineering Properties of Polymers **3 Units**
Description: The relationships between molecular structure, measurable properties, and design requirements for polymeric materials. Molecular topology; morphology; rheology; mechanical, thermal, electrical, optical, and chemical properties; design and economic considerations in engineering applications.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 655. Processing for Additive Manufacturing **3 Units**
Term Typically Offered: Spring Only
Prerequisite(s): Graduate Standing.
Description: This course focuses on the principal, commercially-realized AM processes and on the processing and materials science underlying them. Topics include the physics and chemistry of photopolymerization, material extrusion, polymer laser sintering and metal laser melting and the structure and properties of the materials produced by these processes.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 660. Optimization in Control Systems **3 Units**
Description: Theory of optimization will be studied and applied to the solution of control problems. Both steady-state and dynamic optimization topics will be considered.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 661. Control of Dynamic Processes **3 Units**
Description: A combined laboratory and seminar course involving advanced process-control experiments and simulation procedures with the necessary concomitant discussion.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 662. Advanced Process Control **3 Units**
Description: Advanced control system design and implementation; feed-forward, cascade, adaptive, multivariable, and constraint control systems; computer process control.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 663. Distillation Dynamics and Control **3 Units**
Description: Multicomponent calculations and design of distillation units. Automatic control of these units, sensitivity analysis in control strategy, and dynamic mathematical modeling and simulation of the columns and accessories, including design considerations.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 671. Bioseparation **3 Units**
Prerequisite(s): ENGR 205 or Graduate/Professional school standing or consent of instructor.
Description: This course introduces the basic concept, theory, and applications of bioseparations.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 686. Chemical Engineering Analysis **3 Units**
Description: Mathematical modeling of chemical engineering phenomena leading to total and partial differential equations requiring solution by use of series, transforms, and digital computer techniques. Applications to design and analysis of chemical engineering processes.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 690. Master of Science Thesis in Chemical Engineering **1-6 Units**
Description: Experimental and/or theoretical research to be presented in thesis for degree requirement.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 693. Advanced Research in Chemical Engineering **1-15 Units**
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 694. Special Topics in Chemical Engineering **1-6 Units**
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 695. Chemical Engineering Seminar **1 Unit**
Grading Basis: Pass/Fail
Prerequisite(s): Graduate standing.
Description: Presentation and/or discussion of topics of current interest.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 696. Independent Study in Chemical Engineering **1-6 Units**
Description: Independent research conducted with the approval and supervision of a faculty member.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 697. Master of Engineering Thesis in Chemical Engineering 1-6 Units
Prerequisite(s): Graduate/Professional School standing.
Description: A candidate for the Master of Engineering degree, specializing in the field of Chemical Engineering, is required to perform a study, design, or investigation under the direction of a faculty member. A written dissertation is required to be presented and defended orally and submitted to the faculty for approval. This course must be repeated for a minimum total of 6 semester hour credits to satisfy minimum MEng requirements.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 698. Engineering Project Fundamentals I **3 Units**
Prerequisite(s): Graduate/Professional School standing.
Description: This is the first of a two course sequence to satisfy the project requirement for the Master of Engineering degree (non-thesis option). This course sequence presents the fundamentals of research proposal writing including literature and background investigation, feasibility evaluation and written and oral communication.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

CHE 699. Engineering Project Fundamentals II **3 Units**
Prerequisite(s): Graduate/Professional School standing and CHE 698.
Description: This is the second of a two course sequence to satisfy the project requirement for the Master of Engineering degree (non-thesis option). This course sequence presents the fundamentals of business plan development including literature and background investigation, feasibility evaluation and written and oral communication.
Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content.

For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)