Chemical Engineering (CHEG)

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Chemical engineering deals with the creation, design, operation, and optimization of processes that derive practical benefits from chemical or physical changes principally involving chemical and biochemical reactions. The profession is quite broad and has traditionally provided the technology for: supplying energy and fuel; synthesizing materials such as plastics, chemicals, fertilizers, and pharmaceuticals; and managing environmental and safety concerns of physical and chemical processes. Some new applications of the principles of chemical engineering at nanoscales are being made in sustainable energy production and detection of gene mutations, protein configurations, and virus serotypes as well as thermal destruction of cancer cells.

Chemical engineers have a variety of traditional job opportunities in industries such as petroleum production and processing, chemical manufacturing, food processing, pharmaceutical production, and process equipment manufacturing. Job opportunities may involve research, development, design, manufacturing, sales, or teaching as professional activities. The chemical engineer can also move easily into environmental engineering, nuclear engineering, oceanography, biomedical engineering, pharmacology, law, medicine, or other multidisciplinary fields.

In chemical engineering, students obtain a broad foundation in chemistry, mathematics, physics, communication skills, economics, and the humanities. Courses in material and energy balances, thermodynamics, reaction kinetics, fluid mechanics, heat and mass transfer, process control, computer methods, safety, and design provide students with the background and learning skills required of the practicing chemical engineer. The curriculum includes elective courses that enable a student to prepare for immediate employment or further study at the graduate level or the professional level, such as for medical school. The chemical engineering program also serves as an excellent preparation for dental, pharmacy, or law school.

The educational objective of the undergraduate program in the Ralph E. Martin Department of Chemical Engineering is to prepare students for careers and professional accomplishment after graduating, including:

- Successfully practicing as an engineer or in another professional pursuit, including traditional or emerging fields of chemical engineering, to make a positive impact locally and globally.
- Actively involved in professional lifelong learning, both informal and formal, that deepens their knowledge and readiness to contribute to advancing science, technologies and solutions essential for the future, including successfully participating in a graduate or professional program.

The program prepares graduates to achieve these educational objectives through development of their skills as outlined in our educational outcomes and taught in our curriculum.

Completion of the degree requirements provides graduates with the following learning outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and for global, cultural, social, environmental, economic, and other factors as appropriate to the discipline
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to communicate effectively with a range or audiences
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- An ability to recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge
- An ability to function effectively as a member or leader of a team that establishes goals, plans tasks, meets deadlines, and creates a collaborative and inclusive environment

Requirements for B.S. in Chemical Engineering

Each student in chemical engineering is required to complete 128 hours of coursework including the 35-hour University Core. To be eligible for graduation, all students must complete at least 30 hours of Chemical Engineering (CHEG) classes at the University of Arkansas, Fayetteville that are required for the degree. Each student in chemical engineering is also required to complete six semester hours of technical electives, three semester hours of Advanced Science electives, three semester hours of Chemical Engineering electives, and three semester hours of Advanced Science or Chemical Engineering electives. As discussed in the department's Undergraduate Advising Manual, students can select elective courses to better prepare for employment or further study in areas such as:

- Biotechnology
- Biomedical engineering
- Environmental engineering
- Food process engineering
- Materials engineering
- Microelectronics
- Nanotechnology
- Nuclear engineering
- Pre-medicine
- Simulation and optimization

Additional opportunities are available to enhance the educational experience of students in these areas. Students should consult their academic adviser for recommendations.

Chemical Engineering B.S.Ch.E. Eight-Semester Degree Program

The following section contains the list of courses required for the Bachelor of Science in Chemical Engineering degree. Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program. Entering freshmen will be required to participate in selected Freshman Engineering Student Services.

First Year	Fall	Spring
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3	
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3	
GNEG 1111 Introduction to Engineering I	1	
Fine Arts Core Elective (satisfies General Education Outcome 3.1)[2]	3	
Select one of the following to satisfy General Education Outcome 4.2:		
HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) or HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) or PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)	3	
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)		4
CHEM 1123 University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture)		3
CHEM 1121L University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab)		1
ENGL 1033 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2)		3
GNEG 1121 Introduction to Engineering II		1
PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)		4
Year Total:	17	16

Second Year	Fall	Spring
MATH 2584 Elementary Differential Equations	4	
CHEM 3603 Organic Chemistry I	3	
CHEM 3601L Organic Chemistry I Laboratory	1	
CHEG 2113 Introduction to Chemical Engineering I	3	
PHYS 2074 University Physics II (ACTS Equivalency = PHYS 2044 Lecture) (Satisfies General Education Outcome 3.4)	4	
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603)		4
CHEM 3613 Organic Chemistry II		3
CHEM 3611L Organic Chemistry II Laboratory		1
CHEG 2133 Fluid Mechanics or CHEG 2133H Honors Fluid Mechanics		3
CHEG 2313 Thermodynamics of Single-Component Systems or CHEG 2313H Honors Thermodynamics of Single-Component Systems		3
Social Sciences State Mimimum Core Elective (Satisfies General Education Outcomes 3.3 and 4.1)[3]		3
Year Total:	15	17

Third Year	Fall	Spring
CHEM 3813 Elements of Biochemistry or CHEM 4813H Honors Biochemistry I	3	
CHEG 3144 Heat and Mass Transfer	4	
CHEG 3323 Thermodynamics of Multi-Component Systems or CHEG 3323H Honors Thermodynamics of Multi-Component Systems	3	
Select one of the following to satisfy General Education Outcome 3.3:		
ECON 2143 Basic Economics: Theory and Practice or ECON 2013 Principles of Macroeconomics (ACTS Equivalency = ECON 2103)	3	
Humanities State Minimum Core Elective (Satisfies General Education Outcomes 3.2 and 5.1)[4]	3	
CHEG 3713 Chemical Engineering Materials Technology		3
CHEG 3333 Chemical Engineering Reactor Design or CHEG 3333H Honors Chemical Engineering Reactor Design		3
CHEG 3253 Chemical Engineering Computer Methods		3
CHEG 3233L Chemical Engineering Laboratory I		3
Social Sciences State Minimum Core Elective (Satisfies General Education Outcome 3.3)[5]		3
Technical Elective		3
Year Total:	16	18

Fourth Year	Fall	Spring
CHEG 4163 Separation Processes or CHEG 4163H Honors Separation Processes	3	

CHEG 4413 Chemical Engineering Design I or CHEG 4413H Honors Chemical Engineering Design I	3	
CHEG 4813 Chemical Process Safety or CHEG 4813H Honors Chemical Process Safety	3	
Advanced Science Elective	3	
Technical Elective	3	
CHEG 4332L Chemical Engineering Laboratory II		2
CHEG 4423 Automatic Process Control or CHEG 4423H Honors Automatic Process Control		3
Satisfies General Education Outcome 6.1:		
CHEG 4443 Chemical Engineering Design II or CHEG 4443H Honors Chemical Engineering Design II		3
Advanced Science or Chemical Engineering Elective		3
Chemical Engineering Elective		3
Year Total:	15	14
Total Units in Sequence:		**128**

[1] Students have demonstrated successful completion of the learning indicators identified for learning outcome 2.1, by meeting the prerequisites for MATH 2554.

[2] The Fine Arts Elective courses which satisfy General Education Outcome 3.1 include: ARCH 1003, ARHS 1003, COMM 1003, DANC 1003, LARC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, THTR 1013, or THTR 1013H.

[3] The Social Sciences Elective courses which satisfy General Education Outcomes 3.3 and 4.1 include: ANTH 1023, COMM 1023, HDFS 1403, HDFS 2413, HIST 1113, HIST 1123, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2813, INST 2813H, PLSC 2013, PLSC 2813, PLSC 2813H, RESM 2853, SOCI 2013, SOCI 2013H, or SOCI 2033.

[4] The Humanities Elective courses which satisfy General Education Outcomes 3.2 and 5.1 include: CLST 1003, CLST 1003H, CLST 1013, HUMN 1124H, PHIL 2003, PHIL 2003C, PHIL 2003H, PHIL 2103, or PHIL 2103C.

[5] The Social Sciences Elective courses which satisfy General Education Outcome 3.3 include: AGEC 1103, AGEC 2103, ANTH 1023, COMM 1023, ECON 2013, ECON 2023, ECON 2143, EDST 2003, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2003, HIST 2013, HIST 2093, HUMN 1114H, HUMN 2114H, INST 2813, INST 2813H, PLSC 2003, PLSC 2013, PLSC 2203, PLSC 2813, PLSC 2813H, PSYC 2003, RESM 2853, SOCI 2013, SOCI 2013H, SOCI 2033. Note, courses cannot be counted twice in degree requirements.

Elective Options in Chemical Engineering

Each student in chemical engineering is required to complete six semester hours of technical electives and nine semester hours of Advanced Science electives. At least three semester hours must be taken from the list of Science Electives.

Technical Electives

In general, any upper level (3000-level or above) course in the sciences, math or engineering may serve as a technical elective, with prior approval by your academic adviser. BIOL 2013, BIOL 2213, BIOL 2323 and BIOL 2443 are 2000-level courses that can also serve as technical electives, and are also useful for students applying to medical school. INEG 2333, INEG 2413 and INEG 3513 are statistics-oriented classes, and may be used for technical elective credit. Upper-level courses in non-technical areas such as business may also serve as technical electives with prior approval by your academic adviser. There is no specific list of approved technical electives.

Advanced Science and Chemical Engineering Electives

A list of the approved Advanced Science or Chemical Engineering courses is shown below. Once again, each student in chemical engineering is required to complete nine semester hours of Advanced Science electives. At least three semester hours must be taken from the list of Science electives. Courses not on the list *may* satisfy the requirement with student appeal and approval by the Chemical Engineering faculty.

Science Electives

CHEM 2261L	Analytical Chemistry Laboratory	1
CHEM 2263	Analytical Chemistry Lecture	3
CHEM 3203	Forensic Chemistry	3
CHEM 3451L	Elements of Physical Chemistry Laboratory	1
CHEM 3453	Elements of Physical Chemistry	3
CHEM 3504	Physical Chemistry I	4
CHEM 3514	Physical Chemistry II	4
CHEM 4123	Advanced Inorganic Chemistry I	3
CHEM 4211L	Instrumental Analysis Laboratory	1
CHEM 4213	Instrumental Analysis	3
CHEM 4283	Energy Conversion and Storage	3
CHEM 4843H	Honors Biochemistry II	3
CHEM 4853	Biochemical Techniques	3
CHEM 5283	Energy Conversion and Storage	3
FDSC 4304	Food Chemistry	4
PHYS 3113	Analytical Mechanics	3
PHYS 3453	Electromagnetic Theory I	3
PHYS 3463	Electromagnetic Theory II	3
PHYS 3544	Optics	4
PHYS 3603	Introduction to Modern Physics	3
PHYS 360VL	Introduction to Modern Physics Laboratory	1-3
PHYS 3613	Modern Physics	3
PHYS 4073	Introduction to Quantum Mechanics	3
PHYS 4333	Thermal Physics	3
PHYS 4613	Introduction to Biophysics and Biophysical Techniques	3

Chemical Engineering Electives

- Any graduate Chemical Engineering class (excluding seminar)--instructor permission is required
- Any senior level Chemical Engineering elective class excluding research, co-op/internship, special problem or ChE Car

Students are encouraged to select elective courses to better prepare for employment or further study in areas such as:

- Biotechnology
- Biomedical engineering
- Environmental engineering
- Food process engineering
- Materials engineering
- Microelectronics
- Nanotechnology
- Nuclear engineering
- Pre-medicine
- Simulation and optimization

Additional opportunities are available to enhance the educational experience of students in these areas. Students should consult their academic adviser for recommendations.

Honors Program Requirements

Chemical engineering students enrolled in the Honors College are encouraged to complete the requirements to graduate with honors. In addition to grade point requirements, Honors College students must complete a total of at least 12 hours of honors course credits including a minimum of 6 hours of honors course credits in chemical engineering. The student must also participate in a design or research project culminating in an Honors Thesis. Thesis credit in the department will be satisfied by Honors College students in one of the following ways:

- Completion of the American Institute of Chemical Engineers Design Competition Problem individually following contest rules as part of CHEG 4443 Design II;
- Completion of a design contest problem as part of a team, such as the WERC competition in CHEG 4443 Design II; or
- Completion of CHEG 488V Special Problems at the direction of a faculty mentor.

Regardless of the thesis project, an Honors Thesis and oral presentation will be prepared by the student and approved by the Department Honors Committee and the faculty mentor.

Ackerson, Michael D., Ph.D. (University of Arkansas), M.S., B.S. (University of Missouri-Rolla), Associate Professor, 1986, 1997.
Almodovar Montanez, Jorge L., Ph.D. (Colorado State University), Associate Professor, Ralph E. Martin Professorship in Chemical Engineering, 2018.
Beitle, Karen, M.S.(University of Arkansas), B.S. (University of Pittsburgh), Instructor, .
Beitle, Robert R., Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Pittsburgh), Professor, Jim L. Turpin Professorship in Chemical Engineering, 1993, 2006.
Clausen, Ed, Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Missouri-Rolla), University Professor, Charles W. Oxford Professorship in Chemical Engineering, 1981, 2018.
Hestekin, Christa, Ph.D. (Northwestern University), B.S.Ch.E. (University of Kentucky), Associate Professor, Ansel and Virginia Condray Endowed Professorship in Chemical Engineering, 2006, 2013.
Hestekin, Jamie A., Ph.D. (University of Kentucky), B.S.Ch.E. (University of Minnesota-Duluth), Professor, Maurice E. Barker Chair in Chemical Engineering, 2006, 2017.
Kim, Daesoo, Ph.D., M.S. (University of Arkansas), B.S. (Suncheon National University), Instructor, 2022.
Monroe, Jacob, Ph.D. (University of California, Santa Barbara), B.S. (University of Virginia), Assistant Professor, Ray C. Adam Endowed Chair in Chemical Engineering, .
Mourot, Michael, B.S. (University of Arkansas), Instructor, .
Nayani, Karthik, Ph.D. (Georgia Institute of Technology), B.S.Ch.E. (Indian Institute of Technology, Kanpur), Assistant Professor, 2020.
Richardson, Will, Ph.D. (Texas A&M University), B.S. (University of Arkansas), Associate Professor, Bates Teaching Professorship in Chemical Engineering, .
Spicer, Tom O., Ph.D., M.S., B.S. (University of Arkansas), Professor, Robert E. Babcock Sr. Professorship in Chemical Engineering, 1981, 1997.
Vega, Jose L., Ph.D. (University of Arkansas), M.S., Licenciatura (Universidad de Santiago de Compostela), Instructor, 2020.
Walker, Heather L., Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Arkansas), Teaching Assistant Professor, 2008, 2014.
Walters, Keisha, Ph.D., M.S., B.S. (Clemson University), Professor, Kevin W. and Marie L. Brown Department Head Chair in Chemical Engineering, Ralph E. Martin Leadership Chair in Chemical Engineering, 2021.
Wickramasinghe, Ranil, Ph.D. (University of Minnesota-Twin Cities), M.S., B.S. (University of Melbourne, Australia), Distinguished Professor, Ross E. Martin Chair in Emerging Technologies, 2011, 2021.

Courses

CHEG 2113. Introduction to Chemical Engineering I. 3 Hours.
Introduction to the field of chemical engineering. Industries, careers, and the curriculum are discussed. Basic chemical engineering terms, concepts, and calculations are presented. Mass balance calculations are performed and the application of computers to chemical engineering problems is introduced. Pre- or Corequisite: CHEM 1123 or CHEM 1223. (Typically offered: Fall and Spring)

CHEG 2133. Fluid Mechanics. 3 Hours.
Analysis and design of fluids handling equipment and systems. Application of the principles of fluid statics, fluid dynamics, compressible flow, etc. Prerequisite: MATH 2584 or MATH 2584C. Pre- or Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614). (Typically offered: Fall, Spring and Summer)

CHEG 2133H. Honors Fluid Mechanics. 3 Hours.
Analysis and design of fluids handling equipment and systems. Application of the principles of fluid statics, fluid dynamics, compressible flow, etc. Prerequisite: MATH 2584 or MATH 2584C. Pre- or Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614). (Typically offered: Fall, Spring and Summer)
This course is equivalent to CHEG 2133.

CHEG 2313. Thermodynamics of Single-Component Systems. 3 Hours.
A detailed study of the thermodynamic "state principles," energy and entropy balances, and their application to the solution of problems involving single-component physical systems and processes. Prerequisite: MATH 2584. Pre- or Corequisite: CHEG 2113 or BENG 2632 or BMEG 2614. (Typically offered: Fall, Spring and Summer)

CHEG 2313H. Honors Thermodynamics of Single-Component Systems. 3 Hours.
A detailed study of the thermodynamic "state principles," energy and entropy balances, and their application to the solution of problems involving single-component physical systems and processes. Prerequisite: MATH 2584. Pre- or Corequisite: CHEG 2113 or BENG 2632 or BMEG 2614. (Typically offered: Fall, Spring and Summer)
This course is equivalent to CHEG 2313.

CHEG 3144. Heat and Mass Transfer. 4 Hours.
Applications of the principles of conduction, convection and radiation to the analysis and design of chemical processing heat transfer equipment and systems. Fundamentals of chemical diffusional and convection processes. Pre- or Corequisite: CHEG 3323. Prerequisite: CHEG 2133 with a C or above, and MATH 2584. (Typically offered: Fall and Spring)

CHEG 3144H. Honors Heat and Mass Transfer. 4 Hours.
Applications of the principles of conduction, convection and radiation to the analysis and design of chemical processing heat transfer equipment and systems. Fundamentals of chemical diffusional and convection processes. Pre- or Corequisite: CHEG 3323. Prerequisite: CHEG 2133 with a C or above, and MATH 2584. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 3144.

CHEG 3233L. Chemical Engineering Laboratory I. 3 Hours.
Experimental measurements of various physical properties and comparison with published values and theoretical predictions. Experimental investigation of fluid flow and thermodynamics. Interpretation of results using graphical, numerical and statistical tools, and presentation of results in written technical reports and oral briefings. Identification and quantification of sources of experimental error. Identification of relevant experimental parameters to achieve an objective. Pre- or Corequisite: CHEG 3144. Corequisite: Drill component. Prerequisite: CHEG 2133 and CHEG 2313, both with a C or above. (Typically offered: Fall and Spring)

CHEG 3253. Chemical Engineering Computer Methods. 3 Hours.
Application of computer methods to chemical engineering problems including a review of structured programming principles. Corequisite: Drill component. Pre- or Corequisite: CHEG 3144 and CHEG 3323. Prerequisite: MATH 2584. (Typically offered: Fall and Spring)

CHEG 3323. Thermodynamics of Multi-Component Systems. 3 Hours.
The use of the state principle and energy and entropy balance developed in CHEG 2313 is extended to allow processes. Physical and chemical equilibrium processes are considered in detail. Prerequisite: CHEG 2313 with a C or above, and MATH 2574. (Typically offered: Fall and Spring)

CHEG 3323H. Honors Thermodynamics of Multi-Component Systems. 3 Hours.
The use of the state principle and energy and entropy balance developed in CHEG 2313 is extended to allow processes. Physical and chemical equilibrium processes are considered in detail. Prerequisite: Honors standing, CHEG 2313 with a C or above, and MATH 2574. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 3323.

CHEG 3333. Chemical Engineering Reactor Design. 3 Hours.
Principles of kinetics of homogeneous and heterogeneous reactions, catalysis, and reactor design with applications, drawn from industrial processes. Pre- or Corequisite: CHEG 3253. Prerequisite: CHEG 3323, with a C or above. (Typically offered: Fall and Spring)

CHEG 3333H. Honors Chemical Engineering Reactor Design. 3 Hours.
Principles of kinetics of homogeneous and heterogeneous reactions, catalysis, and reactor design with applications, drawn from industrial processes. Pre- or Corequisite: CHEG 3253. Prerequisite: Honors standing, and CHEG 3323 with a C or above. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 3333.

CHEG 3713. Chemical Engineering Materials Technology. 3 Hours.
Selection of metals, polymers and ceramics for service in process conditions (including corrosion). In addition to static strains on materials, specialized materials such as semiconductors,, composites, and nano-materials are studied. The relationship between molecular structure and macroscopic properties is emphasized including processing and manufacture. Prerequisite: CHEG 3323 with a C or above, CHEM 3603, and PHYS 2054. (Typically offered: Spring)

CHEG 4163. Separation Processes. 3 Hours.
Applications of chemical engineering design to stagewise and continuous separations in systems approaching equilibrium. Prerequisite: CHEG 3144 with a C or above. (Typically offered: Fall and Spring)

CHEG 4163H. Honors Separation Processes. 3 Hours.
Applications of chemical engineering design to stagewise and continuous separations in systems approaching equilibrium. Prerequisite: Honors standing and CHEG 3144 with a C or above. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 4163.

CHEG 4332L. Chemical Engineering Laboratory II. 2 Hours.
Experimental investigations of mass transfer and kinetics/reactor design. Special attention to attaining a high order of accuracy and to presenting results in complete written reports, with emphasis on quality rather than quantity work performed. Pre- or Corequisite: CHEG 3333 and CHEG 4163. Corequisite: Drill component. Prerequisite: CHEG 3233L with a C or above. (Typically offered: Fall and Spring)

CHEG 4413. Chemical Engineering Design I. 3 Hours.
Principles of cost estimation, profitability, economic analysis, and economic balances as practiced in the chemical process industries. Special emphasis on the solution of problems involving the combination of engineering principles and economics. Corequisite: Drill component. Pre- or Corequisite: CHEG 4163. Prerequisite: CHEG 3144 with a C or above, CHEG 3333 with a C or above, and (ECON 2013 or ECON 2143). (Typically offered: Fall and Spring)

CHEG 4413H. Honors Chemical Engineering Design I. 3 Hours.
Principles of cost estimation, profitability, economic analysis, and economic balances as practiced in the chemical process industries. Special emphasis on the solution of problems involving the combination of engineering principles and economics. Corequisite: Drill component. Pre- or Corequisite: CHEG 4163. Prerequisite: Honors standing, CHEG 3144 with a C or above, CHEG 3333 with a C or above, and (ECON 2013 or ECON 2143). (Typically offered: Fall and Spring)
This course is equivalent to CHEG 4413.

CHEG 4423. Automatic Process Control. 3 Hours.
Application of mathematical modeling methods to the description of transient phenomena of interest to process engineers. Modes of control and principles of feedback control are introduced with applications to process engineering problems. Pre- or Corequisite: CHEG 4163. Prerequisite: CHEG 3253 with a C or above. (Typically offered: Spring)

CHEG 4423H. Honors Automatic Process Control. 3 Hours.
Application of mathematical modeling methods to the description of transient phenomena of interest to process engineers. Modes of control and principles of feedback control are introduced with applications to process engineering problems. Pre- or Corequisite: CHEG 4163. Prerequisite: Honors standing, and CHEG 3253 with a C or above. (Typically offered: Spring)
This course is equivalent to CHEG 4423.

CHEG 4443. Chemical Engineering Design II. 3 Hours.
Responsibility for decision making is placed on the students in the solution of a comprehensive, open ended problem based on an industrial process. Both formal oral and formal written presentation of results are required. Students are selected for participation in some sections of the course based on academic performance, honors standing and instructor recommendations. Corequisite: Drill component. Prerequisite: CHEG 4413 with a C or above. (Typically offered: Fall and Spring)

CHEG 4443H. Honors Chemical Engineering Design II. 3 Hours.
Responsibility for decision making is placed on the students in the solution of a comprehensive, open ended problem based on an industrial process. Both formal oral and formal written presentation of results are required. Students are selected for participation in some sections of the course based on academic performance, honors standing and instructor recommendations. Corequisite: Drill component. Prerequisite: CHEG 4413 with a C or above. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 4443.

CHEG 4813. Chemical Process Safety. 3 Hours.
Application of chemical engineering principles to the study of safety, health, and loss prevention. Fires and explosions, hygiene, toxicology, hazard identification, and risk assessment in the chemical process industries. Corequisite: Drill component. Prerequisite: CHEG 3144 and CHEG 3323, both with a C or above. (Typically offered: Fall)

CHEG 4813H. Honors Chemical Process Safety. 3 Hours.
Application of chemical engineering principles to the study of safety, health, and loss prevention. Fires and explosions, hygiene, toxicology, hazard identification, and risk assessment in the chemical process industries. Corequisite: Drill component. Prerequisite: Honors standing, CHEG 3323 and CHEG 3144 both with a C or above. (Typically offered: Fall)
This course is equivalent to CHEG 4813.

CHEG 488V. Special Problems. 1-6 Hour.
Special problems. Prerequisite: Senior standing. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.