Chemical Engineering (CHEG)

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Ralph E. Martin Department of Chemical Engineering Website (https://chemical-engineering.uark.edu)

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:

- Successful practice as an engineer or in some other professional pursuit, including traditional or emerging fields of chemical engineering;

- Entrance and successful participation in a graduate or professional program (such as medical school) that continues their career development.

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 engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- An ability to communicate effectively with a range of 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 function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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.

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Elective Options in Chemical Engineering

Each student in chemical engineering is 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.

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 2313, 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 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. Courses not on the list may satisfy the requirement with student appeal and approval by the Chemical Engineering faculty.

Advanced Science Electives

- CHEM 2263 Analytical Chemistry Lecture 3
- CHEM 226L Analytical Chemistry Laboratory 1
- CHEM 3453 Elements of Physical Chemistry 3
- CHEM 345L Elements of Physical Chemistry Laboratory 1
- CHEM 3504 Physical Chemistry I 4
- CHEM 3514 Physical Chemistry II 4
- CHEM 4213 Instrumental Analysis 3
- CHEM 421L Instrumental Analysis Laboratory 1
- CHEM 4843H Honors Biochemistry II 3
- CHEM 4853 Biochemical Techniques 3
- PHYS 3113 Analytical Mechanics 3
- PHYS 3544 Optics 4
- PHYS 3613 Modern Physics 3
- PHYS 4333 Thermal Physics 3
- PHYS 431L Modern Physics Laboratory 1-3
- PHYS 4734 Introduction to Laser Physics 4
- FDSC 4304 Food Chemistry 4

Chemical Engineering Electives

- CHEG 4273 Corrosion Control 3
- CHEG 5273 Corrosion Control 3
- CHEG 5013 Membrane Separation and System Design 3
- CHEG 488V Special Problems 1-6
- CHEG 5033 Technical Administration 3
- CHEG 5043 Colloid and Interface Science 3
- CHEG 5113 Transport Processes I 3
- CHEG 5133 Advanced Reactor Design 3
- CHEG 5213 Advanced Chemical Engineering Calculations 3
- CHEG 5333 Advanced Thermodynamics 3
- CHEG 5353 Advanced Separations 3
- CHEG 5513 Biochemical Engineering Fundamentals 3

Total Units in Sequence: 128

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.Ch.E., B.S.Ch.E. (University of Missouri-Rolla), Associate Professor, 1986.
Almodovar Montanez, Jorge L., Ph.D. (Iowa State University), Assistant Professor, 2018.
Beitle, Robert R., Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Pittsburgh), Professor, 1993.
Clausen, Ed, Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Missouri-Rolla), University Professor, 1981.
Ford, David M., Ph.D., M.S., B.S.Ch.E. (University of Pennsylvania), Professor, 2017.
Greenlee, Lauren F., Ph.D., M.S. (University of Texas, Austin), BSChE (University of Michigan), Associate Professor, 2015.
Hestekin, Jamie A., Ph.D. (University of Kentucky), B.S.Ch.E. (University of Minnesota-Duluth), Professor, 2006.
Hestekin, Christa, Ph.D. (Northwestern University), B.S.Ch.E. (University of Kentucky), Associate Professor, 2006.
Servoss, Shannnon, Ph.D. (Northwestern University), B.S.Ch.E. (University of Michigan-Ann Arbor), Associate Professor, 2006.
Souto Melgra, Nacacha, Ph.D. (University of Puerto Rico, Mayaguez), Clinical Assistant Professor, 2018.
Spicer, Tom O., Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Arkansas), Professor, 1981.
Thoma, Greg, Ph.D. (Louisiana State University), M.S.Ch.E., B.S.Ch.E. (University of Arkansas), Professor, 1993.
Thompson, Audie K., Ph.D (University of Mississippi Medical Center), Assistant Professor, 2018.
Walker, Heather L., Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Arkansas), Clinical Assistant Professor, 2008.
Wickrasmasinghe, Ranil, Ph.D. (University of Minnesota-Twin Cities), M.S., B.S. (University of Melbourne, Australia), Professor, 2011.

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: CHEG 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. Pre- or Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614 or INEG 2103). (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. Pre- or Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614 or INEG 2103). (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. Pre- or Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614 or INEG 2103). (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. Pre- or Corequisite: MATH 2574 or MATH 2574C and (CHEG 2113 or BENG 2632 or BMEG 2614 or INEG 2103). (Typically offered: Fall, Spring and Summer)

This course is equivalent to CHEG 2313.
CHEG 4163. Separation Processes. 3 Hours.
Applications of chemical engineering design to stagewise and continuous separations in systems approaching equilibrium. Prerequisite: CHEG 3144. (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: CHEG 3144. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 4163.

CHEG 4273. Corrosion Control. 3 Hours.
Qualitative and quantitative introduction to corrosion and its control. Application of the fundamentals of corrosion control in the process industries is emphasized. Prerequisite: CHEG 2313. (Typically offered: Spring)

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. (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: ECON 2013 (or ECON 2143) and CHEG 3144 and CHEG 3333. (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: ECON 2013 (or ECON 2143) and CHEG 3144 and CHEG 3333. (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. (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: CHEG 3253. (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. Corequisite: Drill component. Prerequisite: CHEG 4413. (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. Corequisite: Drill component. Prerequisite: CHEG 4413. (Typically offered: Fall and Spring)
This course is equivalent to CHEG 4443.