Chemical Engineering (CHEG)

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Chemical Engineering Website (http://chemical-engineering.uark.edu/)

Degrees Conferred:
M.S.Ch.E. (CHEGMS)
Ph.D. in Engineering (CHEGPH)

Program Description: The goal of the graduate program in the Ralph E. Martin Department of Chemical Engineering is to prepare the student for advanced roles in the profession through a combination of planned course work and independent research activities. The graduate program allows the student to specialize in an area of interest while also broadening the graduate's intellectual abilities and enhancing career opportunities in research, teaching, management, and general engineering practice. The student's goals for pursuing an advanced degree, including preferences for a research topic, are given primary consideration in the preparation of the course of study. The student's advisory committee will assist in the definition of a diversified program to ensure competence as a practicing engineer.

Primary Areas of Faculty Research: Alternative sources of chemicals and fuels; biochemical and bioprocess engineering; biomaterials; catalysis and reaction engineering; chemical and biochemical separations; chemical process safety and hazard assessment; engineering education; materials science for nanomaterials and microelectronics; membrane materials and process engineering; statistical mechanics and molecular modeling; sustainability and life cycle analysis.

M.S.Ch.E in Chemical Engineering

Admission to the Degree Program: The specific requirements for admission to the program and completion of an advanced degree in chemical engineering are determined by the Graduate School of the University of Arkansas and the Graduate Studies Committee of the Ralph E. Martin Department of Chemical Engineering. A general summary of departmental requirements is given below and detailed information may be obtained from the Chemical Engineering website (http://chemical-engineering.uark.edu/).

An undergraduate or M.S. degree in chemical engineering is recommended for admission to the graduate program, but students with a B.S. in another field of engineering or in a natural science may also enter the program by first taking certain undergraduate chemical engineering courses to prepare them for graduate study. The requirements for admission to the department's graduate program are:

- A grade point average of 3.0 out of 4.0 in a B.S. or M.S. in chemical engineering or, if the student does not have a degree in chemical engineering, satisfactory completion of the department's undergraduate deficiency program.
- A minimum GRE score of 155 on the quantitative section of the exam and a minimum of 307 combined score on the quantitative and verbal sections, taken within five years prior to application.
- Students without a B.S. degree from a U.S. university will need a minimum score on one of the following English proficiency exams: TOEFL paper exam – 550; iBT computer exam – 80; or IELTS – 6.5. The test must have been taken within two years prior to application.
- To enter the Ph.D. program, a majority vote by the Graduate Studies Committee of the Ralph E. Martin Department of Chemical Engineering is required.

Financial aid may be available for the student's stipend and/or tuition on a case-by-case basis. This is decided in the department.

Details about these requirements are in the Chemical Engineering Department Graduate Student Handbook, available as a downloadable PDF (http://chemical-engineering.uark.edu/academics/graduate-program/hestekin-fall-handbook.pdf).

Research Program: The thesis M.S. degree and the Ph.D. degree involve an interactive, hands-on program that exposes the graduate student to the techniques, procedures, and philosophy necessary for successful and ethical research. The students will work closely with their supervising professor and committee to perform original research on a topic of importance to the profession. The student will participate in the planning, managerial, budgetary, experimental, and reporting aspects of his/her research projects. The result will be a thesis (for the thesis master's degree) or a dissertation (for the Ph.D.), both of which should result in at least one journal or conference publication for the student. Active research interests of the faculty are listed on the department's research page (http://chemical-engineering.uark.edu/research/).

Requirements for the non-thesis M.S. Degree: At least 30 hours of course work as follows:

MATH 4423 [1]	3
CHEG 5113	3
CHEG 5133	3
CHEG 5333	3
CHEG 6123	3
Nine hours of a 4000 or 5000 level CHEG course [2]	9
Six hours of any 4000, 5000 or 6000 level technical electives [3]	6
CHEG 5801 (this should be taken every semester)	
Assisting in departmental teaching is required.	
Total Hours	**30**

1. Because this is an undergraduate course, additional work will be required by the instructor for graduate credit. In addition to this course, the non-thesis student will be able to present only three more hours of 3000-level credit for the degree, with the permission of the advisory committee.
2. Not to exceed 3 hours of 4000 level credit. These electives must be lecture courses, not a special project, seminar or independent research topic.
3. Not to exceed 3 hours of 4000 level credit. These electives must be lecture courses, not a special project, seminar or independent research topic.

Students should also be aware of Graduate School requirements with regard to master's degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#mastersdegreestext).

Requirements for the thesis M.S. Degree: At least 24 hours of course work and six hours of thesis as follows:

MATH 4423	[1]	3
CHEG 5113		3
CHEG 5133		3
CHEG 5333		3
CHEG 6123		3
Three hours of a 4000 or 5000 level CHEG course	[2]	3
Six hours of any 4000, 5000 or 6000 level technical electives	[3]	6
CHEG 600V		6
CHEG 5801	(this should be taken every semester)	
Research resulting in a successfully defended thesis and assisting in departmental teaching are required.		
Total Hours		**30**

[1] Because this is an undergraduate course, additional work will be required by the instructor for graduate credit. The thesis student will not be able to present any additional hours of 3000 level credit for the degree.

[2] Not to exceed 3 hours of 4000 level credit. These electives must be lecture courses, not a special project, seminar or independent research topic.

[3] These electives must be lecture courses, not a special project, seminar or independent research topic.

Students should also be aware of Graduate School requirements with regard to master's degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#mastersdegreestext).

Ph.D. in Chemical Engineering

The Ph.D. degree involves an interactive, hands-on program that exposes the graduate student to the techniques, procedures, and philosophy necessary for successful and ethical research. The students will work closely with their supervising professor and committee to perform original research on a topic of importance to the profession. The student will participate in the planning, managerial, budgetary, experimental, and reporting aspects of his/her research projects. The result will be a dissertation, which should result in multiple journal or conference publication for the student. Active research interests of the faculty are listed on the department's research page (http://chemical-engineering.uark.edu/research/).

Requirements for the Ph.D. Degree: At least 33 hours of course work and 39 hours of dissertation as follows:

MATH 54203	Introduction to Partial Differential Equations	3
CHEG 51103	Transport Processes I	3
CHEG 51303	Advanced Reactor Design	3
CHEG 53303	Advanced Thermodynamics	3
CHEG 61203	Transport Processes II	3
3 hours of a 5000 or 6000 level CHEG course		3
12 hours of any 5000 or 6000 level technical electives		12
CHEG 58001	Graduate Seminar (this should be taken every semester)	3
CHEG 7000V	Doctoral Dissertation	39
Research resulting in successfully defended dissertation and assisting in departmental teaching are required.		
Total Hours		**72**

[1] International or non-engineering BS students must take a design course as one of their electives in addition to the above list.

Students should also be aware of Graduate School requirements with regard to doctoral degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#phdandedddegreestext).

Graduate Faculty

Ackerson, Michael D., Ph.D. (University of Arkansas), M.S., B.S. (University of Missouri-Rolla), Associate Professor, 1986, 1997.

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.

Carreon Garciduenas, Maria de Lourdes, Ph.D. (University of Louisville), M.S., B.S. (Universidad Michoacana), Associate Professor, 2023.

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.

Nayani, Karthik, Ph.D. (Georgia Institute of Technology), B.S.Ch.E. (Indian Institute of Technology, Kanpur), Assistant Professor, 2020.

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 50103. Membrane Separation and System Design. 3 Hours.
Theory and system design of cross flow membrane process--reverse osmosis, nanofiltration, ultrafiltration, and microfiltration--and applications for pollution control, water treatment, food and pharmaceutical processing. (Typically offered: Irregular)

CHEG 50403. Colloid and Interface Science. 3 Hours.
This course aims to provide essential knowledge about surface, interface, and molecular self-organization. At the end of this course students should understand (i) basic concepts to describe phenomena at surfaces, (ii) molecular self-organization, and (iii) basic techniques for characterization of surfaces and interfaces. (Typically offered: Spring Odd Years)

CHEG 51103. Transport Processes I. 3 Hours.
Fundamental concepts and laws governing the transfer of momentum, mass, and heat. (Typically offered: Fall)

CHEG 51303. Advanced Reactor Design. 3 Hours.
Applied reaction kinetics with emphasis on the design of heterogeneous reacting systems including solid surface catalysis, enzyme catalysis, and transport phenomena effects. Various types of industrial reactors, such as packed bed, fluidized beds, and other non-ideal flow systems are considered. (Typically offered: Spring)

CHEG 52703. 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. (Typically offered: Spring)

CHEG 53303. Advanced Thermodynamics. 3 Hours.
Methods of statistical thermodynamics, the correlation of classical and statistical thermodynamics, and the theory of thermodynamics of continuous systems (non-equilibrium thermodynamics). (Typically offered: Fall)

CHEG 54403. Chemical Engineering Design II. 3 Hours.
A capstone design class designed for graduate students who do not have an engineering degree. 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 may not receive credit for both CHEG 44403 and CHEG 54403. Prerequisite: Graduate standing. (Typically offered: Fall and Spring)

CHEG 55103. Biochemical Engineering Fundamentals. 3 Hours.
An introduction to bioprocessing with an emphasis on modern biochemical engineering techniques and biotechnology. Topics include: basic metabolism (procaryote and eucaryote), biochemical pathways, enzyme kinetics (including immobilized processes), separation processes (e.g. chromatography) and recombinant DNA methods. Material is covered within the context of mathematical descriptions (calculus, linear algebra) of biochemical phenomenon. (Typically offered: Spring Even Years)

CHEG 57303. Polymer Science and Engineering. 3 Hours.
Synthesis, characterization, and application for polymers and multi-component polymer materials are presented. Topics include polymer science principles, commercial and research practices, processing, and recycling. (Typically offered: Irregular)

CHEG 57703. Medical Applications of Membranes Theory, Current Uses, and Development Areas. 3 Hours.
The course will cover most present-day medical products, treatments, and surgical equipment that rely on membrane transport and/or separation to function effectively. Membranes or membrane devices are used when certain human organs stop working or lose some degree of effectiveness. Those that will be covered in this course include the kidney, the pancreas, the lungs, the skin, and the eye. Localized, controlled-release of medications is also an area where membranes are used in medicine and this area will be described also. Along with dialysis, other external membrane treatment processes such as membrane plasmapheresis (a process whereby a membrane is used to separate blood cells from plasma and thereby opening the door for more effectively treating the cells or plasma separately outside of the body) will be discussed. (Typically offered: Irregular)

CHEG 58001. Graduate Seminar. 1 Hour.
Students hear and present oral presentations on innovations in a variety of chemical engineering subjects with special emphasis on new developments. Prerequisite: Graduate standing. (Typically offered: Fall and Spring) May be repeated for up to 12 hours of degree credit.

CHEG 5880V. Special Problems. 1-6 Hour.
Opportunity for individual study of an advanced chemical engineering problem not sufficiently comprehensive to be a thesis. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.

CHEG 59203. Introduction to Sustainable Process Engineering. 3 Hours.
This course considers the role of engineers in the pursuit of a sustainable future. Broad topics will be addressed including Principles of Sustainability, Sustainable Materials, Renewable Energies, Life Cycle Analyses, and Sustainable Engineering Design Principles. The course will include lectures, open-ended discussions, guest speakers, and case studies. Students may not receive credit for both CHEG 49203 and CHEG 59203. (Typically offered: Irregular)

CHEG 6000V. Master's Thesis. 1-6 Hour.
Master's Thesis. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

CHEG 61203. Transport Processes II. 3 Hours.
Continuation of CHEG 51103. Prerequisite: CHEG 51103. (Typically offered: Spring)

CHEG 6880V. Special Topics in Chemical Engineering. 1-3 Hour.
Advanced study of current Chemical Engineering topics not covered in other courses. Prerequisite: Doctoral students only. (Typically offered: Fall, Spring and Summer) May be repeated for up to 3 hours of degree credit.

CHEG 7000V. Doctoral Dissertation. 1-18 Hour.
Doctoral Dissertation. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.