Chemical Engineering (CHEG)

David Ford
Professor and Department Head
3202 Bell Engineering Center
479-575-4951
Email: daveford@uark.edu

Christa N. Hestekin
Graduate Coordinator
3202 Bell Engineering Center
479-575-3416
Email: chesteki@uark.edu

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

Degrees Conferred:
M.S.Ch.E. (CHEG)
Ph.D. in Engineering (CHEG) (See Engineering (http://catalog.uark.edu/graduatecatalog/programssofstudy/engineeringcollegefengri))

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:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 4423</td>
<td>Introduction to Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5113</td>
<td>Transport Processes I</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5133</td>
<td>Advanced Reactor Design</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5333</td>
<td>Advanced Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 6123</td>
<td>Transport Processes II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Nine hours of a 4000 or 5000 level CHEG course</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Six hours of any 4000, 5000 or 6000 level technical electives</td>
<td>6</td>
</tr>
<tr>
<td>CHEG 5801</td>
<td>Graduate Seminar (this should be taken every</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>semester)</td>
<td></td>
</tr>
</tbody>
</table>

Assisting in departmental teaching is required.

Total Hours: 31

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.
### Requirements for the thesis M.S. Degree:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 4423</td>
<td>Introduction to Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5113</td>
<td>Transport Processes I</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5133</td>
<td>Advanced Reactor Design</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5333</td>
<td>Advanced Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 6123</td>
<td>Transport Processes II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Three hours of a 4000 or 5000 level CHEG course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Six hours of any 4000, 5000 or 6000 level technical electives</td>
<td>6</td>
</tr>
<tr>
<td>CHEG 600V</td>
<td>Master’s Thesis</td>
<td>6</td>
</tr>
<tr>
<td>CHEG 5801</td>
<td>Graduate Seminar (this should be taken every semester)</td>
<td>1</td>
</tr>
</tbody>
</table>

Research resulting in a successfully defended thesis and assisting in departmental teaching are required.

Total Hours: 31

---

1. Because this is an undergraduate course, additional work will be required by the instructor for graduate credit.
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.

---

### Ph.D. in Chemical Engineering

#### Requirements for the Ph.D. Degree:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 4423</td>
<td>Introduction to Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5113</td>
<td>Transport Processes I</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5133</td>
<td>Advanced Reactor Design</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 5333</td>
<td>Advanced Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 6123</td>
<td>Transport Processes II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>6 hours of a 4000 or 5000 level CHEG course</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>18 hours of any 4000, 5000 or 6000 level technical electives</td>
<td>18</td>
</tr>
<tr>
<td>CHEG 5801</td>
<td>Graduate Seminar (this should be taken every semester)</td>
<td>3</td>
</tr>
<tr>
<td>CHEG 700V</td>
<td>Doctoral Dissertation</td>
<td>30</td>
</tr>
</tbody>
</table>

Research resulting in successfully defended dissertation and assisting in departmental teaching are required.

Total Hours: 72

---

1. Because this is an undergraduate course, additional work will be required by the instructor for graduate credit.
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.

---

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

### Graduate Faculty

- **Ackerson, Michael D.**, Ph.D. (University of Arkansas), M.S.Ch.E., B.S.Ch.E. (University of Missouri-Rolla), Associate Professor, 1986.
- **Babcock, Robert Earl**, Ph.D., M.S.Ch.E., B.S. (University of Oklahoma), Professor, 1965.
- **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), 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), Assistant Professor, 2015.
- **Havens, Jerry A.**, Ph.D. (University of Oklahoma), M.S.Ch.E. (University of Colorado-Boulder), B.S.Ch.E. (University of Arkansas), Distinguished Professor, 1970.
- **Herman, Jeremy J.**, Ph.D. (University of Arkansas), B.S.Ch.E. (University of Toledo), Clinical Assistant Professor, 2013.
- **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.
- **Roper, Donald K.**, Ph.D. (University of Wisconsin-Madison), B.S., B.S.Ch.E. (Brigham Young University), Associate Professor, 2008.
- **Servoss, Shannon**, Ph.D. (Northwestern University), B.S.Ch.E. (University of Michigan-Ann Arbor), Associate Professor, 2007.
- **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.
- **Walker, Heather L.**, Ph.D., M.S.Ch.E., B.S.Ch.E. (University of Arkansas), Clinical Assistant Professor, 2008.
- **Wickramasinghe, Ranil**, Ph.D. (University of Minnesota-Twin Cities), M.S., B.S. (University of Melbourne, Australia), Professor, 2011.

### Courses

- **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.

- **CHEG 5033. 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.

- **CHEG 5013. 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: Senior or graduate standing.
CHEG 5043. 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.

CHEG 5113. Transport Processes I. 3 Hours.
Fundamental concepts and laws governing the transfer of momentum, mass, and heat.

CHEG 5133. 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.

CHEG 5213. Advanced Chemical Engineering Calculations. 3 Hours.
Developments of and solutions of equations and mathematical models of chemical processes and mechanisms.

CHEG 5273. 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.

CHEG 5333. 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).

CHEG 5353. Advanced Separations. 3 Hours.
Phase equilibrium in non-ideal and multicomponent systems, digital and other methods of computation are included to cover the fundamentals of distillation, absorption, and extraction.

CHEG 5513. 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.

CHEG 5733. Polymer Theory and Practice. 3 Hours.
Theories and methods for converting monomers into polymers are presented. Topics include principles of polymer science, commercial processes, rheology, and fabrication.

CHEG 5801. Graduate Seminar. 1 Hour.
Oral presentations are given by master's candidates on a variety of chemical engineering subjects with special emphasis on new developments. Prerequisite: Graduate standing.

CHEG 588V. 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. May be repeated for up to 6 hours of degree credit.

CHEG 600V. Master's Thesis. 1-6 Hour.
Master's Thesis. Prerequisite: Graduate standing. May be repeated for degree credit.

CHEG 6123. Transport Processes II. 3 Hours.
Continuation of CHEG 5113. Prerequisite: CHEG 5113.

CHEG 6203. Preparation of Research Proposals. 3 Hours.
This course will cover technical communication in both written and oral presentation. Prerequisite: Instructor consent.

CHEG 6801. Graduate Seminar. 1 Hour.
Oral presentations are given by doctoral students on a variety of chemical engineering subjects with special emphasis on new developments. Prerequisite: Graduate standing.

CHEG 688V. Special Topics in Chemical Engineering. 1-3 Hour.
Advanced study of current Chemical Engineering topics not covered in other courses. Prerequisite: Doctoral students only. May be repeated for up to 3 hours of degree credit.

CHEG 700V. Doctoral Dissertation. 1-18 Hour.
Doctoral Dissertation. May be repeated for degree credit.