# Chemical And Biomolecular Engineering

## Department Information

| Department of Chemical and Biomolecular Engineering Staff | (251) 460-6160 |
|---|---|
| Chair | F. Carl Knopf |
| Professors | Knopf, Leavesley, Sylvester, West |
| Associate Professors | Glover, Wheeler |
| Assistant Professors | Rabideau, Walker |

Department of Chemical and Biomolecular Engineering website
https://www.southalabama.edu/colleges/engineering/chbe/index.html

Chemical Engineering is a profession in which knowledge of mathematics, chemistry, biology and other natural sciences gained by study, experience, and practice is applied with judgment to develop economical ways of using material and energy for the benefit of mankind. The program required for the degree of Bachelor of Science in Chemical Engineering provides fundamental instruction in mathematics, chemistry, biology, physics, and engineering. This education prepares the graduate to seek employment in petrochemical, pharmaceutical, healthcare, microelectronics, polymers, energy and environmental industries. In addition, the graduate is well-prepared to pursue graduate school.

All electives must be approved by the student's advisor. Degree requirements include a minimum of 18 semester hours of approved electives in the Humanities and Social Sciences.

Satisfactory completion of the 126 hour program outlined below leads to a Bachelor of Science in Chemical Engineering. Students must also comply with the College of Engineering Requirements for a Degree, which are covered in the Bulletin under the College of Engineering.

### BSChE Program Educational Objectives

The educational objectives of the Department of Chemical & Biomolecular Engineering's undergraduate program are that, within a few years of program completion, graduates will have used the knowledge and skills gained through academic preparation and post-graduation experience so they have:

1. Advanced in the chemical engineering profession and applied engineering knowledge and problem-solving skills to multi-disciplinary projects.
2. Incorporated economic environmental, social, regulatory, constructability, safety, and sustainability considerations into the practice of chemical engineering.
3. Exhibited effective communication skills, teamwork, leadership, initiative, project management, and professional and ethical behavior.
4. Continued their technical and professional development, which may include graduate level education, continuing education, and participation in professional organizations.

### BSChE Student Outcomes

By the time of graduation from the BSChE program, a student will have demonstrated attainment of the following outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. 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.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The BSChE curriculum is designed to ensure the attainment of the student outcomes.

The Bachelor of Science in Chemical Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org

### BSCHE Accelerated Bachelor's – Master's (ABM) Degree Option

The Department of Chemical and Biomolecular Engineering allows well-qualified undergraduates in the program to follow an "Accelerated Bachelor's to Master's" study plan. This plan permits up to six credit hours of graduate coursework to count towards both the bachelor's (as Technical Electives) and the master's degrees, so that the master's degree is earned faster than usual. (The coursework concerned must individually satisfy the requirements of both degrees.) See a departmental advisor for specific details.

## Areas Of Study

Chemical Engineering (BS)
Chemical Engineering (MS)

## Courses

## Chemical Engineering (CHE)

**CHE 190 Special Topics - 1 TO 5 cr**
Topics of current Chemical Engineering interest. Requires permission of department chair. Fee.

**CHE 203 Material & Energy Balances 4 cr**
Application of multicomponent material and energy balances to chemical processes involving phase changes and chemical reactions. Minimum grade of 'C' is required and only 2 attempts are permitted. Fee
Pre-requisite: CH 132 Minimum Grade of C and CH 132L Minimum Grade of C and MA 126 Minimum Grade of C and (EH 101 Minimum Grade of C or EH 105 Minimum Grade of C or ACT English 27 or SAT Critical Reading 610 or READING TEST SCORE 33 or University - EH101 Exempt P ).

**CHE 290 Special Topics - 1 TO 5 cr**
Topics of current chemical engineering interest. Requires consent of department chair. Fee.

**CHE 311 CHE Separations I 3 cr**
Applications of material balances and equilibrium relations to equilibrium stage design. Design of single stages and cascades for absorption, stripping, distillation, liquid-liquid extraction, and bioseparations. Fee.
Co-requisite: CHE 331
Pre-requisite: CHE 203 Minimum Grade of C.

**CHE 321 Transport Phenomena I 3 cr**
Fundamentals of momentum transfer with applications in fluid flow through pipes and process equipment. Fee.
Pre-requisite: MA 238 Minimum Grade of C and CHE 203 Minimum Grade of C and PH 201 Minimum Grade of C.

**CHE 322 Transport Phenomena II 3 cr**
Fundamentals of conductive, convective, and radiative modes of heat transfer with applications in the design of heat exchanges. Fee.
Pre-requisite: CHE 321 Minimum Grade of C.

**CHE 331 CHE Thermodynamics I 3 cr**
This course introduces the fundamentals of thermophysical property estimation and modeling of non-ideal pure and multicomponent fluid systems, including an introduction to multicomponent vapor/liquid equilibria. Fee.
Co-requisite: CHE 351
Pre-requisite: CH 201 Minimum Grade of C and CHE 203 Minimum Grade of C and MA 238 Minimum Grade of C and CH 201L Minimum Grade of C and PH 201 Minimum Grade of C.

**CHE 332 CHE Thermodynamics II 3 cr**
This class is an advanced thermodynamics course that uses a molecular level viewpoint to introduce students to applications of thermodynamics principles to complex chemical engineering problems including multicomponent, non-ideal fluid phase equilibria (VLE, VLLE, SLE), and chemical reaction equilibria. The concepts of chemical potential, fugacity, partial molar and excess properties as well as complex activity coefficient models are introduced to solve these problems. Fee.
Co-requisite: CHE 352
Pre-requisite: CHE 331 Minimum Grade of C.

**CHE 342 Engineering Communication - W 3 cr**
Formal and informal reports, oral presentations, and visual aids. Fee.
Co-requisite: CHE 352
Pre-requisite: EH 102 Minimum Grade of C or EH 105 Minimum Grade of C.

**CHE 351 Modeling Lab 1 cr**
Computational tools and numerical methods for solving chemical engineering problems. Fee.
Co-requisite: CHE 311, CHE 331

**CHE 352 Measurement Lab 1 cr**
Laboratory practices for measurement of reaction and phase change parameters. Statistical tools for assessing experimental data. Fee.
Co-requisite: CHE 332, CHE 372
Pre-requisite: CHE 351 Minimum Grade of C.

**CHE 372 Chemical Reactor Design 3 cr**
Fundamentals of systems involving chemical reactions, including batch and flow systems. Design of thermal and catalytic systems with single and multiple reactions. Analysis of kinetic data and mechanisms. Fee.
Co-requisite: CHE 322, CHE 332
Pre-requisite: CHE 331 Minimum Grade of C.

**CHE 390 Special Topics - 1 TO 5 cr**
Topics of current chemical engineering interest. Requires consent of department chair. Fee.

**CHE 421 CHE Separations II 3 cr**
Fundamentals of mass transfer. Mass, energy, and momentum transfer analogies. Design of mass transfer equipment. Fee.
Pre-requisite: CHE 311 Minimum Grade of C and CHE 322 Minimum Grade of C.

**CHE 441 Chem Engr Ops Lab I - W 2 cr**
Laboratory Studies of the unit operations of chemical engineering with emphasis on momentum and heat transfer. Fee.
Pre-requisite: CHE 322 Minimum Grade of C and CHE 342 Minimum Grade of C and CHE 351 Minimum Grade of C and CHE 352 Minimum Grade of C.

**CHE 442 Chem Engr Ops Lab II - W 2 cr**
Laboratory studies of the unit operations of chemical engineering with emphasis on stage-wise and differential contactors. Fee.
Pre-requisite: CHE 441 Minimum Grade of C and CHE 311 Minimum Grade of C and CHE 421 Minimum Grade of C. CHE 441 can be taken concurrently with this course.

**CHE 451 Process Models 3 cr**
Mathematical modeling, simulation, and dynamics of chemical process systems for design and analysis. Fee.
Pre-requisite: CHE 322 Minimum Grade of C.

**CHE 452 Process Dynamics and Control 3 cr**
Mathematical modeling, simulation and dynamics of chemical process systems. Feedback and Feed-forward control of chemical processes. Specification of control loops. Selection and tuning of controller modes. Fee.
Pre-requisite: CHE 372 Minimum Grade of C.

**CHE 461 Process Design I 3 cr**
Engineering economics and elements of process design, including energy and material balances, manufacturing and product cost. Unit operation equipment sizing, and cost. This course is considered a "Senior Capstone Design" course. Fee.
Pre-requisite: EG 231 Minimum Grade of C and CHE 332 Minimum Grade of C and CHE 342 Minimum Grade of C and CHE 372 Minimum Grade of C.

**CHE 462 Process Design II 3 cr**
Selection, design and specification of principal chemical processes. This course is considered a "Senior Capstone Design" course. Fee.
Pre-requisite: CHE 461 Minimum Grade of C.

**CHE 463 Simulation of Chemical Process 3 cr**
In this course, students utilize modern software tools, such as Aspen Plus, to model steady rate chemical processes. Simulation topics include physical property selection, flowsheet generation, separations, and reactors. Fee.
Pre-requisite: CHE 311 Minimum Grade of C and CHE 332 Minimum Grade of C and CHE 372 Minimum Grade of C.

**CHE 490 Special Topics 1 TO 3 cr**
Topics of current chemical engineering interest. Requires consent of department chair or departmental approval. Fee.

**CHE 494 Directed Studies 1 TO 3 cr**
Directed study, under the guidance of a faculty advisor, of a topic from the field of chemical engineering, not offered in a regularly scheduled course. A written report is required. May be repeated for a maximum of 6 credit hours. Requires consent of the department chair and minimum GPA of 3.00 for admission or departmental approval. Fee.

**CHE 499 Honors Senior Project 1 TO 6 cr**
Under the advice and guidance of a faculty mentor, honors students will identify and carry out a research project, relevant to the field of chemical engineering. The senior project will be judged and graded by three faculty chaired by the honors mentor. This course is required for Honors recognition. A minimum of 4 credit hours is required, but students may enroll for a maximum of 6 credit hours over two semesters. Requires completion of an approved project prospectus.
Pre-requisite: CHE 322 Minimum Grade of C and CHE 332 Minimum Grade of C.

**CHE 501 Chemical Engineering Seminar 0 TO 1 cr**
A weekly research seminar for Chemical Engineering graduate students. Students will attend research presentations by faculty, invited speakers and other students rehearsing for their proposal presentations, thesis defenses or conference presentations. Topics will include research, research methods, safety and responsible conduct of research.

**CHE 510 Adv Chemical Thermodynamics 3 cr**
Advanced classical and molecular thermodynamics as applied to non-ideal multicomponent phase and reaction equilibria for chemical engineering applications. An introduction to statistical thermodynamics will also be given. Fee.

**CHE 520 Adv Transport Phenomena I 3 cr**
An advanced treatment of the principles and methods of transport phenomena. Detailed coverage of several key aspects of energy and momentum transfer including creeping flows, boundary layers and lubrication theory.

**CHE 521 Adv Transport Phenomena II 3 cr**
An advanced treatment of the principles and methods of mass transfer, diffusion and adsorption phenomena. Coverage of conservation equations, mass transfer at interfaces and boundary conditions. Includes coverage of adsorption and diffusion on surfaces, porous structures and membranes.

**CHE 525 Chemical Reactor Analysis 3 cr**
Design, modeling and analysis of non-ideal chemical reactor systems. Includes effects of mass transfer in heterogeneous catalytic reactors, non-steady-state heat transfer and residence time distributions.

**CHE 530 Synthetic Fuels 3 cr**
Fundamentals of gasification and liquefaction concepts applied to fossil fuels and biomass conversion.

**CHE 550 Chemical Process Control 3 cr**
Sampled-data algorithms, feedback, feedforward, deadtime compensation, advanced control schemes applied to chemical engineering processes. Fee.

**CHE 551 Adv Chem Engineering Modeling 3 cr**
Advanced mathematical modeling of chemical process systems for design and analysis.

**CHE 563 Simulation of Chem Processes 3 cr**
In this course, students utilize modern software, tools, such as Aspen Plus, to model steady state chemical processes. Simulation topics include physical property selection, flowsheet generation, separations and reactors. Fee.

**CHE 570 Separation Processes 3 cr**
Analysis and design of separation processes. Topics include molecular diffusion and convective mass transfer with applications in the chemical, petroleum and pharmaceutical industries. Fee.

**CHE 575 Chem Proc Synth Optimization 3 cr**
Use of analysis, synthesis, and optimization in process development. Fee.

**CHE 580 Chem Process Safety and Design 3 cr**
Fundamental principles of chemical process safety, fires and explosions and design for the mitigation of associated hazards. Fee.

**CHE 590 Special Topics - 3 cr**
Topics of current chemical engineering interest. Requires consent of the department chair or departmental approval. Fee.

**CHE 592 Directed Independent Study 1 TO 6 cr**
Directed study, under the guidance of a faculty advisor, of a topic from the field of chemical engineering, not offered in a regularly scheduled course. A written report is required. Requires consent of the department chair and overall minimum GPA of 2.5 for admission or departmental approval. Fee.

**CHE 594 Project in Chem Engineering 3 cr**
Approved investigation of original problems under direction of a faculty member. Requires approved prospectus. Fee.

**CHE 599 Thesis 1 TO 6 cr**
May be taken more than once. Only 6 hours may be applied for credit toward a degree. Requires approved prospectus. Fee.

# Faculty

GLOVER, THOMAS G.
Associate Professor
BS, Georgia Inst of Tech - Main
PHD, Vanderbilt University

KNOPF, FREDERICK C.
Professor
BSCHE, Ohio State U-Main Campus
MS, Ohio State U-Main Campus
PHD, Purdue University-Main Campus

LEAVESLEY, SILAS J.
Professor
BS, Florida State University
PHD, Purdue University-Main Campus

RABIDEAU, BROOKS D.
Assistant Professor
BS, Northwestern University
PHD, University of Texas- Austin

SYLVESTER III, NICHOLAS D.
Professor
BS, Ohio University
PHD, Carnegie Mellon University

USHER, JOHN M.
Professor
BS, University of Florida
MS, Louisiana State University
MS, Louisiana State University
PHD, Louisiana State University

WALKER, SEAN
Assistant Professor
MAS, Univ of Waterloo
BAS, Univ of Waterloo
PHD, Univ of Waterloo

WEST, CHRISTY W.
Associate Professor
BS, University of Alabama
PHD, Georgia Inst of Tech - Main

WEST, KEVIN N.
Professor
BS, University of Virginia
PHD, Georgia Inst of Tech - Main