

ARTIE MCFERRIN DEPARTMENT OF CHEMICAL ENGINEERING

Chemical engineering is a broad field of engineering and thus requires a diverse preparation in science and engineering. Distinguishing chemical engineering from other engineering disciplines is its use of chemical and biochemical reactions to produce products and materials for society. Traditionally, chemical engineers have provided leadership in the petrochemical, refining, chemical, polymer, and food processing industries. Because of strengths in the foundation sciences of mathematics, chemistry, physics and biology, as well as in engineering, this leadership role has now extended to the biochemical, biomedical, high-tech materials, semi-conductor and microelectronics, nanotechnology, environmental quality, safety, and a host of other areas. Chemical engineers have consistently commanded starting salaries among the highest of all college graduates because of the combined breadth and depth of their education.

The mission of the Artie McFerrin Department of Chemical Engineering at Texas A&M is to educate and prepare students for national and international leadership roles in industry, government, and academia; to attract top students to chemical engineering; to define and develop new directions in chemical engineering fundamentals and practices, and in chemical engineering education and curricula; to be a valuable resource and service base to the State and to industry; and to provide leadership in solving problems of social and economic importance.

Objectives of the chemical engineering program are that

1. graduates will have successful chemical engineering careers in industry, academia or government,
2. graduates will obtain, apply and transfer knowledge across disciplines and into emerging areas of chemical engineering and related fields,
3. graduates will communicate effectively, be leaders in their fields and work competently in interdisciplinary teams, and
4. graduates will be professionally responsible and ethical and engage in professional activities to impact the society on a global scale.

To supplement coursework, well-equipped laboratories provide our students with experiences in operating and analyzing a variety of unit operations and process control equipment and in the use of the modern computational tools and software used in chemical engineering. The department offers vibrant undergraduate research, co-op and study abroad programs that provide students with additional enrichment and experiential opportunities.

The undergraduate program in Chemical Engineering at Texas A&M University is accredited by the Engineering Accreditation Commission of ABET, www.abet.org, and compares favorably with the best in the nation.

Before commencing course work in the major, students must be admitted to the major or have the approval of the department.

Faculty

Akbulut, Mustafa, Associate Professor
Chemical Engineering
PHD, University of California, Santa Barbara, 2007

Balbuena, Perla B, Professor
Chemical Engineering
PHD, University of Texas, 1996

Cheng, Zheng Dong, Professor
Chemical Engineering
PHD, Princeton University, 1999

El-Halwagi, Mahmoud M, Professor
Chemical Engineering
PHD, University of California, Los Angeles, 1990

Elabd, Yossef A, Professor
Chemical Engineering
PHD, Johns Hopkins University, 2001

Glover, Charles J, Senior Professor
Chemical Engineering
PHD, Rice University, 1975

Green, Micah, Associate Professor
Chemical Engineering
PHD, Massachusetts Institute of Technology, 2007

Harris, James E, Professor of the Practice
Chemical Engineering
PHD, University of Texas, Austin, 1981

Hasan, M M Faruque, Assistant Professor
Chemical Engineering
PHD, National University of Singapore, 2010

Hilaly, Ahmad K, Professor of the Practice
Chemical Engineering
PHD, Colorado State University, 1992

Holste, James C, Senior Professor
Chemical Engineering
PHD, Iowa State University, 1973

Holtzapfel, Mark T, Professor
Chemical Engineering
PHD, University of Pennsylvania, 1981

Isdale, Charles E, Senior Lecturer
Chemical Engineering
MBA, Southern Illinois University at Edwardsville, 1977

Jayaraman, Arul, Professor
Chemical Engineering
PHD, University of California, Irvine, 1998

Jeong, Hae-Kwon, Associate Professor
Chemical Engineering
PHD, University of Minnesota, 2004

Kao, Katy C, Associate Professor
Chemical Engineering
PHD, University of California, Los Angeles, 2005

Karim, Muhammad N, Professor
Chemical Engineering
PHD, University of Manchester, 1977

Khosravianghadikolaie, Homa, Research Assistant Professor
Chemical Engineering
PHD, University of Illinois at Chicago, 2013

Kravaris, Costas, Professor
Chemical Engineering
PHD, California Institute of Technology, 1984

Kuo, Yue, Professor
Chemical Engineering
PHD, Columbia University, 1980

Kwon, Joseph, Assistant Professor
Chemical Engineering
PHD, University of California, Los Angeles, 2015

Lele, Pushkar P, Assistant Professor
Chemical Engineering
PHD, University of Delaware, Newark, 2010

Lutkenhaus, Jodie L, Associate Professor
Chemical Engineering
PHD, University of Notre Dame, 2003

Mannan, Mahboobul, Professor
Chemical Engineering
PHD, University of Oklahoma, 1986

Mashuga, Chad V, Assistant Professor
Chemical Engineering
PHD, Michigan Technological University, 1999

Menon, Rani, TEES Assistant Research Scientist
Chemical Engineering
PHD, The University of Mississippi, 2011

Pistikopoulos, Efstratios, Professor
Chemical Engineering
PHD, Carnegie Mellon University, 1988

Raftery, Jonathan P, Lecturer
Chemical Engineering
PHD, Texas A&M University, 2018

Rogers, William J, Lecturer
Chemical Engineering
PHD, Ohio State University, 1976

Seminario, Jorge M, Professor
Chemical Engineering
PHD, Southern Illinois University Carbondale, 1987

Sun, Qing, Assistant Professor
Chemical Engineering
PHD, University of Delaware, 2010

Tamamis, Phanourios, Assistant Professor
Chemical Engineering
PHD, University of Cyprus, 2010

Vaddiraju, Sreeram, Associate Professor
Chemical Engineering
PHD, University of Louisville, 2006

White, James D, Senior Lecturer
Chemical Engineering
BA1, Texas A&M University, 1978

Wilhite, Benjamin A, Associate Professor
Chemical Engineering
PHD, University of Notre Dame, 2003

Wilson, Christin M, Lecturer
Chemical Engineering
PHD, The Ohio State University, 2012

Wu, Hung-Jen, Assistant Professor
Chemical Engineering
PHD, Texas A&M University, 2006

Majors

- Bachelor of Science in Chemical Engineering (<http://catalog.tamu.edu/undergraduate/engineering/chemical/bs>)

Minors

- Chemical Engineering Minor (<http://catalog.tamu.edu/undergraduate/engineering/chemical/minor>)

Certificates

- Engineering Therapeutics Manufacturing Certificate (<http://catalog.tamu.edu/undergraduate/engineering/chemical/therapeutics-manufacturing-certificate>)

Courses

CHEN 204 Elementary Chemical Engineering

Credits 3. 2 Lecture Hours. 3 Lab Hours.

Solution of elementary problems by application of mass balances, energy balances and equilibrium relationships.

Prerequisites: Grade of C or better in CHEM 102, CHEM 112, ENGR 112, MATH 152 and PHYS 218; admission to chemical engineering major or approval of department.

CHEN 205 Chemical Engineering Thermodynamics I

Credits 3. 3 Lecture Hours.

First and second laws of thermodynamics; volumetric properties of pure fluids; heat effects; applications to flow processes, power cycles, refrigeration.

Prerequisites: CHEN 204.

CHEN 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours.

Directed study of special projects or studies in chemical engineering processes or operations, for lower division students. Credit not applicable to degree requirements in chemical engineering.

Prerequisites: Freshman or sophomore classification; approval of department head.

CHEN 289 Special Topics in...**Credits 1 to 4. 1 to 4 Lecture Hours.**

Selected topics in an identified area of chemical engineering for lower division students. May be repeated for credit. Credit not applicable to degree requirements in chemical engineering.

Prerequisite: Approval of instructor.**CHEN 301 Engineering Workplace Writing****Credits 3. 3 Lecture Hours.**

Processes for preparing documents commonly developed by engineers in the workplace; database research; electronic collaboration; ethics, planning, drafting, revising, and editing reports, proposals, correspondence, instructions, procedures, and presentations for the engineering workplace; meets ABET communication requirements.

Prerequisites: ENGL 104 or equivalent; junior or senior classification in chemical engineering or approval by CHEN.**CHEN 304 Chemical Engineering Fluid Operations****Credits 3. 3 Lecture Hours.**

Fundamentals of fluid mechanics with applications to design and analysis of process equipment.

Prerequisites: CHEN 204 with a grade of C or better; CHEN 205 or concurrent enrollment; MATH 308 with a grade of C or better.**CHEN 320 Numerical Analysis for Chemical Engineers****Credits 3. 3 Lecture Hours.**

Applications of numerical analysis techniques to mathematical models of processes common to chemical and associated industries; computational methods and software for analysis of chemical engineering processes.

Prerequisites: CHEN 205 with a grade of C or better; MATH 308 with a grade of C or better; or approval of department.**CHEN 322 Chemical Engineering Materials****Credits 3. 3 Lecture Hours.**

Overview of materials science with particular emphasis on classes of materials relevant to chemical engineers.

Prerequisite: Grade of C or better in CHEN 204, MATH 251 or concurrent enrollment, and CHEN 205 or concurrent enrollment; or approval of department.**CHEN 323 Chemical Engineering Heat Transfer Operations****Credits 3. 3 Lecture Hours.**

Heat transfer operations.

Prerequisite: Grade of C or better in CHEN 205 and CHEN 304.**CHEN 324 Chemical Engineering Mass Transfer Operations****Credits 3. 3 Lecture Hours.**

Mass transfer operations with applications to design and analysis of process equipment.

Prerequisites: Grade of C or better in CHEN 354; grade of C or better in CHEN 323 or concurrent enrollment; or approval of department.**CHEN 354 Chemical Engineering Thermodynamics II****Credits 3. 3 Lecture Hours.**

Applications of thermodynamics to pure and mixed fluids; phase equilibria and chemical reaction equilibria.

Prerequisites: CHEN 205 and MATH 308 with a grade of C or better; or approval of department.**CHEN 364 Kinetics and Reactor Design****Credits 3. 3 Lecture Hours.**

Kinetics of reactions and application of fundamental principles to design and operation of commercial reactors.

Prerequisites: Grade of C or better in CHEN 320; grade of C or better in CHEN 323 and CHEN 324, or concurrent enrollment, or approval of department.**CHEN 382 Bioprocess Engineering****Credits 3. 3 Lecture Hours.**

Application of engineering principles to design of biocatalysts and bioprocesses.

Prerequisite: CHEN 205 with a grade of C or better; junior or senior classification.**CHEN 399 Mid-Curriculum Professional Development****Credits 0. 0 Other Hours.**

Participation in an approved high-impact learning practice; reflection on professional outcomes from engineering body of knowledge; documentation and self-assessment of learning experience at mid-curriculum point.

Prerequisites: CHEN 204 and ENGL 210; junior or senior classification or approval of instructor.**CHEN 409 Mathematical Models of Chemical Processes****Credits 3. 3 Lecture Hours.**

Development of the mathematical models of chemical and physical processes common to the petroleum processing, chemical and associated industries.

Prerequisite: CHEN 424.**CHEN 422/BAEN 422 Unit Operations in Food Processing****Credits 3. 2 Lecture Hours. 2 Lab Hours.**

Design of food process engineering systems; basic concepts of rheology and physical properties of foods; fundamentals of heat and mass transfer and process control.

Prerequisites: CHEN 205 and CHEN 304, or ENGR 214.**Cross Listing:** BAEN 422/CHEN 422.**CHEN 425 Process Integration, Simulation and Economics****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Integration, simulation, and economic methods involved in the design of chemical processes and equipment.

Prerequisites: Grade of C or better in CHEN 320, CHEN 323, CHEN 354, and CHEN 424 or concurrent enrollment.**CHEN 426 Chemical Engineering Plant Design****Credits 3. 1 Lecture Hour. 6 Lab Hours.**

Integration of material from other chemical engineering courses with applications to the design of plants and processes representative of the chemical and related process industries.

Prerequisites: Grade of C or better in CHEN 425 and CHEN 364.**CHEN 430/SENG 430 Risk Analysis in Safety Engineering****Credits 3. 3 Lecture Hours.**

Concepts of risk and risk assessment, which uses all available information to provide a foundation for risk-informed and cost-effective engineering practices; examples and exercises are drawn from a variety of engineering areas.

Prerequisite: Junior or senior classification.**Cross Listing:** SENG 430/CHEN 430.

CHEN 431/BAEN 431 Fundamentals in Bioseparations

Credits 3. 2 Lecture Hours. 2 Lab Hours.

Design principles and application of chemical engineering unit operations to the production of therapeutic and bioactive molecules.

Prerequisite: Grade of C or better in BAEN 302, BMEN 282, CHEN 282, or CHEN 382.

Cross Listing: BAEN 431/CHEN 431.

CHEN 432 Chemical Engineering Laboratory I

Credits 2. 1 Lecture Hour. 3 Lab Hours.

Laboratory work based on CHEN 304 and CHEN 323.

Prerequisites: Grade of C or better in CHEN 323 and ENGL 210.

CHEN 433 Chemical Engineering Laboratory II

Credits 2. 1 Lecture Hour. 3 Lab Hours.

Laboratory work based on CHEN 324, CHEN 364, CHEN 432, and CHEN 461.

Prerequisites: Grade of C or better in CHEN 324, CHEN 364, CHEN 432, and CHEN 461.

CHEN 440 Introduction to Transport Phenomena

Credits 3. 3 Lecture Hours.

Unifying principles and analytical description of phenomena of momentum transport (viscous flow), energy transport (heat conduction and convection) and mass transport (diffusion) in continuous media; similarities and differences in these phenomena.

Prerequisite: Senior classification or approval of instructor.

CHEN 450 Microfabrication and Microfluidics Technology

Credits 3. 3 Lecture Hours.

Micro Electro Mechanical Systems (MEMS) technology; study the fundamentals of fluidics, heat and mass transfer, surface chemistry, and electrochemical interactions.

Prerequisite: Junior or senior classification.

CHEN 451 Introduction to Polymer Engineering

Credits 3. 3 Lecture Hours.

Fundamentals of polymer reaction kinetics, morphology, chemical and rheological properties with applications to polymer synthesis, production and processing operations.

Prerequisite: Senior classification in chemical engineering or approval of instructor.

CHEN 455/SENG 455 Process Safety Engineering

Credits 3. 3 Lecture Hours.

Applications of engineering principles to process safety and hazards analysis, mitigation, and prevention, with special emphasis on the chemical process industries; includes source modeling for leakage rates, dispersion, analysis, relief valve sizing, fire and explosion damage analysis, hazards identification, risk analysis, accident investigations.

Prerequisite: Senior classification in any engineering major.

Cross Listing: SENG 455/CHEN 455.

CHEN 456 Advanced Chemical Process Optimization I

Credits 3. 3 Lecture Hours.

State-of-the-art optimization based techniques for process synthesis, process design and process operability; emphasis on mathematical modeling via mixed integer and continuous optimization formulations and application to heat integration problems; use modeling/optimization software systems.

Prerequisites: Senior classification or approval of instructor.

CHEN 457 Environmental Engineering

Credits 3. 3 Lecture Hours.

Overview of environmental engineering for chemical engineers; analyzing and solving environmental problems associated with engineered systems; emphasis on water/wastewater quality and treatment, air pollution control, and soil and hazardous waste management; includes guest lectures and field trips.

Prerequisites: CHEN 304 and CHEN 354 or approval of instructor; junior or senior classification; Qatar campus.

CHEN 458 Fundamentals of Environmental Remediation Processes

Credits 3. 3 Lecture Hours.

Fundamental approach to various remediation technologies; topics in environmental thermodynamics and mass transfer; adsorption, desorption, ion exchange, air stripping extractions, chemical oxidation, biodegradation.

Prerequisites: CHEN 354 and CHEN 424.

CHEN 459 Gas and Petroleum Processing

Credits 3. 3 Lecture Hours.

Design and operation of petroleum and gas processing facilities including hydrate suppression, dehydration, sweetening, sulfur recovery, LPG and liquid recovery, refining operations; analysis of the design and operations involving a large degree of process simulation.

Prerequisites: CHEN 323 and approval of instructor.

CHEN 460/SENG 460 Quantitative Risk Analysis in Safety Engineering

Credits 3. 3 Lecture Hours.

Fundamental concepts, techniques, and applications of risk analysis and risk-informed decision making for engineering students; practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas.

Prerequisite: Senior or graduate classification.

Cross Listing: SENG 460/CHEN 460.

CHEN 461 Process Dynamics and Control

Credits 3. 3 Lecture Hours.

Analysis of process dynamics and methods for the design of automatic control systems for chemical process plants.

Prerequisite: Grade of C or better in CHEN 320 and CHEN 364 or concurrent enrollment.

CHEN 463 Systems Biology

Credits 3. 3 Lecture Hours.

Experimental and computational techniques in systems biology; includes high throughput experiments, data analysis, modeling and simulation; discussed in the context to specific applications such as signal transduction.

Prerequisite: CHEN 382 or approval of instructor.

CHEN 469 Chemical Engineering Car Design

Credit 1. 1 Lecture Hour.

Application of chemical, physical and engineering principles in design process, idea generation and development of design concepts, economic, safety and performance analysis. May be taken four times for credit.

Prerequisites: CHEN 204, CHEN 205; junior or senior classification or approval of instructor.

CHEN 471/BAEN 471 Bioreactor Engineering**Credits 3. 3 Lecture Hours.**

Fundamentals of microbial and enzyme kinetics; basic biochemical reaction theory and reactor systems; heterogeneous reactions and transport considerations in enzyme and cell reactors, and immobilized systems; bioreactor design considerations in bioprocessing.

Prerequisite: Grade of C or better in CHEN 282, CHEN 382, or BAEN 302; junior or senior classification or approval of instructor.

Cross Listing: BAEN 471/CHEN 471.

CHEN 475 Microelectronics Process Engineering**Credits 3. 3 Lecture Hours.**

State-of-the-art process engineering principles on microelectronics, especially for the fabrication of very large scale integrated circuits (VLSICs); fundamental unit processes, such as thin film deposition, thermal growth, lithography, etching and doping, material structures and properties, and basic device operation principles.

Prerequisites: CHEN 354 and CHEN 464 or approval of instructor; CHEM 322.

CHEN 476 Applied Catalysis**Credits 3. 3 Lecture Hours.**

Principles of catalysis and applications to industrial reactions; catalyst preparation, methods for catalyst characterization, deactivation mechanisms and regeneration techniques, catalyst testing (laboratory and industrial reactors), fundamentals of kinetics of heterogeneous reactions; applications to selected industrial processes.

Prerequisites: CHEN 354; CHEN 464 or registration therein; junior or senior classification; Qatar campus.

CHEN 481 Seminar**Credit 1. 2 Lab Hours.**

Preparation of oral and written reports on selected topics from recent technical publications.

Prerequisites: Senior classification in chemical engineering; grade of C or better in CHEN 432 or concurrent enrollment and ENGL 210.

CHEN 485 Directed Studies**Credits 1 to 5. 1 to 5 Other Hours.**

Work covers one or more problems in chemical engineering processes or operations.

Prerequisite: Approval of department head.

CHEN 489 Special Topics in...**Credits 1 to 4. 1 to 4 Lecture Hours.**

Selected topics in an identified area of chemical engineering. May be repeated for credit.

Prerequisite: Senior classification in chemical engineering or approval of instructor.

CHEN 491 Research**Credits 0 to 4. 0 to 4 Other Hours.**

Research conducted under the direction of faculty member in chemical engineering. May be repeated 2 times for credit.

Prerequisites: Junior or Senior classification and approval of instructor.