ARTIE MCFERRIN  
DEPARTMENT OF CHEMICAL  
ENGINEERING

http://engineering.tamu.edu/chemical

Head: M. N. Karim

Graduate Advisor: A. Jayaraman

The Department of Chemical Engineering offers three graduate degrees: Doctor of Philosophy (PhD), Master of Science (MS), and Master of Engineering (MEng). The PhD and MS degree programs include a significant research component in addition to graduate coursework. Information about specific departmental requirements for coursework and examinations is available upon request from the graduate advisor and on our website: http://engineering.tamu.edu/chemical.

Some of the research areas available within the department include: advanced materials, applied fluid mechanics and transport phenomena, catalysis, kinetics and reaction engineering, microelectronics and plasma processing, nanotechnology, polymers, process modeling and control, process optimization, process safety and design, systems biology, thermodynamics, and molecular simulation. Modern equipment is available in numerous laboratories to perform research in these and other areas.

There is no foreign language requirement for the PhD program in chemical engineering.

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

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

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

Khosravianghadikolaei, 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 Cyprus, 2010

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

Masters

• Master of Engineering in Chemical Engineering (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/engineering/chemical/meng)

• Master of Science in Chemical Engineering (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/engineering/chemical/ms)

Doctoral

• Doctor of Philosophy in Chemical Engineering (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/engineering/chemical/phd)

Certificates

• Engineering Therapeutics Manufacturing Certificate (http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/engineering/chemical/engineering-therapeutics-manufacturing-certificate)

Courses

CHEN 601 Chemical Engineering Laboratory Safety and Health
Credit 1. 1 Lecture Hour.
Control of hazards associated with chemical engineering research laboratories and the chemical process industry; causes and prevention of accidents, emergency procedures, safety codes, health effects of toxic substances and experimental design for safety.
Prerequisite: Graduate classification.

CHEN 604 Chemical Engineering Process Analysis I
Credits 3. 3 Lecture Hours.
Development and analysis of chemical process models that involve systems of algebraic equations, ordinary differential equations and partial differential equations.
Prerequisite: MATH 308 or approval of instructor.

CHEN 605 Chemical Engineering Process Analysis II
Credits 3. 3 Lecture Hours.
Formulation of mathematical models and solution of resulting mass and energy balance equations by modern computational techniques, applications to separation processes, chemical kinetics, reaction engineering, heat and mass transfer.
Prerequisite: CHEN 320 or approval of instructor.

CHEN 614 Advanced Transport Phenomena I
Credits 4. 4 Lecture Hours.
First part of a two-semester sequence covering advanced transport phenomena; emphasis is placed on momentum transfer or fluid mechanics applied to chemical engineering problems.
Prerequisite: Approval of instructor.

CHEN 615 Advanced Transport Phenomena II
Credits 3. 3 Lecture Hours.
Advanced energy and mass transfer in chemical engineering processes.
Prerequisite: Approval of instructor.

CHEN 623 Applications of Thermodynamics to Chemical Engineering
Credits 3. 3 Lecture Hours.
Application of thermodynamics to chemical engineering operations and processes.
Prerequisite: CHEN 354 or approval of instructor.

CHEN 624 Chemical Engineering Kinetics and Reactor Design
Credits 3. 3 Lecture Hours.
Rates and mechanisms of chemical reactions. Thermal and catalytic reactions both homogeneous and heterogeneous.
Prerequisite: CHEN 464 or approval of instructor.

CHEN 629 Transport Phenomena
Credits 3. 3 Lecture Hours.
Principles of transfer of momentum, energy and mass studied by application to advanced chemical engineering problems. Theoretical analogy of these three modes of transfer.
Prerequisite: CHEN 424 or approval of instructor.
CHEN 631 Process Dynamics and Advanced Process Control
Credits 3. 3 Lecture Hours.
Modeling, analysis, and simulation of linear and nonlinear process systems; model-based control techniques for achieving desired process dynamics.
Prerequisite: CHEN 461 or approval of instructor.

CHEN 633 Thermodynamics and Kinetics of Confined Fluids
Credits 3. 3 Lecture Hours.
Emphasis on fluids, adsorption phenomena (theory and applications), phase transitions in confined fluids (capillary condensation and freezing), the behavior of confined water, reactions in confinement, and applications.
Prerequisite: CHEN 623 or approval of instructor.

CHEN 634 Catalysis and Multiphase Reactor Design
Credits 3. 3 Lecture Hours.
Introduction and overview of catalyzed reactions; topics include heterogeneous catalysis and relevant surface science concepts, mass transport, and reactor design; discussion of industrially relevant chemistries.
Prerequisite: CHEN 624 or approval of instructor.

CHEN 635 Advanced Nanostructured Materials
Credits 3. 3 Lecture Hours.
Chemical synthesis and characterization of materials with structures and properties in the nano-scale; emphasis on the fundamental science and engineering of understanding and manipulating "bottom-up" material formation.
Prerequisite: Approval of instructor.

CHEN 640 Rheology
Credits 3. 3 Lecture Hours.
Principles of stress, deformation and flow; vector and tensor equations of fluid mechanics. Behavior of Newtonian, non-Newtonian and viscoelastic fluids.
Prerequisite: MATH 601 or approval of instructor.

CHEN 641 Polymer Engineering
Credits 3. 3 Lecture Hours.
Principles and practice of polymer structure, synthesis, reaction mechanisms and kinetics; polymer characterization, chemical and physical properties degradation and recycling, melt and solid mechanical and rheological properties. Technology of production and processing operations.
Prerequisite: Graduate classification.

CHEN 642 Colloidal and Interfacial Systems
Credits 3. 3 Lecture Hours.
Fundamental principles related to interactions, dynamic, and structure in colloidal and interfacial systems. Concepts covered include hydrodynamics, brownian motion, diffusion sedimentation, electrophoresis, colloidal forces, surface forces, polymeric forces, aggregation, deposition, equilibrium phase behavior, rheology, and experimental methods.

CHEN 643 Applied Statistical Mechanics of Fluids
Credits 3. 3 Lecture Hours.
Application of molecular theories and computer simulation techniques to describe the thermodynamics and transport properties of fluids and fluid mixtures.
Prerequisite: CHEN 623 or approval of instructor.

CHEN 644 Nanotechnology: The Physics, Chemistry, and Engineering of Nanotechnology
Credits 3. 3 Lecture Hours.
Introduction to the basics and tools of nanotechnology; nanotechnology approaches and algorithms to analyze, design and simulate systems; focus on developing, modifying, adapting and creating tools to solve problems in the field.
Prerequisite: Approval of instructor.

CHEN 645 Fundamentals of Catalysis with Applications
Credits 3. 3 Lecture Hours.
Principles of catalyst preparation, methods of characterization, catalyst deactivation and regeneration techniques; effect of physical transport processes on the rate of catalytic heterogeneous reactions; kinetics of heterogeneous reactions; laboratory and industrial reactors; application to selected industrial processes.
Prerequisites: CHEN 354; CHEN 464 or approval of instructor.

CHEN 646 Thermodynamics of Oil and Gas and Water Systems
Credits 3. 3 Lecture Hours.
Techniques to predict the thermodynamic properties of oil and gas and aqueous saline systems; characterization of petroleum fluids; effect of surface tension and confinement; gas hydrate formation, and thermodynamic models for aqueous electrolyte systems and their application to phase equilibrium calculations.
Prerequisites: CHEN 623 or approval of instructor; Qatar campus.

CHEN 650 Introduction to Microfabrication and Microfluidics Technology
Credits 3. 3 Lecture Hours.
Micro Electro Mechanical Systems (MEMS Technology). To study the fundamentals of fluidics, heat and mass transfer, surface chemistry, and electrochemical interactions.

CHEN 651 Biochemical Engineering
Credits 3. 3 Lecture Hours.
Integration of principles of engineering, biochemistry and microbiology; application to the design, development and improvement of industrial processes that employ biological materials. Engineering discipline directed toward creative application of interdisciplinary information to the economic processing of biological and related materials.
Prerequisite: Approval of instructor.

CHEN 653 Chemical Engineering in Tissue Engineering and Drug and Gene Delivery
Credits 3. 3 Lecture Hours.
Application of chemical engineering principles to the examination of tissue engineering systems, metabolic engineering systems, drug design and delivery, and gene delivery.
Prerequisite: Approval of instructor.

CHEN 655/SENG 655 Process Safety Engineering
Credits 3. 3 Lecture Hours.
Applications of engineering principles to process hazards analysis including source and dispersion modeling, emergency relief systems, fire and explosion prevention and mitigation, hazard identification, risk assessment, process safety management, etc.
Prerequisite: Approval of instructor.
Cross Listing: SENG 655/CHEN 655.

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CHEN 656 Advanced Process Chemical 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;  
application to heat integration problems; use of modeling/optimization  
software systems.  
Prerequisites: Graduate classification; or approval of instructor.

CHEN 658 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, extraction, chemical oxidation,  
biodegradation.  
Prerequisite: Graduate classification in engineering.

CHEN 660 Quantitative Risk Analysis  
Credits 3. 3 Lecture Hours.  
Fundamental concepts, techniques, and applications of quantitative risk  
analysis and risk-informed decision making for all engineering fields;  
practical uses of probabilistic methods are demonstrated in exercises  
and case studies from diverse engineering areas.  
Prerequisites: Graduate classification.  
Cross Listing: SENG 660 and ISEN 660.

CHEN 661 Optimization of Chemical Engineering Processes  
Credits 3. 3 Lecture Hours.  
Methods of optimization applied for the design and control of chemical  
engineering processes.  
Prerequisite: Approval of instructor.

CHEN 662 Computational Chemistry and Molecular Modeling for  
Engineers  
Credits 3. 3 Lecture Hours.  
Applications of computational chemistry and molecular modeling  
relevant to engineers, especially predictions for thermophysical  
properties and reaction rates; emphasis on the creative and intelligent  
use of commercial software to solve practical problems; problems  
relevant to process safety engineer.  
Prerequisites: CHEN 623 and 624 or approval of instructor.

CHEN 663 Systems Biology  
Credits 3. 3 Lecture Hours.  
Introduction to experimental and computational techniques in systems  
biology; includes high throughput experiments, data analysis, modeling  
and simulation; discussion in the context of specific applications such as  
signal transduction.  
Prerequisite: Approval of instructor.

CHEN 664 Global Optimization of Chemical Engineering Problems  
Credits 3. 3 Lecture Hours.  
Advances in global optimization and applications to chemical  
engineering systems; modeling and formulation of optimization  
problems, general theories and techniques of global optimization, and  
applications to problems on process design and integration.  
Prerequisite: Approval of instructor.

CHEN 665 Sustainable Design of Chemical Processes  
Credits 3. 3 Lecture Hours.  
Sustainability in chemical engineering; includes sustainable approaches  
to design and development of processes, products, energy usage; issues  
and roles of chemical engineers, service learning.  
Prerequisite: Graduate and senior classification in engineering or  
approval of instructor.

CHEN 670 Computational Materials Science and Engineering  
Credits 3. 3 Lecture Hours.  
Modern methods of computational modeling and simulation of materials  
properties and phenomena, including synthesis, characterization, and  
processing of materials, structures and devices; quantum, classical,  
and statistical mechanical methods, including semi-empirical atomic  
and molecular-scale simulations, and other modeling techniques using  
microscopic input.  
Prerequisites: Approval of instructor; graduate classification.  
Cross Listing: MSEN 670 and MEMA 670.

CHEN 675 Microelectronics Process Engineering  
Credits 3. 3 Lecture Hours.  
State-of-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 623 and CHEN 624 or approval of instructor.

CHEN 676 Sustainable Design through Process Integration  
Credits 3. 3 Lecture Hours.  
Systematic and state-of-the-art techniques for the sustainable design of  
chemical processes; emphasis on holistic and systematic approaches  
using process integration for the conservation of natural resources  
and the enhancement of process performance; includes visualization,  
algebraic and mathematical optimization tools.  
Prerequisites: Graduate classification or approval of instructor.

CHEN 677 Advanced Process Integration and Synthesis  
Credits 3. 3 Lecture Hours.  
Systematic and state-of-the-art techniques of understanding the  
global insights of mass and energy flows within a process; use of  
integrated insights to optimize process performance; includes a variety of  
mathematical and visualization tools.  
Prerequisite: Approval of instructor.

CHEN 681 Seminar  
Credit 1. 1 Lecture Hour.  
Presentations and discussions covering problems of current importance  
in chemical engineering research.

CHEN 684 Professional Internship  
Credit 1. 1 Other Hour.  
Engineering research experience in industrial setting away from Texas  
A&M campus; projects supervised jointly by faculty and industrial  
representative.  
Prerequisites: Approval of student’s advisory committee chair and  
department head.

CHEN 685 Directed Studies  
Credits 1 to 12. 1 to 12 Other Hours.  
Limited investigations in fields other than those chosen for thesis or  
dissertation research and not covered by other formal courses.  
Prerequisite: Approval of department head.

CHEN 689 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.  
Selected topics in particular areas of chemical engineering. May be  
repeated for credit.  
Prerequisites: Approval of particular head and instructor.

CHEN 691 Research  
Credits 1 to 23. 1 to 23 Other Hours.  
Research for thesis or dissertation.  
Prerequisite: Approval of department head.
CHEN 695 Graduate Mentoring Seminar I  
Credit 1. 1 Lecture Hour.  
Development of skills to compliment formal research and coursework training; includes improvement of communication and interaction skills; development of technical writing and presentation skills.  
**Prerequisites:** Four chemical engineering core graduate courses; graduate advisor approval.

CHEN 696 Graduate Mentoring Seminar II  
Credit 1. 1 Lecture Hour.  
Development of a variety of skills to compliment formal research and coursework training; includes improvement to communication/interaction with students in a classroom setting, and improvement and development of teaching skills. Must be taken on a satisfactory/unsatisfactory basis.  
**Prerequisites:** 4 CHEN core graduate courses, CHEN 695; graduate advisor approval.