



**DEPARTMENT OF CHEMICAL
ENGINEERING**

GRADUATE HANDBOOK

THE UNIVERSITY OF AKRON

DEPARTMENT OF CHEMICAL ENGINEERING

Highlights

- ❖ MSc and PhD degrees are available
- ❖ All faculty members hold PhD degrees
- ❖ Laboratories support wide range of research topics in biochemical engineering, advanced materials, filtration and reaction engineering.

Program Facts

Program founded: 1967

Program start dates: Fall & Spring

Expected length of Masters: 2 years

Expected length of PhD: 5 years

of Faculty members: 10

% with highest degree in field: 100%

of Endowed Chairs/Professors: 1

Annual Research Funding: \$700,000

Student Profile	Master	PhD
Student Applied/yr	79	17
Student Accepted/yr	44	11
Students Enrolled/yr	12	3
Total program Enrollment	25	15
# of International Students	20	10

Admissions (please refer to the AdmissionsHandbook.pdf)

Program Overview

The Department of Chemical Engineering at the University of Akron (UA) offers a Master of Science (MS) in Chemical Engineering and a Doctor of Philosophy (PhD) in engineering.

Areas of specialization for graduate students include catalysis, enzymatic synthesis, filtration, biocompatible materials, bio-reaction engineering, chemical vapor deposition, molecular simulation, supercritical fluids, colloids and adhesion, surface modification, polymer thin films, advanced materials, chaos, and controls.

To earn an MS degree under thesis option, students must complete 30 credit hours of study. This includes a minimum of 24 credit hours of course work and six credit hours of thesis work. A written comprehensive thesis and an oral defense of the thesis are also required.

PhD students must complete a minimum of 96 credit hours including 36 hours of coursework beyond the bachelor of science level. Students must pass a departmental qualifying examination, a candidacy examination, and present and successfully defend their dissertation to a college-wide Interdisciplinary Doctoral Committee of five faculty. The PhD degree has a residency requirement of one year full-time.

An MS in Chemical Engineering typically requires two years to complete. The PhD typically requires an additional three years. The department has a goal of averaging at least one ISI journal publication per thesis and at least three per dissertation.

In the fall of 2000, an option became available for students with BS degrees in subjects other than Chemical Engineering interested in bridging to a MS Chemical Engineering degree. This program enables bridge students to complete their MS degree in roughly 6 months more than a student entering with a BS in Chemical Engineering.

The department's major research apparatuses include gas chromatographs; gas chromatograph-mass spectrometry; BET; differential scanning calorimetry and thermogravimetric analysis; FT-IR, HPLC, XRF, ellipsometry, contact angle goniometer, optical ~~microscope~~ microscopy and scanning probe microscopy and heat release equipment; laser and light scattering equipment; pilot scale bubble cap and packed towers; extruders; biochemical reactors; sterilizers; high-pressure phase equilibrium analyzers; supercritical extraction equipment, polymer thin film self-assembled monolayer deposition equipment. In addition, students have access to the extensive library and computer facilities at the university and to external supercomputer facilities.

Buildings and Facilities

The Applied Colloid and Surface Science Laboratory has a state-of-art laser light scattering facility including a Lexel argon-ion laser, a vibration isolated optical bench, a Brookhaven correlation and probability analyzer, and an IBM PC-based data acquisition system. The biochemical and Environmental Bioengineering Laboratory is a satellite center of the Ohio Bioprocessing Research Consortium, housing a state-of-the-art HPLC-MS with additional luminescence, UV/VIS, RI detectors. The labs are well equipped with several bioreactor assemblies, Sorvall RC-5C refrigerated super centrifuge, Perkin-Elmer UV/VIS spectrometer and LS-50B luminescence spectrophotometer, and on-line NAD(p)H flurometers. The Biomaterials Laboratory is available for polymer synthesis and storage include a nitrogen hood, Sephadex separation columns, an oil bath, a dry bath, a vacuum oven, a Buch rotary evaporator, and a Labconco lyophilizer. The Supercritical Fluid Research Laboratory has FTIR-Raman, TGA/DSC, Instron, several phase equilibrium and extraction systems, and a 500g/min pilot plant.

The Catalysis Research Laboratory is equipped with high pressure and high temperature IR reactor system with a Nicolet Magna-IR 550 Spectrometer Series-II, a Nicolet Magna-IR 560 Spectrometer E.S.P. and a Blazers Prisma QMG 200 Mass Spectrometer for in situ catalyst preparation, in situ characterization, temperature programmed desorption of NO, H₂, and CO, and in situ reaction studies.

The Multiphase and Solids Processing Laboratory is equipped to do research in filtration and flows through porous media. The labs are equipped with a gamma ray instrument for measuring porosity of packed columns and filter cakes, a Frazier Test to measure air permeability of filter media, a Hiac Royco BR8 particle counter, a Zeta Meter and a Brookhaven EKA Streaming potential instrument for measuring zeta potentials. An optical system is set up to measure particle sizes and size distributions. The Nonlinear Control Laboratory is equipped with Unix based workstations and a variety of engineering software packages.

The surface modification and characterization laboratory is equipped with a spin coater for depositing polymer thin films, self-assembled monolayer deposition chambers, an UV/O chamber, an ultrasonicator and a Soxhlet extractor for substrate preparation and sample cleaning. The laboratory houses several optical microscopes, a scanning probe microscope, a contact angle goniometer, and an ellipsometer. All the microscopes are equipped with CCD cameras and computerized video systems.

The Supercritical Fluids Laboratory, a key lab in Ohio Supercritical Fluid Consortium, is equipped with FTIR/RAMAN/ATR, GC/FID/TCD high pressure phase behavior apparatus, Berty Reactor, 1-liter stirred Reactor, Instron mechanical testing, TGA/DSC, multistage extruder, a 500 g/min pilot plant, and high temperature GPC. The thin Film Laboratory is equipped with plasma systems, thermal chemical vapor deposition, and in situ microbalance.

Expenses and Financial Support

Students may apply for financial aid in the form of graduate assistantships. Graduate assistants render services to the university through teaching and/or research. UA awards a number of graduate assistantships to qualified students. Assistantships are normally awarded for up to two years of master's study and up to four years of doctoral study. Teaching and research assistantships provide annual stipends of US\$13,500 for master's students and US\$16,000 for doctoral students. Remission of tuition is also included. (Tuition scholarships are available on a very limited basis for first-time graduate students.) Domestic students may also apply to <http://www.orau.gov/dhsed/>.

International students: To cover tuition and living expenses for 12 months (Fall, Spring, and Summer semesters) international students will need approximately US\$22,000. International applicants should provide the Office of International Programs with an original bank statement reflecting the appropriate amount stated herewith; copies of financial documentation will not be accepted. Applicants are encouraged to send the original financial documentation to the Office of International Programs at the same time the application for admission is sent to the Graduate School in order to prevent a delay in the issuance of the Certification of Eligibility.

International Students

Each year, approximately 850 international students from 89 countries pursue studies and research at UA. The University of Akron requires that all international students carry medical insurance that meets minimum established requirements. Such coverage must be in effect throughout the student's studies at the University of Akron.

The Office of International Programs (OIP) assists international students. OIP helps students adjust to a new culture through orientation programs and professional advice concerning immigration issues, housing, academic concerns, and cultural issues. OIP promotes diversity on campus by organizing social and cultural celebrations. A number of student cultural organizations have regular activities on campus.

International students are required to attend the International Student Orientation program that takes place one week before classes. The orientation fee is US\$45, which will not be waived even if the student does not attend the orientation program. The orientation dates will be mailed to students with their orientation letter and immigration documents.

MASTERS AND DOCTORAL STUDENTS

Students who have secured an assistantship for Master's program or Doctoral program should have satisfactory performance in the completion of the respective program.

Any Masters student who receives an assistantship should pursue the Masters thesis option. Consideration of satisfactory performance for Ph.D. students includes progress in passing all subject categories of the qualifying exam.

Faculty

George Chase, Professor (1983), Ph.D.

The University of Akron, 1989

Specialties: Multiphase Processes, Heat Transfer

H. Michael Cheung, Professor (1984), Ph.D.

Case Western Reserve University, 1985

Specialties: Colloids, Light Scattering, Sonochemical processing

Steven S.C. Chuang, Professor (1986), Ph.D.

University of Pittsburgh

Specialties: Catalysis and Reaction Engineering, Environmentally Benign Synthesis

J. Richard Elliott, Professor (1986), Ph.D.

Pennsylvania State University, 1985

Specialties: Thermodynamics, Molecular Simulation, Supercritical Fluid Technology

Edward Evans, Assistant Professor (1997), Ph.D.

Case Western Reserve University, 1998

Specialties: Materials Processing and CVD

Lu-Kwang Ju, Professor (1990), Ph.D.

State University at New York at Buffalo, 1988

Specialties: Biochemical Engineering, Environmental Biotechnology

Lingyun Liu, Assistant Professor (2007), Ph.D.

University of Washington

Specialties: Surface protein interactions

Bi-Min Zhang Newby, Assistant Professor (2000), Ph.D.

~~Drexel~~ Lehigh, 1999

Specialties: Surface Modification, Polymer Thin Film and Advanced Materials

Helen Qammar, Assistant Professor (1989), Ph.D.

University of Virginia, 1986

Specialties: Nonlinear Control, Chaotic Processes, Dynamic Time series Analysis, Compressor Dynamics

Jie Zheng, Assistant Professor (2004), Ph.D.
University of Washington
Specialties: Molecular Simulation of Biological Systems

ORIENTATION DATE

All graduate assistants must be available to attend any orientations required by the college, department/school, Graduate School or International Programs (generally two weeks prior to the start of fall semester)

The New TA/TF Orientation will be Monday morning, August 18, in Ballrooms B,C,D,& E of the Student Center. Per request of department chairs, this orientation will be only for new graduate TAs/TFs -- those who've never before attended this orientation at UA. The program will run from 8:30 - 11:45 AM, with lunch for new TAs/TFs (only) and their respective chairs and directors at 12 noon.

ARRIVAL CHECKSHEET

Here are some suggestions about what to do when first arriving:

(Please note: Your family name is to be used as your LAST NAME on all documents and the name your mother calls you is the name you use as your FIRST NAME)

1. Go to the Office of International Programs (OIP) and check in. Get the forms for a Social Security Number (SSN) if possible. Pick up a Graduate Bulletin while you are there. Review the Master's/PhD program. Get any required forms and make a list of dates for advancement to candidacy.
2. Go to a bank and get a checking account (we have a bank on campus).
3. Find housing.
4. Go to the Federal Building on Main Street and apply for your SSN. The Chemical Engineering secretary can supply you with a letter for Social Security. A map to the federal building is included in this handbook.
5. Register for Classes. Schedule as follows:

Course Selection for Students with Tuition Waivers ONLY
4200:605 Reaction Engineering
4200:610 Thermodynamics
4200:631 Chemical Engineering Analysis
Must attend 4200:791 Chem. Engr. Seminar But don't sign up for it.

Course Selection for Students with Full Scholarships
4200:605 Reaction Engineering
4200:610 Thermodynamics
4200:631 Chemical Engineering Analysis
4200:791 Chem Engineering Seminar
Discuss with your research advisor courses they want you to take. Remainder of credits should include Preliminary Research.

6. Go to the Bookstore and buy your books.
7. Go to the Zip Card Office and obtain a zip card. The department secretary will need to activate the card to give you access to the computer labs.
8. See the department secretary in Whitby 102 for paperwork and to obtain any keys your advisor may need to assign to you. (\$20 required deposit for **EACH** key).
9. See Professor Lopina to obtain a safety handbook. Review relevant sections of the handbook.
10. Get an email/gozips account from the computer center. Give this address to the department secretary along with your new home address and phone number. A form is provided in this packet.
11. Set goals for the semester. If you do not have a research advisor talk to each faculty member to select a research project. Forms are included in this package. Research Advisors will be formally assigned some time during fall semester, but initiating research earlier if possible is encouraged. Make a list of hardware and software relevant to your research group--group, department and campus.
12. Students coming in with Tuition Waiver contracts may carry them for ONE academic year only. The contracts will not be extended for a second year.

List of Keys to Order (deposit of \$20 for each key is required and will be returned when you graduate).

Name: _____ Soc. Sec. # _____

Professor/Advisor: _____



Chemical Engineering Department
 Masters Program
Plan of Study



302 Buchtel Mall
 Akron, OH 44325
 330-972-7111

Date: _____

Plan of Study Course List for: _____
 (Masters Student's Name)

Advisory Committee:

- 1) _____
 (Advisor Signature)
- 2) _____
 (Signature)
- 3) _____
 (Signature)

	<i>Course</i>	<i>Title</i>	<i>Sem. Cr.</i>	<i>Sem./ Year</i>	<i>Transfer-Grade</i>
<i>Core Classes</i>					
1.	4200:610	Classical Thermodynamics	3		
2.	4200:605	Chemical Reaction Engineering	3		
3.	4200:600	Transport Phenomena	3		
Chemical Engineering Electives (6 credits min.)					
4.					
5.					
6.					
Approved Mathematics (3 credit min.)					
7.					
8.					
Approved Electives (6 credits min.)					
9.					
10.					
11.					

Total _____

ADVISER'S CHECK SHEET
CHEMICAL ENGINEERING
NON-THESIS MASTER DEGREE

1. All Chemical Engineering courses.
2. All Chemistry courses 600 level or higher.
3. Polymer Science Electives:
 - 9871:601 Polymer Concepts
 - 9871:631 Physical Properties of Polymers I
 - 9871:632 Physical Properties of Polymers II
 - 9871:674 Polymer Structure and Characterization
 - 9871:675 Polymer Thermodynamics
 - 9871:701 Polymer Technology I
 - 9871:702 Polymer Technology II
 - 9871:703 Polymer Technology III
4. College of Engineering
 - Mechanical Engineering
 - 4600:609 Finite Element Analysis I
 - 4600:611 Computational Fluid dynamics I
 - 4600:622 Continuum Mechanics
 - 4600:642 System Analysis and Control Design
 - 4600:643 Distributed Process Control Design and Applications
 - 4600:645 Process Identification and Computer Control
 - 4600:704 Finite Element Analysis II
 - 4600:705 Finite Element Analysis III
 - Electrical Engineering
 - 4400:671 Discrete Control Systems
 - 4400:674 Control System Theory
 - 4400:677 Optimal Control I
 - 4400:774 Advanced Linear Control Systems
 - 4400:778 Adaptive Control
 - Civil Engineering
 - 4300:621 Environmental Engineering Principles
 - 4300:626 Wastewater Treatment Plant Design
5. Math Electives
 - 3450:625 Analytic Function Theory
 - 3450:627,8 Advanced Numerical Analysis I and II
 - 3450:629,30 Matrix Computations I and II
 - 3450:631 Calculus of Variations
 - 3450:632 Advanced Partial Differential Equations
 - 3450:633,4 Methods of Applied Mathematics I and II
 - 3450:635 Optimization
 - 3450:636 Advanced Combinatorics and Graph Theory
6. Statistics Electives
 - 3470:663 Experimental Design
 - 3470:665 Regression
 - 3470:668 Multivariate Statistical Methods
 - 3470:675 Response Surface Methodology



Chemical Engineering Dept.
302 Buchtel Mall
Akron, OH 44325-3906
330-972-7250

Date: _____

Please meet with as many prospective advisors as possible and have the prospective advisors sign to indicate that they have met with you. Indicate below your preferred projects with (1) being your most preferred. Every attempt will be made to satisfy your first choice. Please return this form prior to the first Friday in October.

Advisor Preference for: _____
(Masters Student's Name)

Advisor and Project Preferences in Priority Order:

- 1) _____
(Advisor) (Project)
- 2) _____
(Advisor) (Project)
- 3) _____
(Advisor) (Project)

Signatures of Prospective Advisors to Indicate Meeting and Date:

