

# UNIVERSITY OF ALBERTA

EDMONTON, ALBERTA, CANADA

## Graduate Programs in Chemical Engineering

### Financial Aid

Ph.D. Candidates: up to \$5,000/year.  
M.Sc. and M.Eng. Candidates: up to \$4,000/year.

Commonwealth Scholarships, Industrial Fellowships and limited travel funds are available.

### Costs.

Tuition: \$535/year.  
Married students housing rent: \$140/month.  
Room and board, University Housing: \$115/month.

### Ph.D. Degree

Qualifying examination, minimum of 13 half-year courses, thesis.

### M.Sc. Degree

5-8 half-year courses, thesis.

### M.Eng. Degree

10 half-year courses, 4-6 week project.

### Department Size

12 Professors, 3 Post-doctoral Fellows,  
30-40 Graduate Students.

### Applications

Return postcard or write to:

Chairman  
Department of Chemical Engineering  
University of Alberta  
Edmonton, Alberta, Canada

### Faculty and Research Interests

I. G. Dalla Lana, Ph.D. (Minnesota): Kinetics, Heterogeneous Catalysis.

D. G. Fisher, (Chairman), Ph.D. (Michigan): Process Dynamics and Control, Real-Time Computer Applications, Process Design.

A. E. Mather, Ph.D. (Michigan): Phase Equilibria, Fluid Properties at High Pressures, Thermodynamics.

W. Nader, Dr. Phil. (Vienna): Heat Transfer, Air Pollution, Transport Phenomena in Porous Media, Applied Mathematics.

F. D. Otto, Ph.D. (Michigan): Mass Transfer, Computer Design of Separation Processes, Environmental Engineering.

D. Quon, (Associate Dean), Sc.D. (M.I.T.): Applied Mathematics, Optimization, Statistical Decision Theory.

D. B. Robinson, Ph.D. (Michigan): Thermal and Volumetric Properties of Fluids, Phase Equilibria, Thermodynamics.

J. T. Ryan, Ph.D. (Missouri): Process Economics, Energy Economics and Supply.

D. E. Seborg, Ph.D. (Princeton): Process Control, Adaptive Control, Estimation Theory.

F. A. Seyer, Ph.D. (Delaware): Turbulent Flow, Rheology of Complex Fluids.

S. E. Wanke, Ph.D. (California-Davis): Catalysis, Kinetics.

R. K. Wood, Ph.D. (Northwestern): Process Dynamics and Identification, Control of Distillation Columns.

### Department Facilities

Located in new 8-story Engineering Centre.

Excellent complement of computing and analytical equipment:

- IBM 1800 (real-time) computer
- EAI 590 hybrid computer
- AD 32 analog computer
- IBM 360/67 terminal
- Weissenberg Rheogoniometer
- Infrared spectrophotometer
- Research and industrial gas chromatographs

### The University of Alberta

One of Canada's largest universities and engineering schools.

Enrollment of 18,000 students.

Co-educational, government-supported, non-denominational.

Five minutes from city centre, overlooking scenic river valley.

### Edmonton

Fast growing, modern city; population of 440,000.

Resident professional theatre, symphony orchestra, professional sports.

Major chemical and petroleum processing centre.

Within easy driving distance of the Rocky Mountains and Jasper National Park.

# UNIVERSITY OF ARIZONA

The chemical engineering department at the University of Arizona is young and dynamic with a fully accredited undergraduate degree program and MS and Ph.D. Graduate Programs. Financial support is available through government grants, teaching and research assistantships, and industrial grants. The faculty assures full opportunity to study in all major areas of chemical engineering.

## THE FACULTY AND THEIR RESEARCH INTEREST ARE:

**WILLIAM P. COSART**, Asst. Professor  
Ph.D., Oregon State University, 1972  
Transpiration Cooling, Heat Transfer in Biological Systems, Blood Processing

**JOSPH F. GROSS**, Professor  
Ph.D., Purdue University, 1956  
Boundary Layer Theory, Pharmacokinetics, Fluid Mechanics and Mass Transfer in The Microcirculation, Biorheology

**JOST O.L. WENDT**, Asst. Professor  
Ph.D., Johns Hopkins University, 1968  
Combustion Generated Air Pollution, Nitrogen and Sulfur Oxide Abatement, Chemical Kinetics, Thermodynamics Interfacial Phenomena

**RICHARD D. WILLIAMS**, Asst. Professor  
Ph.D., Princeton University, 1972  
Catalysis, Chemical Reactor Engineering Energy and Environmental Problems, Kinetics of Heterogenous Reaction

**DON H. WHITE**, Professor and Head  
Ph.D., Iowa State University, 1949  
Polymers Fundamentals and Processes, Membrane Separation Processes, Microbial and Enzymatic Processes

**ALAN D. RANDOLPH**, Professor  
Ph.D., Iowa State University, 1962  
Simulation and Design of Crystallization Processes, Nucleation Phenomena, Particulate Processes, Explosives Initiation Mechanisms

**THOMAS R. REHM**, Professor  
Ph.D., University of Washington, 1960  
Mass Transfer, Process Instrumentation, Packed Column Distillation, Applied Design

**JAMES WM. WHITE**, Assoc. Professor  
Ph.D., University of Wisconsin, 1968  
Real-Time Computing, Process Control Minerals Industry Instrumentation, Model Building and Simulation

Tucson has an excellent climate and many recreational opportunities. It is a growing, modern city of 350,000 that retains much of the old Southwestern atmosphere.

For further information,  
write to

*Dr. D. H. White*  
*Head*  
*Department of*  
*Chemical Engineering*  
*University of Arizona*  
*Tucson, Arizona 85721*



University of California, Berkeley  
**CHEMICAL ENGINEERING**  
at  
**BERKELEY??**

The answer to the above question is YES. Now for the rest of our quiz for the ambitious chemical engineering senior. You'll probably finish in 4 minutes, and it may influence your next 4 years.

**Is the Department well rated professionally?**

The most recent American Council on Education survey, which samples faculty opinion nationwide, rated us #2 for "strength of graduate program" and #3 on "graduate faculty." This must mean we try hard, too.

**What areas of graduate research are represented?**

Which aren't? With an experienced and distinguished faculty of 20 professors, the Department can offer a tremendous variety of work. For details, please write.\*

**Let's try specifics. How about research related to the environment?**

At least 7 faculty members have been active in such work. Projects have included: extraction of pollutants from wastewater, electrostatic precipitation of dusts, scrubbing SO<sub>2</sub> out of stack gases with seawater, NO<sub>x</sub> removal from car and plant effluents, design of substitute nonpolluting processes,....

**The biological sciences seem to be coming to the fore in engineering disciplines. Is this true at Berkeley?**

Four ChE faculty members are involved in these interface areas, specifically in biochemical, biomedical, and food processing and production research.

**Does this mean that traditional areas are underrepresented?**

No way! (See the second question.) Actually, many such areas are represented by more than one professor—electrochemical engineering, fluid mechanics, kinetics and catalysis, mass transfer, materials, process development and design, and thermodynamics.

**It sounds like a big operation. Doesn't this lead to an impersonal quality of education?**

We don't think so. It's true that the campus is big (27,500 students), although not unusually so these days, and that we have a pretty big graduate group for ChE departments—45 M.S. and 67 Ph.D. candidates. But we have eight graduate advisers, in addition to each student's thesis adviser, and numerous social and sporting interactions—for example, the summer softball team (can anybody out there pitch?). All together, there is ample opportunity for student-faculty contact.

**What is the mean temperature in Berkeley?**

Summertime highs average 70°F, wintertime 56°F. Outdoor "summer" sports are year-round activities. Some people get bored with this...but climatic extremes can be reached easily by car.

**Can I get to the key libraries and computing facilities conveniently?**

Chemistry Library—60 ft., Physics—60 yd., Math—100 yd., Engineering—250 yd., main library—150 yd. (Excuse the English units.) The College has its own computer, and the campus Computer Center—only 100 yd. away—is as close as the terminal in our building.

**What opportunities do graduate students have to explore the teaching experience?**

Ph.D. students act as teaching assistants for one quarter in each of 3 years during their studies here. M.S. students may occasionally have an opportunity to teach, if they want.

**Many urban schools impress the eye as being predominantly concrete. What's the Berkeley picture?**

Two branches of Strawberry Creek run through campus, one within a stone's throw of the ChE Dept. Numerous redwood trees. Tallest grove of eucalyptus in the U.S. The 1300 ft. Berkeley Hills rising steeply behind campus, to the east. San Francisco and 25 miles of Bay Area in view to the west. Parklike landscaping, lots of it—honest. Let's get back to basics now.

**What are the course work requirements for graduate degrees?**

For the M.S., 20 graded quarter units, of which 12 must be ChE graduate courses. (Another 10 units must be amassed for the degree, but thesis research and other Pass/Not Pass courses are allowable.) For the Ph.D. no units are officially prescribed, but students are strongly encouraged to explore classes in our department and elsewhere. The catalogue lists 20 ChE regular graduate courses as well as many seminars. The real problem is limiting yourself, in view of the great selection of interesting courses on campus.

**How does the Department happen to be in the College of Chemistry?**

Simply because we grew out of the Department of Chemistry. Having a two-department College is very cozy, and the strength of the Chemistry Department (e.g., Nobel laureates Calvin, Giauque, Seaborg) is especially helpful for chemical engineers.

**How about traditional recreational opportunities in the Bay Area?**

You must be joking. We wouldn't try to capitalize on sailing on the beautiful Bay; skiing and hiking in the majestic Sierra Nevada; the amateur and professional baseball, football, basketball, hockey; the superlative restaurants, museums, and music of San Francisco and the whole Bay Area (Berkeley itself is full of artistic and musical happenings) — would we? Don't even consider it.

**How are thesis research projects assigned to new students?**

Students usually select their own projects, from among those offered by the faculty. The only constraint is that Research Assistants must choose from funded projects; fellowship holders are not restricted in this way. Indeed, if you bring your own fellowship, you might even try to design your own project and convince some faculty member to sponsor it.

**What is the job market for a Berkeley graduate?**

Over the past decade our advanced-degree grads have had exceptional opportunities. Of our Ph.D.'s 1/3 have gone into teaching, 1/3 into chemical and petroleum firms, and 1/3 into other industries. With tightening of the economy, fewer offers are being made everywhere, but industrial prospects are pretty good here. In last year's grim job market, *all* our M.S. and Ph.D. grads got *good* professional jobs, and the general employment situation is improving. Berkeley is visited by more industrial recruiters than any other western school, and the Placement Center is vigorous. The faculty cares, too.

\*Write: Professor D. N. Hanson, Chemical Engineering Department, Gilman Hall, Graduate Admissions, University of California, Berkeley, Ca. 94720.



# Caltech



**PROGRAM OF STUDY** Distinctive features of study in chemical engineering at the California Institute of Technology are the creative research atmosphere in which the student finds himself and the strong emphasis on basic chemical, physical, and mathematical disciplines in his program of study. In this way a student can properly prepare himself for a productive career of research, development, or teaching in a rapidly changing and expanding technological society.

A course of study is selected in consultation with one or more of the faculty listed below. Required courses are minimal. The Master of Science degree is normally completed in one academic year and a thesis is not required. A special terminal M.S. option, involving either research or an integrated design project, is a newly added feature to the overall program of graduate study. The Ph.D. degree requires a minimum of three years subsequent to the B.S. degree, consisting of thesis research and further

advanced study.

**FINANCIAL ASSISTANCE** Graduate students are supported by fellowship, research assistantship, or teaching assistantship appointments during both the academic year and the summer months. A student may carry a full load of graduate study and research in addition to any assigned assistantship duties. The Institute gives consideration for admission and financial assistance to all qualified applicants regardless of race, religion, or sex.

**APPLICATIONS** Further information and an application form may be obtained by writing

Professor J. H. Seinfeld  
Executive Officer for Chemical Engineering  
California Institute of Technology  
Pasadena, California 91109

It is advisable to submit applications before February 15, 1974.

## FACULTY IN CHEMICAL ENGINEERING

**WILLIAM H. CORCORAN**, Professor and Vice-President for Institute Relations  
Ph.D. (1948), California Institute of Technology  
Kinetics and catalysis; plasma chemistry; biomedical engineering; air and water quality.

**SHELDON K. FRIEDLANDER**, Professor  
Ph.D. (1954), University of Illinois  
Aerosol chemistry and physics; air pollution; biomedical engineering; interfacial transfer; diffusion and membrane transport.

**GEORGE R. GAVALAS**, Associate Professor  
Ph.D. (1964), University of Minnesota  
Applied kinetics and catalysis; process control and optimization; coal gasification.

**L. GARY LEAL**, Assistant Professor  
Ph.D. (1969), Stanford University  
Theoretical and experimental fluid mechanics; heat and mass transfer; suspension rheology; mechanics of non-Newtonian fluids.

**CORNELIUS J. PINGS**, Professor,  
Vice-Provost and Dean of Graduate Studies  
Ph.D. (1955), California Institute of Technology  
Liquid state physics and chemistry; statistical mechanics.

**JOHN H. SEINFELD**, Associate Professor,  
Executive Officer  
Ph.D. (1967), Princeton University  
Control and estimation theory; air pollution.

**FRED H. SHAIR**, Associate Professor  
Ph.D. (1963), University of California, Berkeley  
Plasma chemistry and physics; tracer studies of various environmental problems.

**NICHOLAS W. TSCHOEGL**, Professor  
Ph.D. (1958), University of New South Wales  
Mechanical properties of polymeric materials; theory of viscoelastic behavior; structure-property relations in polymers.

**ROBERT W. VAUGHAN**, Assistant Professor  
Ph.D. (1967), University of Illinois  
Solid state and surface chemistry.

**W. HENRY WEINBERG**, Assistant Professor  
Ph.D. (1970), University of California, Berkeley  
Surface chemistry and catalysis.

DEPARTMENT OF CHEMICAL ENGINEERING

# CLARKSON

PROGRAMS LEADING TO THE DOCTORAL DEGREE IN  
CHEMICAL ENGINEERING AND ENGINEERING SCIENCE



On the southern brow of the Hill Campus, Clarkson's massive new Science Center now stands complete, its laboratories, classrooms, and corridors teeming with student activity. The \$5.5-million structure is the first educational building to be constructed "on the hill."

## CHEMICAL ENGINEERING FACULTY

**E. J. DAVIS**—Prof. and Chmn. (Ph.D., 1960, University of Washington) Heat transfer and fluid mechanics associated with two-phase flow, convective diffusion, aerosol physics, bubble and droplet transport phenomena, Mathematical modeling.

**R. COLE**—Assoc. Prof. and Exec. Officer. (Ph.D., 1966, Clarkson College of Technology) Boiling heat transfer, bubble dynamics, boiling nucleation.

**D. O. COONEY**—Assoc. Prof. (Ph.D., 1966, University of Wisconsin) Mass transfer in fixed beds, biomedical engineering, unstable flow in porous media.

**J. ESTRIN**—Prof. (Ph.D., 1960, Columbia University) Nucleation phenomena, change processes.

**E. W. GRAHAM**—Assoc. Prof. (Ph.D., 1962, University of California, Berkeley) Chemical reaction kinetics and related theoretical problems, catalysis, fuel cells, air pollution.

**J. L. KATZ**—Assoc. Prof. (Ph.D., 1963, University of Chicago) Homogeneous nucleation of vapors, homogeneous boiling, heterogeneous nucleation, aerosols, equations of state, nucleation of voids in metals, thermal conductivity of gases.

**R. A. MARRA**—Instructor. (M.S., 1972, Clarkson College of Technology) fixed bed sorption and ion exchange, dispersion with chemical reaction.

**R. J. NUNGE**—Assoc. Prof. (Ph.D., 1965, Syracuse University) Transport phenomena, multistream forced convection transport processes, structure of pulsating turbulent flow, flow through porous media, atmospheric transport processes, transient dispersion.

**R. A. SHAW**—Assoc. Prof. (Ph.D., 1967, Cornell University) Nuclear engineering, reverse osmosis, radioactive tracers, environmental effects of power generation.

**H. L. SHULMAN**—Prof., Dean of Eng. and Vice Pres. of the College. (Ph.D., 1950, University of Pennsylvania) Mass Transfer, packed columns, adsorption of gases, absorption.

**R. S. SUBRAMANIAN**—Asst. Prof. (Ph.D., 1972, Clarkson College of Technology) Heat and mass transfer problems, unsteady convective diffusion—miscible dispersion, material and thermal pollution, chromatographic and other interphase transport systems, fluid mechanics.

**S. K. SUNEJA**—Asst. Prof. (Ph.D., 1970, Illinois Institute of Technology) Transport phenomena, transport in aerosols and hydrosols, air pollution, water pollution.

**T. J. WARD**—Assoc. Prof. (Ph.D., 1959, Rensselaer Polytechnic Institute) Process control, nuclear engineering, ceramic materials.

**G. R. YOUNGQUIST**—Assoc. Prof. (Ph.D., 1962, University of Illinois) Adsorption, crystallization, diffusion and flow in porous media.

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For information concerning Assistantships and Fellowships contact the Graduate School Office, Clarkson College of Technology, Potsdam, New York 13676

CLARKSON COLLEGE OF TECHNOLOGY / POTSDAM, NEW YORK 13676

# CORNELL UNIVERSITY

## Graduate Study in Chemical Engineering

Three graduate degree programs in several subject areas are offered in the Field of Chemical Engineering at Cornell University. Students may enter a research-oriented course of study leading to the degrees of Doctor of Philosophy or Master of Science, or may study for the professional degree of Master of Engineering (Chemical). Graduate work may be done in the following subject areas.

### **Chemical Engineering (general)**

Thermodynamics; applied mathematics; transport phenomena, including fluid mechanics, heat transfer, and diffusional operations.

### **Bioengineering**

Separation and purification of biochemicals; fermentation engineering and related subjects in biochemistry and microbiology; mathematical models of processes in pharmacology and environmental toxicology; artificial organs.

### **Chemical Microscopy**

Light and electron microscopy as applied in chemistry and chemical engineering.

### **Kinetics and Catalysis**

Homogeneous kinetics; catalysis by solids and enzymes; catalyst deactivation; simultaneous mass transfer and reaction; optimization of reactor design.

### **Chemical Processes and Process Control**

Advanced plant design; process development; petroleum refining; chemical engineering economics; process control; related courses in statistics and computer methods.

### **Materials Engineering**

Polymeric materials and related course work in chemistry, materials, mechanics, metallurgy, and solid-state physics, biomaterials.

### **Nuclear Process Engineering**

Nuclear and reactor engineering and selected courses in applied physics and chemistry.

### **Faculty Members and Research Interests**

**John L. Anderson, Ph.D.** Membrane transport, bioengineering.

**Kenneth B. Bischoff, Ph.D.** Medical and microbiological bioengineering, chemical reaction engineering.

**George G. Cocks, Ph.D.** Light and electron microscopy, properties of materials, solid-state chemistry, crystallography.

**Robert K. Finn, Ph.D.** Continuous fermentation, agitation and aeration, processing of biochemicals, electrophoresis, microbial conversion of hydrocarbons.

**Peter Harriott, Ph.D.** Kinetics and catalysis, process control, diffusion in membranes and porous solids.

**J. Eldred Hedrick, Ph.D.** Economic analyses and forecasts, new ventures development.

**Ferdinand Rodriguez, Ph.D.** Polymerization, properties of polymer systems.

**George F. Scheele, Ph.D.** Hydrodynamic stability, coalescence, fluid mechanics of liquid drops and jets, convection-distorted flow fields.

**Michael L. Shuler, Ph.D.** Biochemical engineering.

**Julian C. Smith, Chem.E.** Conductive transfer processes, heat transfer, mixing, mechanical separations.

**James F. Stevenson, Ph.D.** Chemical engineering applications to biomedical problems; rheology.

**Raymond G. Thorpe, M.Chem.E.** Phase equilibria, fluid flow, kinetics of polymerization.

**Robert L. Von Berg, Sc.D.** Liquid-liquid extraction, reaction kinetics, effect of radiation on chemical reactions.

**Herbert F. Wiegandt, Ph.D.** Crystallization, petroleum processing, saline-water conversion, direct contact heat transfer.

**Charles C. Winding, Ph.D.** Degradation of polymers, polymer compounding, filler-polymer systems, differential thermal analysis.

**Robert York, Sc.D.** Molecular sieves, chemical market analyses, chemical economics, process development, design, and evaluation.

FURTHER INFORMATION. Write to Professor K. B. Bischoff, Olin Hall of Chemical Engineering, Cornell University, Ithaca, New York 14850.





# **UNIVERSITY OF DELAWARE**

**Newark, Delaware 19711**

The chemical engineering department offers graduate instruction and research in all the major areas of the profession. These include:

Catalysis and reaction engineering  
Energy, environmental control and natural resources problems  
Structure, properties and processing characteristics of polymers  
Fluid mechanics and rheology  
Surface and interfacial phenomena  
Modern separational processes  
Optimization  
Applications of chemical engineering to problems in biology and biotechnology  
Development and control of technical innovations in society

The application of molecular and microscopic insights to solution of engineering problems couples the sciences very closely with engineering. Students and faculty benefit from an extensive visiting faculty program and by close association with leading practitioners in the nearby Penna., N.J. and Delaware heartland of the chemical process industries.

## FACULTY

B. E. Anshus	J. H. Olson
C. E. Birchenall	C. A. Petty
M. M. Denn	T. W. F. Russell
B. C. Gates	S. I. Sandler
J. R. Katzer	J. M. Schultz
R. L. McCullough	J. Wei
A. B. Metzner	

## VISITING FACULTY

Prof. G. Astarita, University of Naples  
Prof. G. C. A. Schuit, Technical Univ. of Eindhoven

Graduate study inquiries and requests for financial aid invited; personal visits encouraged.

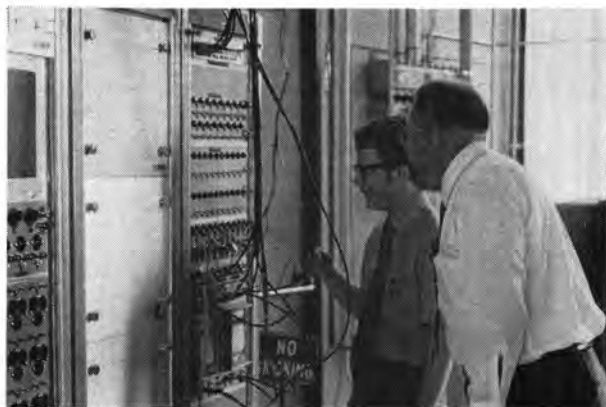
Contact: A. B. Metzner, Chairman

# The university of florida

offers you

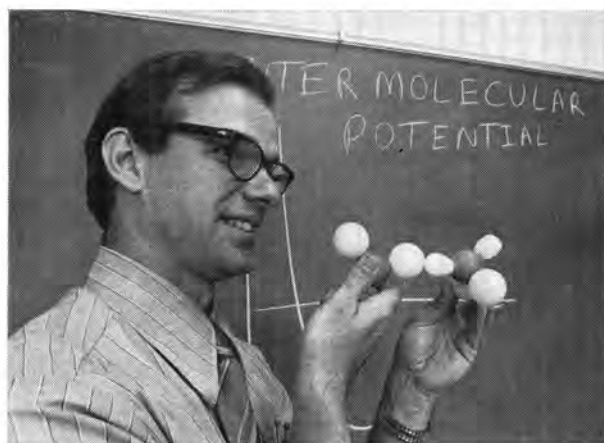
## *Transport Phenomena & Rheology*

Drag-reducing polymers greatly modify the familiar bathtub vortex, as studied here by dye injection.



## *Optimization & Control*

Part of a computerized distillation control system.



## *Thermodynamics & Statistical Mechanics*

Illustrating hydrogen-bonding forces between water molecules.



## *Biomedical Engineering & Interfacial Phenomena*

Oxygen being extracted from a substance similar to blood plasma.

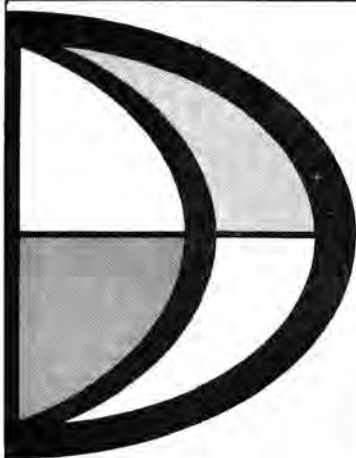
*and much more...*

*A young, dynamic faculty  
Wide course and program selection  
Excellent facilities  
Year-round sports*

*Write to:*

*Dr. John C. Biery, Chairman  
Department of Chemical Engineering - Room 227  
University of Florida  
Gainesville, Florida 32611*





# The Real World of Chemical Engineering

The University of Houston is located in the midst of the largest complex of chemical and petrochemical activity in the world. This environment provides unequalled opportunities for graduate students in . . . THE REAL WORLD OF CHEMICAL ENGINEERING.

**Petrochemical  
Industry  
Medicine  
Space**

Houston is the national center for manufacturing, sales, research and design in the petroleum and petrochemical industry. Most of the major oil and petrochemical companies have plants and research installations in the Houston area. The headquarters of many of these organizations are here.

The world - famous Texas Medical Center is located in Houston.

The NASA Lyndon B. Johnson Space Center is located in the Houston area.

**There is continuous interaction through seminars, courses and research between the faculty and graduate students of this department and the engineers and scientists of this large technical community.**

**Faculty**

The research of 14 faculty members encompass a wide range of subjects in chemical engineering. Faculty members are active in the interdisciplinary areas of biomedical, environmental urban and systems engineering.

**Department**

The department is one of the fastest growing in the nation. The current enrollment includes 50 seniors and 45 full-time graduate students; a 200% increase in the enrollment over the past 5 years. Research grants and contracts currently in progress exceed 1.2 million dollars.

**Facilities**

Over \$900,000 of modern research equipment is located in 50,000 square feet of research and office space.

**Financial Aid**

Fellowship stipends are available to qualified applicants.

**Houston**

The temperate Gulf Coast area with its year-round outdoor weather offers unlimited recreational opportunities. An equal number of cultural opportunities exist in the sixth largest and fastest-growing city in the country. Houston has an outstanding symphony orchestra several theatre companies, fine museums, and a stimulating intellectual community.

**INQUIRIES  
ARE DIRECTED  
TO:**

Head, Graduate Admissions  
Department of Chemical Engineering  
University of Houston  
Houston, Texas 77004



# GRADUATE STUDY AND RESEARCH

The Department of Energy Engineering

UNIVERSITY OF ILLINOIS AT CHICAGO CIRCLE



Graduate Programs in  
The Department of Energy Engineering  
leading to the degrees of  
MASTER OF SCIENCE and  
DOCTOR OF PHILOSOPHY

Faculty and Research Activities  
in the field of  
**CHEMICAL ENGINEERING**

David S. Hacker  
Ph.D., Northwestern University, 1954  
Associate Professor

James P. Hartnett  
Ph.D., University of California, Berkeley, 1954  
Professor and Head of the Department

John H. Kiefer  
Ph.D., Cornell University, 1961  
Professor

G. Ali Mansoori  
Ph.D., University of Oklahoma, 1969  
Associate Professor

Irving F. Miller  
Ph.D., University of Michigan, 1960  
Professor

Satish C. Saxena  
Ph.D., Calcutta University, India, 1956  
Professor

Stephen Szepe  
Ph.D., Illinois Institute of Technology, 1966  
Associate Professor

John D. Gabor  
Ph.D., Cornell University, 1958  
Visiting Lecturer

Edward J. Schlossmacher  
Ph.D., Princeton University, 1970  
Adjunct Assistant Professor

The Department invites applications for admission and support from all qualified candidates. To obtain application forms or to request further information, please write to:

Chemical kinetics; combustion, simultaneous transport phenomena; and chemical process design.

Forced convection; mass transfer cooling; non-Newtonian fluid mechanics and heat transfer.

Kinetics of gas reactions; energy transfer processes; molecular lasers.

Thermodynamics and statistical mechanics of fluids, solids and solutions; kinetics of liquid reactions.

Chemical engineering; bioengineering; membrane transport processes; mathematical modeling.

Transport properties of fluids and solids; heat and mass transfer; isotope separation; fixed and fluidized bed combustion.

Catalysis; chemical reaction engineering; optimization; environmental and pollution problems.

Fluidization; heat transfer; nuclear fuel reprocessing; nuclear reactor safety.

Process dynamics and control; process optimization.

Professor Harold A. Simon, Chairman  
The Graduate Committee  
Department of Energy Engineering  
University of Illinois at Chicago Circle  
Box 4348, Chicago, Illinois 60680



## IOWA STATE UNIVERSITY

First Land Grant school (1862). Largest College of Engineering west of the Mississippi River and fifth largest in the U.S. Ranks ninth in Ph.D. degrees in Chemical Engineering. Current enrollment of 300 undergraduates and 60 grad students in Chemical Engineering.

## PROGRAMS

M.S. and Ph.D. degrees. Five year integrated program for M.E.

## FACULTY

Graduate faculty of 18 in Chemical Engineering having a variety of backgrounds and interests.

## FACILITIES

New, fully equipped Chemical Engineering building with 50,000 square feet of laboratory, office, and classroom space. Adjacent to computer center and to library. Excellent technical support from Engineering Research Institute and technical service groups. Affiliation with the Ames Laboratory, the only National Laboratory of the U.S. AEC located on a university campus.

## RESEARCH

International reputation in the following areas:

Biochemical Engineering (Tsao)	Fluidization (Wheelock)
Biomedical Engineering (Seagrave)	Polymer Kinetics (Abraham)
Coal Research (Wheelock)	Process Chemistry (Burnet)
Crystallization (Larson)	Simulation (Burkhart)

Outstanding programs also in electronic instrumentation, computer applications to process control, air and water pollution control, extraction, thermodynamics, kinetics and reaction engineering, liquid metals technology, fluid mechanics and rheology, heat and mass transfer, and interfacial and surface phenomena.

## FINANCIAL AID

Teaching and research assistantships and industrial fellowships available.

## LOCATION

Ames, a small city of 40,000 in central Iowa. Site of the Iowa State Center (pictured above), which hosts the annual Ames International Orchestra Festival and athletic events of the Big Eight Conference.

## TO APPLY

Write to:

George Burnet, Head  
 Chemical Engineering Department  
 Iowa State University  
 Ames, Iowa 50010



# **UNIVERSITY OF KANSAS**

Department of Chemical and Petroleum Engineering Research



M.S. and Ph.D. Programs  
in  
Chemical Engineering  
Petroleum Engineering  
also  
Doctor of Engineering (D.E.)  
and  
M.S. in Petroleum Management

The Department is the recent recipient of a \$150,000 industrial grant for research and teaching in the area of Fluid Flow and Transport Phenomena Applicable to the Petroleum Industry.

Financial assistance is  
available for Research Assistants  
and Teaching Assistants

## **Research Areas**

Transport Phenomena

Fluid Flow in Porous Media

Process Dynamics and Control  
Water Resources and  
Environmental Studies

Mathematical Modeling of  
Complex Physical Systems

Reaction Kinetics and  
Process Design

Nucleate Boiling

High Pressure, Low Temperature  
Phase Behavior

For Information and Applications write:

Don W. Green, Chairman  
Dept. of Chemical and Petroleum Engineering  
University of Kansas  
Lawrence, Kansas, 66044  
Phone (913) UN4-3922

UNIVERSITY OF KENTUCKY

# DEPARTMENT OF CHEMICAL ENGINEERING

M.S. & Ph.D. Programs  
Including Intensive Study in

## ENERGY ENGINEERING

Energy supply and demand  
Fuel combustion processes  
Coal liquefaction and gasification processes

## AIR POLLUTION CONTROL

Rates and equilibria of atmospheric reactions  
Process and system control, and gas cleaning  
Diffusion, and modelling of urban atmospheres

## WATER POLLUTION CONTROL

Advanced waste treatment and water reclamation  
Design of physical and chemical processes  
Biochemical reactor design

## STIPENDS:

Excellent financial support is available  
in the form of Environmental Protection Agency  
Traineeships, fellowships & assistantships.

## OTHER PROGRAM AREAS:

Electrochemical engineering  
Process control

Reactor design  
Transport



WRITE TO: R.B. Grieves, Chairman  
Dept. of Chemical Engineering  
UNIVERSITY OF KENTUCKY  
LEXINGTON, KENTUCKY 40506



Massachusetts  
Institute  
of Technology

DEPARTMENT OF  
CHEMICAL ENGINEERING

- ENVIRONMENTAL QUALITY
- BIOCHEMICAL ENGINEERING
- BIOMEDICAL ENGINEERING
- TRANSPORT PHENOMENA
- CHEMICAL ENGINEERING SYSTEMS
- SURFACE CHEMISTRY AND TECHNOLOGY
- POLYMERS AND MACROMOLECULES
- ENERGY

For decades to come, the chemical engineer will play a central role in fields of national concern. In two areas alone, energy and the environment, society and industry will turn to the chemical engineer for technology and management in finding process related solutions to critical problems. M.I.T. has consistently been a leader in chemical engineering education with a strong working relationship with industry for over a half century. For detailed information, contact Professor Raymond F. Baddour, Head of the Department of Chemical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139.

FACULTY

Raymond F. Baddour  
Lawrence B. Evans  
Paul J. Flory  
Hoyt C. Hottel  
Herman P. Meissner  
Edward W. Merrill  
J. Th. G. Overbeek  
Robert C. Reid  
Adel F. Sarofim

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J. Edward Vivian  
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Jack B. Howard  
Michael Modell  
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Samuel M. Fleming  
Ronald A. Hites  
Gary J. Powers  
Jefferson W. Tester



Department of Chemical Engineering

# UNIVERSITY OF MISSOURI — ROLLA

ROLLA, MISSOURI 65401

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Contact Dr. M. R. Strunk, Chairman  
Day Programs            M.S. and Ph.D. Degrees

---

Established fields of specialization in which research programs are in progress are:

- (1) Fluid Turbulence and Drag Reduction Studies—Drs. J. L. Zakin and G. K. Patterson
- (2) Electrochemistry and Fuel Cells—Dr. J. W. Johnson
- (3) Heat Transfer (Cryogenics) Dr. E. L. Park, Jr.
- (4) Mass Transfer Studies—Dr. R. M. Wellek
- (5) Structure and Properties of Polymers—Dr. K. G. Mayhan

In addition, research projects are being carried out in the following areas:

- (a) Optimization of Chemical Systems—Prof. J. L. Gaddy
- (b) Evaporation through non-Wettable Porous Membranes—Dr. M. E. Findley
- (c) Multi-component Distillation Efficiencies—Dr. R. C. Waggoner
- (d) Gas Permeability Studies—Dr. R. A. Primrose
- (e) Separations by Electrodialysis Techniques—Dr. H. H. Grice
- (f) Process Dynamics and Control—Drs. M. E. Findley, R. C. Waggoner, and R. A. Mollenkamp
- (g) Transport Properties and Kinetics—Dr. O. K. Crosser and Dr. B. E. Poling
- (h) Thermodynamics, Vapor-Liquid Equilibrium—Dr. D. B. Manley



**Financial aid is obtainable in the form of Graduate and Research Assistantships, and Industrial Fellowship. Aid is also obtainable through the Materials Research Center.**



## PHILADELPHIA

The cultural advantages and historical assets of a great city, including the incomparable Philadelphia Orchestra are within walking distance of the University. Enthusiasts will find a variety

of college and professional sports at hand. A complete range of recreational facilities exists within the city. The Pocono Mountains and the New Jersey shore are within a two hour drive.

## UNIVERSITY OF PENNSYLVANIA

The University of Pennsylvania is an Ivy League School emphasizing scholarly activity and excellence in graduate education. A unique feature of the University is the breadth of medically related activities including those in engineering. In recent years the University has undergone

a great expansion of its facilities, including specialized graduate student housing. The Department of Chemical and Biochemical Engineering has also undergone considerable change and growth, attracting national attention because of its rapid rise to excellence.

## DEPARTMENT OF CHEMICAL AND BIOCHEMICAL ENGINEERING

### FACULTY

Stuart W. Churchill  
William C. Forsman  
David J. Graves  
A. Norman Hixson  
Arthur E. Humphrey  
Ronald L. Klaus  
Mitchell Litt

Alan L. Myers  
Melvin C. Molstad  
Leonard Nanis  
Avinoam Nir  
Daniel D. Perlmutter  
John A. Quinn  
Warren D. Seider  
Vladimir Zakian

### RESEARCH SPECIALTIES

Enzyme Engineering  
Biomedical Engineering  
Computer-Aided Design  
Chemical Reactor Analysis  
Electrochemical Engineering

Environmental Control  
Polymer Engineering  
Process Simulation  
Surface Phenomena  
Separations Techniques

**For further information on graduate studies in this dynamic setting, write to: Dr. A. L. Myers, Department of Chemical and Biochemical Engi-**

**neering, University of Pennsylvania, Philadelphia, Pennsylvania 19174**

# LOOKING



for a  
graduate education  
in  
Chemical Engineering?

Consider

## **PENN STATE**

**M.S. and Ph.D. Programs Offered  
with Research In**

Separation Processes  
Kinetics and Mass Transfer  
Petroleum Research  
Unit Processes  
Thermodynamic Properties  
Catalysis and Applied Chemistry  
Air Environment  
Bio-Engineering  
Nuclear Technology  
Transport Properties  
Lubrication and Rheology  
And Other Areas

WRITE TO

Prof. Lee C. Eagleton, Head  
160 Chemical Engineering Building  
The Pennsylvania State University  
University Park, Pa. 16802





# RENSSELAER POLYTECHNIC INSTITUTE

offers graduate study programs in Chemical Engineering leading to M.S. and Ph.D. degrees with opportunities for specialization in:

**THERMODYNAMICS  
HEAT TRANSFER  
REACTION KINETICS  
FLUIDIZATION  
ELECTROCHEMICAL DEVICES**

**POLYMER MATERIALS  
POLYMER PROCESSING  
ENVIRONMENTAL ENGINEERING  
PROCESS DYNAMICS  
BIOMEDICAL ENGINEERING**

**Rensselaer Polytechnic Institute**, established in 1824 "for the application of science to the common purposes of life," has grown from a school of engineering and applied science into a technological university, serving some 3500 undergraduates and over 1000 graduate students.

It is located in Troy, New York, about 150 miles north of New York City and 180 miles west of Boston. Troy, Albany, and Schenectady together comprise the heart of New York's Capital District, an upstate metropolitan area of about 600,000 population. These historic cities and the surrounding countryside provide the attractions of both urban and rural life.

Scenic streams, lakes and mountains, including the Hudson River, Lake George, the Green Mountains of Vermont, the Berkshires of Massachusetts, and portions of the Adirondack Forest Preserve, are within easy driving distance, and offer many attractions for those interested in skiing, hiking, boating, hunting, fishing, etc.

**For full details write Mr. R. A. Du Mez, Director of Graduate Admissions, Rensselaer Polytechnic Institute, Troy, New York 12181.**



# Graduate Study in Chemical Engineering at Rice University

Graduate study in Chemical Engineering at Rice University is offered to qualified students with backgrounds in the fundamental principles of Chemistry, Mathematics, and Physics. The curriculum is aimed at strengthening the student's understanding of these principles and provides a basis for developing in certain areas the necessary proficiency for conducting independent research. A large number of research programs are pursued in various areas of Chemical Engineering and related fields, such as Biomedical Engineering and Polymer Science. A joint program with the Baylor College of Medicine, leading to M.D.-Ph.D. and M.D.-M.S. degrees is also available.

The Department has approximately 35 graduate students, predominantly Ph.D. candidates. There are also several post-doctoral fellows and research engineers associated with the various laboratories. Permanent faculty numbers 12, all active in undergraduate and graduate teaching, as well as in research. The high faculty-to-student ratio, outstanding laboratory facilities, and stimulating research projects provide a graduate education environment in keeping with Rice's reputation for academic excellence. The Department is one of the top 15 Chemical Engineering Departments in the U.S., ranked by graduate faculty quality and program effectiveness, according to a recent evaluation by the American Council of Education.

## MAJOR RESEARCH AREAS

Thermodynamics and Phase Equilibria  
Chemical Kinetics and Catalysis  
Chromatography  
Optimization, Stability, and Process Control  
Systems Analysis and Process Dynamics  
Rheology and Fluid Mechanics  
Polymer Science

## BIOMEDICAL ENGINEERING

Blood Flow and Blood Trauma  
Blood Pumping Systems  
Biomaterials

## Rice University

Rice is a privately endowed, nonsectarian, coeducational university. It occupies an architecturally attractive, tree-shaded campus of 300 acres, located in a fine residential area, 3 miles from the center of Houston. There are approximately 2200 undergraduate and 800 graduate students. The school offers the benefits of a complete university with programs in the various fields of science and the humanities, as well as in engineering. It has an excellent library with extensive holdings. The academic year is from September to May. As there are no summer classes, graduate students have nearly four months for research. The school offers excellent recreational and athletic facilities with a completely equipped gymnasium, and the southern climate makes outdoor sports, such as tennis, golf, and sailing year-round activities.

## FINANCIAL SUPPORT

Full-time graduate students receive financial support with tuition remission and a tax-free fellowship of \$300-350 per month.

## APPLICATIONS AND INFORMATION

Address letters of inquiry to:

Chairman  
Department of Chemical Engineering  
Rice University  
Houston, Texas 77001

## Houston

With a population of nearly two million, Houston is the largest metropolitan, financial, and commercial center in the South and Southwest. It has achieved world-wide recognition through its vast and growing petrochemical complex, the pioneering medical and surgical activities at the Texas Medical Center, and the NASA Manned Spacecraft Center.

Houston is a cosmopolitan city with many cultural and recreational attractions. It has a well-known resident symphony orchestra, an opera, and a ballet company, which perform regularly in the newly constructed Jesse H. Jones Hall. Just east of the Rice campus is Hermann Park with its free zoo, golf course, Planetarium, and Museum of Natural Science. The air-conditioned Astrodome is the home of the Houston Astros and Oilers and the site of many other events.

***Chemical Engineering***  
*at*  
***Stevens Institute of Technology***

***MASTER'S and DOCTORATE PROGRAMS***

*in*

Chemical Engineering Science  
Design and Plant Operations  
Polymer Engineering

***RESEARCH***

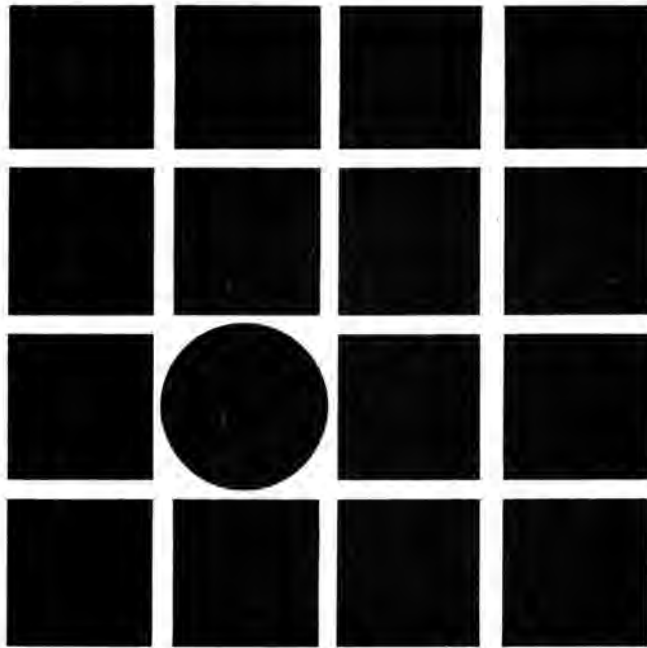
*in*

Chemical Reaction Engineering • Rheology  
Polymer Property — Structure Relationships  
Thermodynamics of Polymer Deformation  
Polymerization Kinetics • Combustion  
Polymer Processing • Mass Transfer  
Optimal Control • Waste Treatment  
Flame and Arc Plasmas

***Full and Part-time Programs***

For further information contact:

PROFESSOR JOSEPH BIESENBERGER, HEAD  
DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING  
STEVENS INSTITUTE OF TECHNOLOGY  
Castle Point Station — Navy Building, Room 315  
Hoboken, New Jersey 07030



## UNIVERSITY of TENNESSEE

### Graduate Studies in Chemical & Metallurgical Engineering

#### Programs

Programs for the degrees of Master of Science and Doctor of Philosophy are offered in both Chemical and Metallurgical Engineering. The Master's program may be tailored as a terminal one with emphasis on professional development, or it may serve as preparation for more advanced work leading to the Doctorate. Specialization in Polymer Science and Engineering is available at both levels.

#### Faculty and Research Interests

WILLIAM T. BECKER, Ph.D., Illinois Mechanical Properties and Deformation; DONALD C. BOGUE, Ph.D., Delaware, Rheology, Polymer Science and Engineering; CHARLIE R. BROOKS, Ph.D., Tennessee, Electron Microscopy, Thermodynamics; EDWARD S. CLARK, Ph.D., California (Berkeley), Polymer Crystallography; ORAN L. CULBERSON, Ph.D., Texas, Operations Research, Process Design; JOHN F. FELLERS, Ph.D., Akron, Polymer Chemistry; GEORGE C. FRAZIER, JR., D. Eng., Johns Hopkins, Kinetics and Combustion, Transfer with Reaction; HSIEN-WEN HSU, Ph.D., Wisconsin, Bioengineering, Transport Phenomena, Optimization; HOMER F. JOHNSON, D. Eng., Yale (Department Head), Mass Transfer, Interface Phenomena; STANLEY H. JURY, Ph.D., Cincinnati, Sorption Kinetics in Flow Systems; WILLIAM J. KOOYMAN, Ph.D., Johns Hopkins, Reaction Kinetics in Flow Systems; CARL D. LUNDIN, Ph.D., Rensselaer, Physical Metallurgy, Welding; CHARLES F. MOORE, Ph.D., L.S.U., Computer Process Control; BEN F. OLIVER, Ph.D., Pennsylvania State University, (Professor-in-Charge of Metallurgical

Engineering), Solidification, High Purity Metals; JOSEPH J. PERONA, Ph.D., Northwestern, Mass Transfer and Kinetics, Heat Transfer; JOSEPH E. SPRUIELL, Ph.D., Tennessee, X-ray Diffraction, Electron Microscopy, Polymer Science and Engineering; E. EUGENE STANSBURY, Ph.D., Cincinnati, Thermodynamics Kinetics of Phase Deformation, Corrosion; JAMES L. WHITE, Ph.D., Delaware, Polymer Science and Engineering, Rheology, Separation Processes. **Regular Part-Time:** LLOYD G. ALEXANDER, Ph.D., Purdue, Fluid Flow, Heat Transfer; BERNARD S. BORIE, Ph.D., M.I.T., X-ray Diffraction; ALBERT H. COOPER, Ph.D., Michigan State, Process Design, Economics; JOHN M. HOLMES, Ph.D., Tennessee, Economic Analysis and Design; CARL J. MCHARGUE, Ph.D., Kentucky, Physical Metallurgy; ROY A. VANDERMEER, Ph.D., Illinois Institute of Technology, Physical Metallurgy; JACK S. WATSON, Ph.D., Fluid Mechanics.

#### Laboratories and Shops

Computer complex (DEC, PDP 15/35 with interfaces to research labs and analog computer), High-speed automatic frost point hygrometer, Mass and heat transfer in porous media, Polymer rheology and processing (Weissenberg rheogoniometer, Instron rheological tester, roll mill, extruder, Vibron viscoelastometer), Polymer characterization (gel permeation chromatograph, osmometer), Mass spectrophotometer, Continuous zone centrifuge, Process dynamics, X-ray diffraction (including single crystal diffuse scattering analysis), Electron microscopes (Philips EM75 EM300, AMR900), Calorimetry (25-1000°C), Electrical resistivity measurements for studies of structural and phase changes, Single crystal preparation facilities, Mechanical fabrication and testing, (metallograph, optical microscopes and melting, etc.), High purity materials preparation, Electronic and mechanical shops staffed by 16 full-time technicians and craftsmen.

#### Financial Assistance

Sources available include graduate assistantships, graduate teaching assistantships, research assistantships, and a variety of fellowships.

#### Knoxville and Surroundings

With a population near 200,000, Knoxville is the trade and industrial center of East Tennessee. In the nearby Auditorium-Coliseum, Broadway plays, musical and dramatic artists, and other entertainment events are regularly scheduled. Knoxville has a number of points of historical interest, a theater-in-the-round, a symphony orchestra, two art galleries, and a number of museums. Within an hour's drive are many TVA lakes and mountain streams for water sports, the Great Smoky Mountains National Park with the Gatlinburg tourist area, two state parks, and the atomic energy installations at Oak Ridge including the Museum of Atomic Energy.

#### Students

The Department of Chemical and Metallurgical Engineering has 230 undergraduate and 60 full-time graduate students enrolled at present.

**WRITE: Department of Chemical and Metallurgical Engineering,  
The University of Tennessee, Knoxville, Tennessee 37916**



THE UNIVERSITY OF AKRON



DEPARTMENT OF  
CHEMICAL ENGINEERING



AUBURN SCIENCE AND ENGINEERING CENTER

## GRADUATE STUDY AND RESEARCH IN CHEMICAL ENGINEERING

### RESEARCH AREAS:

Applied Mathematics  
Biomedical  
Environmental  
Porous Media  
Rheology  
Polymer Processing  
Transport Processes

### FINANCIAL AID:

Teaching and Research Assistantship  
Fellowships Available  
Competitive Stipends

### FULL AND PART-TIME ENROLLMENT

FOR FURTHER INFORMATION WRITE  
DEPARTMENT OF  
CHEMICAL ENGINEERING  
THE UNIVERSITY OF AKRON  
AKRON, OHIO 44325

Study To Be A

# PROFESSIONAL Chemical Engineer at OKLAHOMA STATE UNIVERSITY

Whatever your career plans, The School of Chemical Engineering at Oklahoma State University offers a degree program to help you achieve your objectives:

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The School of Chemical Engineering is now considering applicants for the OSU GRADUATE PROFESSIONAL COLLEGE OF ENGINEERING. This new program is designed to provide

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**for**

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At the School of Chemical Engineering of Oklahoma State University, you will find

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- Well-equipped research laboratories

For information on Graduate Professional education at OSU, write:

Dr. Robert N. Maddox, Head  
School of Chemical Engineering  
Oklahoma State University  
Stillwater, Oklahoma 74074



DEPARTMENT OF CHEMICAL ENGINEERING

# BUCKNELL UNIVERSITY

LEWISBURG, PENNSYLVANIA 17837

For admission, address

**Dr. Paul H. DeHoff**

**Coordinator of Graduate Studies**

- Graduate degrees granted: Master of Science in Chemical Engineering
- Courses for graduate credit are available in the evenings.
- Typical research interests of the faculty include the areas of: mass transfer, particularly distillation, solid-liquid, and liquid-liquid extraction; thermodynamics; mathematical application in chemical systems; reaction kinetics; process dynamics and control; metallurgy and the science of materials; biomedical engineering.
- Assistantships and scholarships are available.
- For the usual candidate, with a B.S. in Chemical Engineering, the equivalent of thirty semester-hours of graduate credit including a thesis is the requirement for graduation.

## UNIVERSITY OF CALIFORNIA, DAVIS

### CHEMICAL ENGINEERING, M.S. AND PH.D. PROGRAMS

#### Faculty

R. L. Bell:	Mass Transfer, Bio-Medicine
R. G. Carbonell	Enzyme Kinetics, Quantum Mechanics
A. P. Jackman:	Process Dynamics, Thermal Pollution
B. J. McCoy:	Molecular Theory, Transport Processes
J. M. Smith:	Water Pollution, Reactor Design
S. Whitaker:	Fluid Mechanics, Interfacial Phenomena

#### Write To:

Graduate Student Advisor  
Department of Chemical Engineering  
University of California  
Davis, California 95616



# UNIVERSITY OF CALIFORNIA SANTA BARBARA

## CHEMICAL AND NUCLEAR ENGINEERING

Henri J. Fenech  
Owen T. Hanna  
Duncan A. Mellichamp  
John E. Myers

G. Robert Odette  
A. Edward Profio  
Robert G. Rinker  
Orville C. Sandall

For information, please write to: Department of Chemical and Nuclear Engineering  
University of California, Santa Barbara 93106

### Case Institute of Technology

# CASE WESTERN RESERVE UNIVERSITY

## M.S. and Ph.D. Programs in Chemical Engineering

### Current Research Topics

Environmental Engineering  
Coal Gasification  
Systems Optimization and Control  
Catalysis and Surface Chemistry

Crystal Growth and Materials  
Engineering Applications of Lasers  
Process Development  
Biomedical Engineering

### General Information

Case Institute of Technology is a privately endowed institution with a tradition of excellence in Engineering and Applied Science since 1880. In 1967 Case Institute and Western Reserve University joined together. The enrollment, endowment and faculty make Case Western Reserve University one of the leading private schools in the country. The modern, urban campus is located in Cleveland's University Circle, an extensive concentration of education, scientific, social and cultural organizations.

For more information, contact: Graduate Student Advisor

Department of Chemical Engineering  
Case Western Reserve University  
Cleveland, Ohio 44106



# CLEMSON UNIVERSITY

Chemical Engineering Department

M.S. and Doctoral Programs

## THE FACULTY AND THEIR INTERESTS

Alley, F. C., Ph.D., U. North Carolina—Air Pollution, Unit Operations  
Barlage, W. B., Ph.D., N. C. State—Transfer Processes in Non-Newtonian Fluids  
Beard, J. N., Ph.D., L.S.U., Chemical Kinetics, Hybrid Computation  
Beckwith, W. F., Ph.D., Iowa State—Transport Phenomena  
Bruley, D. F., Ph.D., U. Tennessee—Process Dynamics, Bio-medical Engineering  
Hall, J. W., Ph.D., U. Texas—Chemical Kinetics, Catalysis, Design  
Harshman, R. C., Ph.D., Ohio State—Chemical and Biological Kinetics, Design  
Littlejohn, C. E., Ph.D., V.P.I.—Mass Transfer  
Melsheimer, S.S., Ph.D. Tulane—Process Dynamics, Applied Mathematics  
Mullins, J. C., Ph.D., Georgia Tech—Thermodynamics, Adsorption

**FINANCIAL ASSISTANCE**—Fellowships, Assistantships, Traineeships

Contact:

C. E. Littlejohn, Head  
Department of Chemical Engineering  
Clemson University  
Clemson, S. C. 29631

# THE CLEVELAND STATE UNIVERSITY



## MASTER OF SCIENCE PROGRAM IN CHEMICAL ENGINEERING

### AREAS OF SPECIALIZATION

**Thermodynamics      Pollution Control      Transport Processes**

The program may be designed as terminal or as preparation for further advance study leading to the doctorate at another institution. Financial assistance is available.

### FOR FURTHER INFORMATION, PLEASE CONTACT:

Department of Chemical Engineering  
The Cleveland State University  
Euclid Avenue at East 24th Street  
Cleveland, Ohio 44115



# the university of connecticut

## faculty

J. P. BELL  
C. O. BENNETT  
M. B. CUTLIP  
A. T. DiBENEDETTO  
G. M. HOWARD  
H. E. KLEI  
R. M. STEPHENSON  
L. F. STUTZMAN  
D. W. SUNDSTROM

## programs

M.S. and Ph.D. programs covering most aspects of Chemical Engineering.

Research projects concentrate in four main areas:

KINETICS AND CATALYSIS  
POLYMERS AND COMPOSITE MATERIALS  
PROCESS DYNAMICS AND CONTROL  
WATER AND AIR POLLUTION CONTROL

**financial aid** — Research and Teaching Assistantships, Fellowships

**location** — Beautiful setting in rural Northeast Connecticut, convenient to Boston, New York, and Northern New England

We would like to tell you much more about the opportunities for an education at UCONN, please write to:

Graduate Admissions Committee  
Department of Chemical Engineering  
The University of Connecticut  
Storrs, Connecticut 06268

## ILLINOIS INSTITUTE OF TECHNOLOGY

CHICAGO, ILLINOIS 60616

M.S. and Ph.D. programs in Chemical Engineering and Interdisciplinary Areas of Polymer Science, Biochemical and Food Engineering, Gas Engineering, Biomedical Engineering, and Particle Technology.

### Faculty

W. M. Langdon	Environmental Control and Process Design
R. E. Peck	Heat Transfer and Thermodynamics
B. S. Swanson	Process Dynamics and Controls
L. L. Tavlarides	Biochemical Engineering and Reactor Engineering
J. S. Vrentas	Polymer Science and Transport Phenomena
D. T. Wasan	Mass Transfer and Particle Dynamics
H. Weinstein	Biomedical Engineering and Reactor Engineering

For inquiries write to: D. T. Wasan, Chairman

Chemical Engineering Department  
Illinois Institute of Technology  
10 West 33rd Street  
Chicago, Illinois 60616

# Graduate Study in Chemical Engineering

## KANSAS STATE UNIVERSITY

M.S. and Ph.D. programs in Chemical Engineering and Interdisciplinary Areas of Systems Engineering, Food Science, and Environmental Engineering.

### Financial Aid Available

Up to \$5,000 Per Year

### FOR MORE INFORMATION WRITE TO

Professor B. G. Kyle  
 Department of Chemical Engineering  
 Kansas State University  
 Manhattan, Kansas 66502

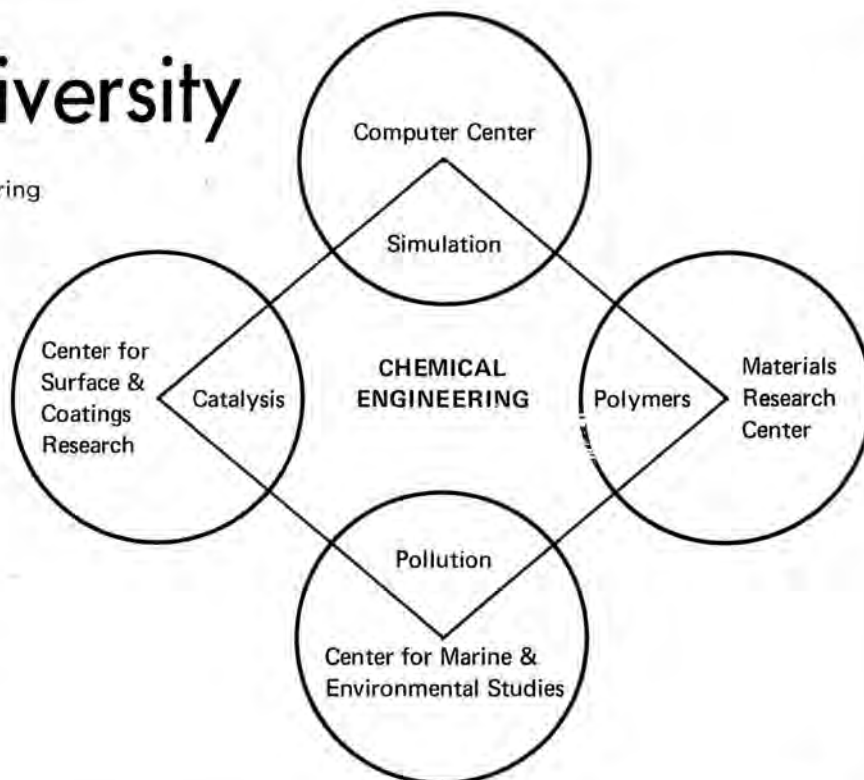
### AREAS OF STUDY AND RESEARCH

DIFFUSION AND MASS TRANSFER  
 HEAT TRANSFER  
 FLUID MECHANICS  
 THERMODYNAMICS  
 BIOCHEMICAL ENGINEERING  
 PROCESS DYNAMICS AND CONTROL  
 CHEMICAL REACTION ENGINEERING  
 MAGNETOHYDRODYNAMICS  
 SOLID MIXING  
 DESALINATION  
 OPTIMIZATION  
 FLUIDIZATION  
 PHASE EQUILIBRIUM

# Lehigh University

Department of Chemical Engineering

M. CHARLES  
 C. W. CLUMP  
 R. W. COUGHLIN  
 A. S. FOUST  
 W. L. LUYBEN  
 A. J. McHUGH  
 G. W. POEHLEIN  
 W. E. SCHIESSER  
 L. H. SPERLING  
 F. P. STEIN  
 L. A. WENZEL  
 Bethlehem, Pa. 18015



# LSU

Graduate Enrollment — 80

Faculty — 19

- Bioengineering
  - Pollution Control
    - Process Dynamics
      - Computer Control
        - Kinetics and Catalysis
          - Thermodynamics
            - Ecological Modeling
              - Sugar Technology

Write: Chemical Engineering Department  
Louisiana State University  
Baton Rouge, Louisiana 70803

## McMASTER UNIVERSITY

Hamilton, Ontario, Canada

### M. ENG. & PH.D. PROGRAMS

#### THE FACULTY AND THEIR INTERESTS

R. B. Anderson (Ph.D., Iowa) . . . . .	Catalysis, Adsorption, Kinetics
M. H. I. Baird (Ph.D., Cambridge) . . . . .	Oscillatory Flows, Transport Phenomena
A. Benedek (Ph.D., U. of Washington) . . . . .	Wastewater Treatment, Novel Separation Techniques
J. L. Brash (Ph.D., Glasgow) . . . . .	Polymer Chemistry, Use of Polymers in Medicine
C. M. Crowe (Ph.D., Cambridge) . . . . .	Optimization, Chemical Reaction Engineering, Simulation
I. A. Feuerstein (Ph.D., Massachusetts) . . . . .	Biological Fluid and Mass Transfer
A. E. Hamielec (Ph.D., Toronto) . . . . .	Polymer Reactor Engineering, Transport Processes
J. W. Hodgins (Ph.D., Toronto) . . . . .	Polymerization, Applied Chemistry
T. W. Hoffman (Ph.D., McGill) . . . . .	Heat Transfer, Chemical Reaction Engr., Simulation
J. F. MacGregor (Ph.D., Wisconsin) . . . . .	Statistical Methods in Process Analysis, Computer Control
K. L. Murphy (Ph.D., Wisconsin) . . . . .	Wastewater Treatment, Physicochemical Separations
J. D. Norman (Ph.D., Rice) . . . . .	Wastewater Treatment, Biochemical Reactions
L. W. Shemilt (Ph.D., Toronto) . . . . .	Mass Transfer, Corrosion
J. Vlachopoulos (D.Sc., Washington U.) . . . . .	Polymer Rheology and Processing, Transport Processes
D. R. Woods (Ph.D., Wisconsin) . . . . .	Interfacial Phenomena, Particulate Systems
J. D. Wright (Ph.D., Cambridge) . . . . .	Process Simulation and Control, Computer Control

**DETAILS OF FINANCIAL ASSISTANCE AND ANNUAL RESEARCH REPORT AVAILABLE UPON REQUEST**

**CONTACT: Dr. C. M. Crowe, Chairman  
Department of Chemical Engineering  
Hamilton, Ontario, Canada L8S 4L7**



## THE UNIVERSITY OF MICHIGAN CHEMICAL ENGINEERING GRADUATE PROGRAMS on the ANN ARBOR CAMPUS

The University of Michigan awarded its first Chemical Engineering M.S. in 1912 and Ph.D. in 1914. It has moved with the times since and today offers a flexible program of graduate study that allows emphases ranging from fundamentals to design.

The Chemical Engineering Department, with 21 faculty members and some 70 graduate students, has opportunities for study and research in areas as diverse as: thermodynamics, reactor design, transport processes, mathematical and numerical methods, optimization, materials, mixing, bioengineering, electrochemical engineering, rheology and pollution control.

The M.S. program may be completed in 10 months and does not require a thesis. The Professional Degree requires thirty-hours beyond the Master's and a professional problem. The Ph.D. program has recently been revamped to expedite entry into a research area as early in the program as possible.

For further information and applications, write:

Chairman of the Graduate Committee  
The University of Michigan  
Department of Chemical Engineering  
Ann Arbor, Michigan 48104

## MICHIGAN TECHNOLOGICAL UNIVERSITY



DEPARTMENT OF CHEMISTRY  
AND CHEMICAL ENGINEERING  
HOUGHTON, MICHIGAN 49931

### CHEMICAL ENGINEERING FACULTY

L. B. HEIN, Ph.D., Department Head

DEGREES GRANTED: M.S.

M. W. BREDEKAMP, Ph.D. — Instrumentation, Process Dynamics and Control  
E. R. EPPERSON, M.S. — Phase Equilibria  
D. W. HUBBARD, Ph.D. — Lake Studies, Mixing Phenomena, Turbulent Flow  
J. T. PATTON, Ph.D. — Biosynthesis, Waste Treatment, Petroleum Recovery  
A. J. PINTAR, Ph.D. — Energy Conversion, Transport Phenomena, Applied Mathematics  
J. M. SKAATES, Ph.D. — Fluid-Solid Reactions, Catalysis, Reactor Design  
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### For further information contact

Dr. Robert F. Benenati  
Head, Department of Chemical Engineering  
Polytechnic Institute of New York  
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D. R. Brutvan	staged operations
H. T. Cullinan, Jr.	multicomponent diffusion, nonequilibrium thermodynamics
P. Ehrlich	polymeric materials, thermodynamics
W. N. Gill	dispersion, reverse osmosis
R. J. Good	surface phenomena, adhesion of living cells
J. A. Howell	biological reactors, waste treatment
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Chairman, Department of Chemical Engineering  
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WRITE TO: Dr. Henry A. McGee, Jr.

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**Dr. Donald E. Severson, Chairman**  
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Dr. M. A. Bergougnou, Chairman  
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### **TO DEPARTMENT CHAIRMEN:**

The staff of CHEMICAL ENGINEERING EDUCATION wishes to thank the 64 departments whose advertisements appear in this fifth graduate issue. We also appreciate the excellent response you gave to our request for names of prospective authors. We regret that, because of space limitations, we were not able to include some outstanding papers and that certain areas are not represented. In part our selection of papers was based on a desire to complement this issue with those of the previous years. As indicated in our letter we are sending automatically to each department for distribution to seniors interested in graduate school at least sufficient free copies of this issue for 20% of the number of bachelor's degrees reported in "ChE Faculties." Because there was a large response to our offer in that letter to supply copies above this basic allocation, we were not able to fully honor all such requests. However, if you have definite need for more copies than you received, we may be able to furnish these if you write us. We also still have some copies of previous Fall issues available.

We would like to thank the departments not only for their support of CEE through advertising, but also through bulk subscriptions. We hope that you will be able to continue or increase your support next year.

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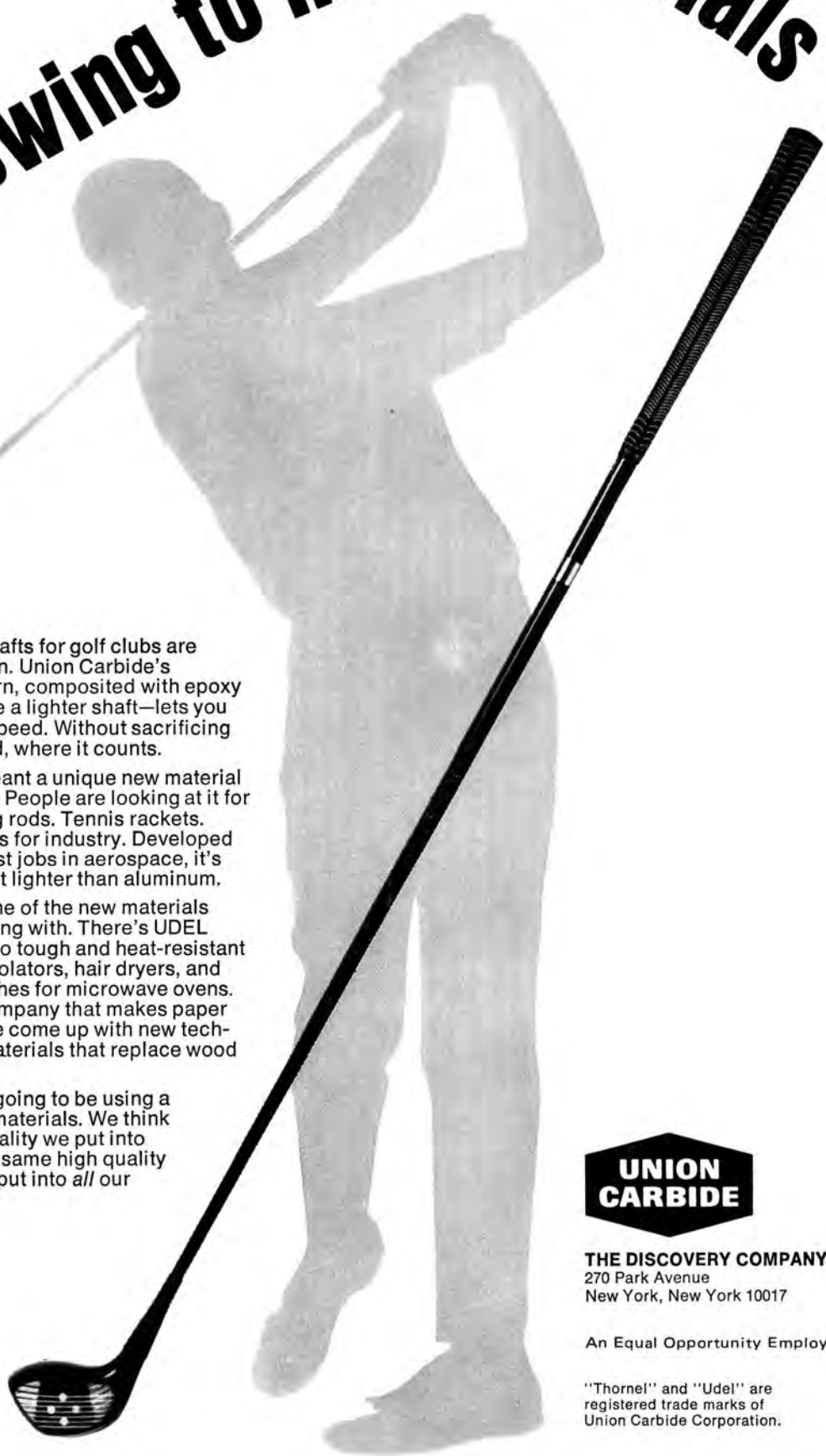
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