

UNIVERSITY OF ALBERTA

EDMONTON, ALBERTA, CANADA

Graduate Programs in Chemical and Petroleum 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: \$120/month.
Room and board, University Housing: \$100/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

15 Professors, 3 Post-doctoral Fellows,
40-50 Graduate Students.

Applications

Return postcard or write to:

Chairman

Department of Chemical and Petroleum Engineering
Application deadline for the academic year is May 1st.
Late applications considered only in exceptional cases.

Faculty and Research Interests

R. G. Bentsen, Ph.D. (Penn. State): Flow Through Porous Media, Secondary Recovery Mechanisms.

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

P. M. Dranchuk, M.Sc. (Alberta): Pattern Flooding, Reservoir Wettability, Flow Through Porous Media.

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

D. L. Flock, (Associate Dean), Ph.D. (Texas A & M): Petroleum Reservoir Analysis, Secondary Recovery Mechanisms.

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, Polymerization.

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

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

J. T. Ryan, Ph.D. (Missouri): Two Phase Flow, Fluid Mechanics.

D. E. Seborg, Ph.D. (Princeton): Process Control, Adaptive Control, Stability 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
- 2 IBM 360/67 terminals
- 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 420,000.

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.

You don't have to dig your Honda out of a snowdrift each morning to earn an advanced degree in Chemical Engineering.



The University of Arizona at Tucson has excellent advanced degree programs in Chemical engineering and you won't have to put on chains once unless you want to go skiing in the nearby mountains.

The Ch.E. department at Arizona is young and aggressive with a fully accredited undergraduate degree program and MS and PhD graduate programs. Financial support is available through NSF and NASA traineeships, teaching and research assistantships, and industrial grants. The faculty of eight in this medium-sized department assures full opportunity to study in the major areas of chemical engineering interest. Some graduate study areas of particular interest to the faculty are:

- reaction kinetics
- fluid flow
- thermal transport
- polymer processing
- process dynamics & simulation
- particulate systems
- crystallization
- minerals processing & recovery

Several interesting interdisciplinary research projects are being initiated including:

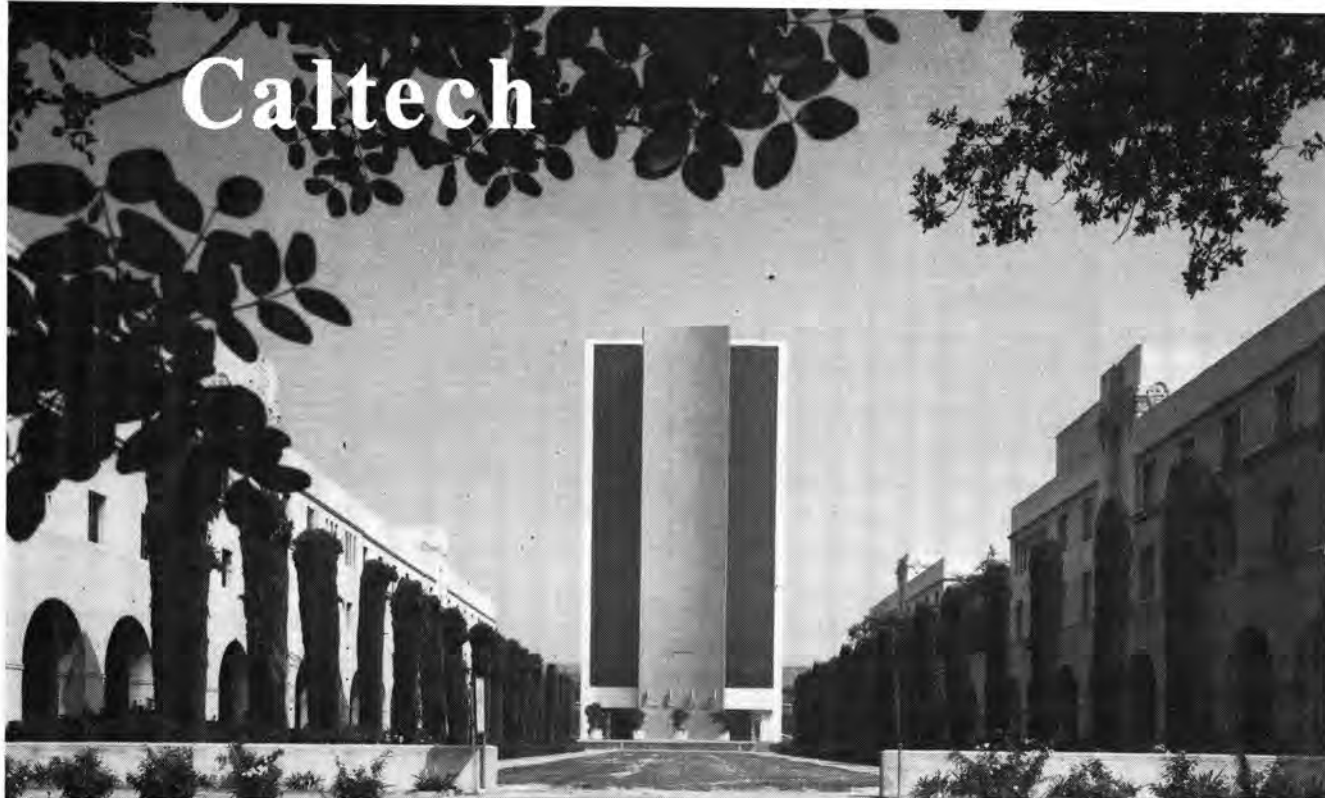
- biomedical (with Pathology and Urology Departments)
- solid state (with Electrical Engineering)
- advanced automotive fuel systems (with Electrical Engineering)

Tucson, abounding with recreational opportunities, is a pleasant modern city of 300,000 yet 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*





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. 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.

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

Prof. C. J. Pings
Executive Officer for Chemical Engineering
California Institute of Technology
Pasadena, California 91109

It is advisable to submit applications before February 15, 1972.

FACULTY IN CHEMICAL ENGINEERING

WILLIAM H. CORCORAN, Professor and Vice-President for Institute Relations
Ph.D. (1948), California Institute of Technology
Kinetics and catalysis; gas chromatography; plasma chemistry.

SHELDON K. FRIEDLANDER, Professor
Ph.D. (1954), University of Illinois
Aerosol chemistry and physics; particle-surface interactions; interfacial transfer; diffusion and membrane transport.

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

L. GARY LEAL, Assistant Professor
Ph.D. (1969), Stanford University
Fluid mechanics; rheology.

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

JOHN H. SEINFELD, Associate Professor
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; combustion.

NICHOLAS W. TSCHOEGL, Professor
Ph.D. (1958), University of New South Wales
Mechanical properties of polymeric materials and dilute polymer solutions.

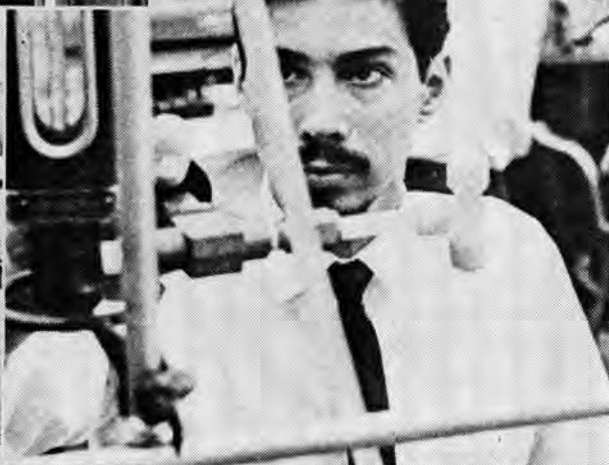
ROBERT W. VAUGHAN, Assistant Professor
Ph.D. (1967), University of Illinois
Solid state chemistry and physics, particularly effects of high pressure.

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

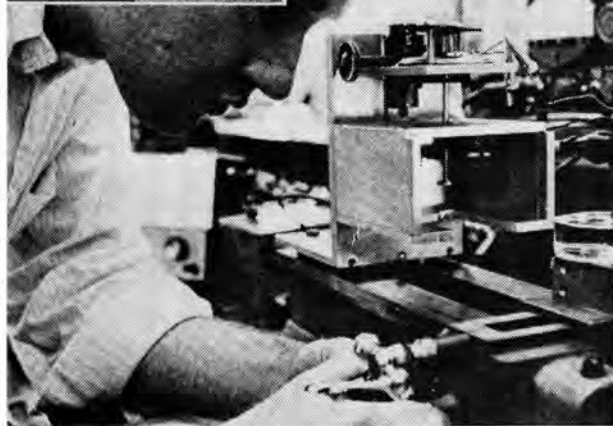
CASE WESTERN RESERVE UNIVERSITY



CASE INSTITUTE OF TECHNOLOGY, a privately endowed institution with a tradition of excellence in Engineering and Applied Science has long offered a variety of courses and research areas leading to the M.S. and Ph.D. degrees in Chemical Engineering. In 1967 Case Institute and Western Reserve University joined together. The enrollment and endowment make Case Western Reserve University one of the largest private schools in the country.



Students interested in graduate work in Chemical Engineering or Applied Chemistry should consider the varied opportunities available in the Chemical Engineering Science Division. Of special interest are strong programs in systems optimization and control, pollution, catalysis and surface chemistry, polymer science and engineering, biomedical engineering, mass transfer, reactor design, and others. Within these broad categories are many individual research projects and course offerings.



FINANCIAL ASSISTANCE

Graduate Assistantships are offered with stipends ranging from \$415 to \$515 per month (depending on background and marital status) from which \$170 per month tuition charge is deducted. Appointments are made by either the academic or the calendar year.

Fellowships and Traineeships are available providing stipends from \$200 to \$350 per month plus full tuition. Additional allowances for teaching and for dependents are included with some.

Predocctoral loans of substantial amounts are available.

FOR FURTHER
INFORMATION YOU ARE
INVITED TO WRITE:

ROBERT J. ADLER, Head
Chemical Engineering Science Division
School of Engineering
Case Western Reserve University
University Circle
Cleveland, Ohio 44106

CLARKSON

COLLEGE OF TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

POTSDAM, N. Y.

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

We are the recipient of an NSF Departmental Development Grant in the amount of \$590,000. As a consequence we have available attractive Assistantships and Fellowships. For information on programs and stipends contact the Graduate School Office, Clarkson College of Technology, Potsdam, New York 13676

CHEMICAL ENGINEERING FACULTY

- J. ESTRIN**—Prof. (Ph.D., 1960, Columbia University) Nucleation phenomena in crystallizing systems; condensation of vapors.
- W. N. GILL**—Prof. and Chmn. (Ph.D., 1960, Syracuse University) Reverse osmosis desalination; dispersion in fluid systems; heat transfer from free and forced convection; porous wall reactors.
- H. L. SHULMAN**—Prof. and Vice Pres. of the College. (Ph.D., 1950, University of Pennsylvania) Mass transfer, packed columns; adsorption of gases; absorption.
- A. F. BURKE**—Assoc. Prof. (Ph.D., 1967, Princeton University) High temperature, electrochemical, and electric arc processes; shock tube studies; chemical kinetics; combustion; corrosion.
- R. COLE**—Assoc. Prof. (Ph.D., 1966, Clarkson College of Technology) Boiling heat transfer; liquid film dynamics.
- E. J. DAVIS**—Assoc. Prof. (Ph.D., 1960, University of Washington) Two-phase flow fluid mechanics; convective diffusion; aerosol physics and bubble and droplet transport phenomena.
- J. L. KATZ**—Assoc. Prof. (Ph.D., 1963, University of Chicago) Nucleation phenomena; thermal conductivity of gas mixtures; the equation of state.
- R. J. NUNGE**—Assoc. Prof. (Ph.D., 1965, Syracuse University) Dispersion and flow in porous media; pulsating turbulent flow; heat transfer in multistream systems.
- T. J. WARD**—Assoc. Prof. (Ph.D., 1959, Rensselaer Polytechnic Institute) Process systems analysis; multivariable control; analog simulation; properties of materials; thermodynamics.
- G. R. YOUNGQUIST**—Assoc. Prof. (Ph.D., 1962, University of Illinois) Kinetics of catalytic reactions; reactor analysis; kinetics and equilibria of adsorption; crystallization.
- J. H. BEAMER**—Asst. Prof. (Ph.D., 1970, Stanford University) Optimization; desalination; societal systems.
- D. O. COONEY**—Asst. Prof. (Ph.D., 1966, University of Wisconsin) Multi-component absorption; biomedical engineering; unstable fluid flow; membrane separation processes; pharmacokinetics.
- C. S. LU**—Asst. Prof. (Ph.D., 1967, California Institute of Technology) Multiphase equilibrium; optimization methods; complex chemical reaction systems.
- R. A. SHAW**—Asst. Prof. (Ph.D., 1967, Cornell University) Nuclear engineering; reverse osmosis; radioactive tracers; nuclear reactor effluents.

The Cleveland State University

Graduate Study and Research in

CHEMICAL ENGINEERING

Leading to the Master of Science
Degree in Chemical Engineering



AREAS OF SPECIALIZATION

Thermodynamics ■ Pollution Control ■ Transport Processes

A limited number of fellowships and assistantships with stipends up to \$4000 per calendar year, plus tuition remission, are available for full time students. The master's program may be tailored to be terminal or to serve as preparation for more advanced work leading to the doctorate at another institution.

Students with a Bachelor of Science in Chemistry are invited to apply.

COURSE OFFERINGS 1971-1972					
Fall Quarter		Winter Quarter		Spring Quarter	
ChE 500	Chemical Engineering Analysis	ChE 481	Chemical Engineering Fundamentals	ChE 561	Transport Phenomena II
ChE 520	Applied Thermodynamics I	ChE 521	Applied Thermodynamics II	ChE 626	Biology for Engineers
ChE 615	Principles of Air Pollution Control	ChE 560	Transport Phenomena I		
ChE 630	Biological Wastewater Treatment	ChE 571	Turbulent Flow	ChE 636	Industrial Water Pollution Control

Inquiries and application forms may be obtained from:

Department of Chemical Engineering
The Cleveland State University
Cleveland, Ohio 44115



The Cleveland State University/Cleveland, Ohio 44115



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.

Victor H. Edwards, Ph.D. Kinetics and process control in fermentation.

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.

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

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

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

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.

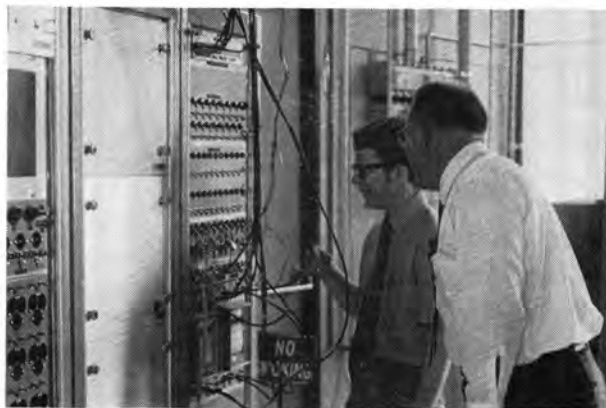
FURTHER INFORMATION, Write to the Graduate Field Representative, Olin Hall of Chemical Engineering, Cornell University, Ithaca, New York 14850.

The university of florida

offers you

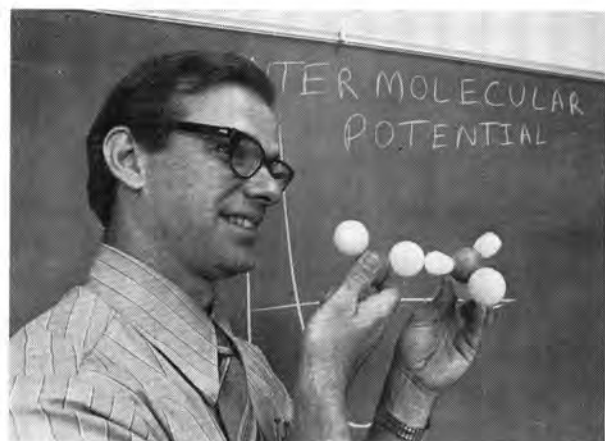
Transport Phenomena & Rheology

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

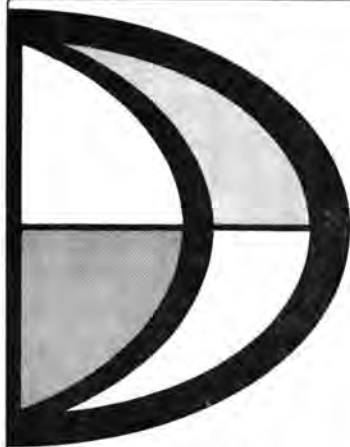
Oxygen being extracted from a substance similar to blood plasma.

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 231
University of Florida
Gainesville, Florida*



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 Manned Spacecraft 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





Iowa State University in Ames, Iowa, the first school to be established under the 1862 Land Grant Act, has a long tradition of leadership in Engineering and Applied Science. Today it ranks seventh in the nation in Ph.D. degrees granted in Engineering and ninth in degrees in Chemical Engineering. Its College of Engineering is the largest west of the Mississippi River.

To those interested in Chemical Engineering, Iowa State offers a variety of courses and research areas leading to the M.E., M.S. and Ph.D. degrees. The Department of Chemical Engineering is one of the oldest in the United States and enjoys a rich heritage of excellence in teaching and research. The staff numbers 22 and the enrollment consists of 300 undergraduate and 70 graduate students.

In addition to facilities available in a new Chemical Engineering building, research is

conducted in the Ames Laboratory, a National Laboratory of the US Atomic Energy Commission, located on the Iowa State campus. A staff of nearly 1,000 at the Laboratory conducts basic research of long-range interest to the nuclear industry.

Ames lies amid the gently rolling hills of central Iowa. Typical of the picturesque yet modern campus is the new cultural center shown above, now half complete. This fall the Festival of Concerts at the center auditorium was opened by the New York Philharmonic. The 14,000-seat coliseum will host many Big Eight Conference athletic events.

A large variety of assistantships and fellowships are filled each year by new graduate students in Chemical Engineering. Living accommodations are available for single students in a new eight-story graduate dormitory, and for married students in more than 1300 apartments operated by the University.

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

Please send application forms and further information on your graduate program.

Name _____ Undergraduate School _____

Number and Street _____

City _____ State _____ Zip Code _____

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

M.S. and Ph.D. Study in Chemical Engineering

including

A Unique Program in AIR POLLUTION CONTROL

Kinetics and equilibria of atmospheric reactions

Micrometeorology

Diffusion in the atmosphere: modelling of urban areas

Air sampling and analysis

Process and system control; air cleaning

Effects of pollutants on man, materials, and environs

A Specialized Program in WATER POLLUTION CONTROL

Excellent E.P.A. Traineeships available

At U.K.—a nine-man faculty, new laboratory and class-room facilities, a complete graduate curriculum, a variety of research topics . . .

Contact: Robert B. Grieves

Dep't of Chemical Engineering

University of Kentucky

Lexington, Kentucky 40506

Chemical Engineering at LSU

... offering master of science, and doctor of philosophy degrees, and a master of science in sugar engineering. Master's candidates may pursue a degree under thesis or course options; the thesis option is encouraged for master's-only candidates.

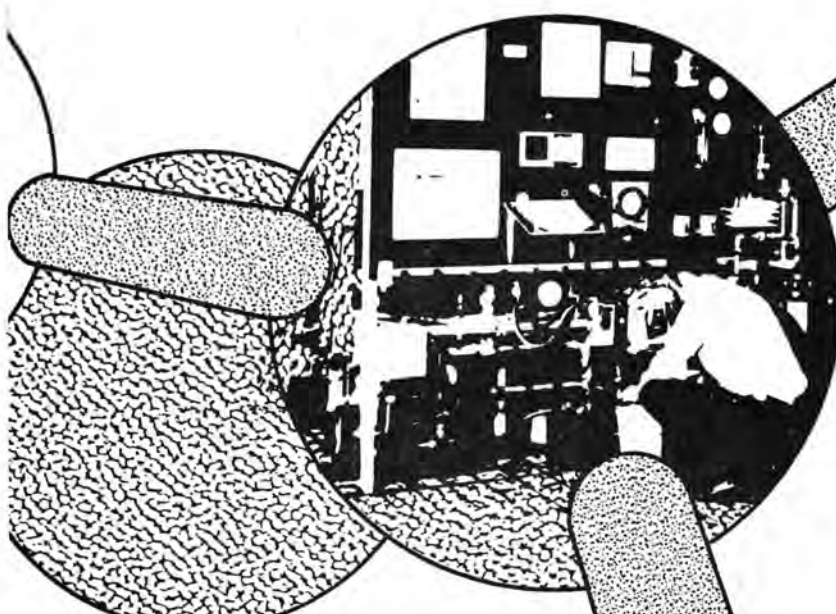
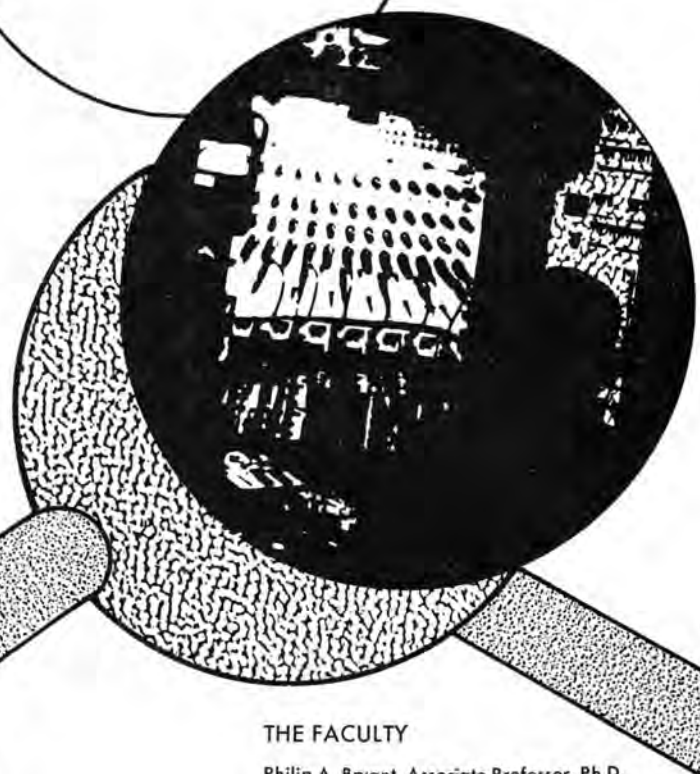
The department—with new, modern facilities—is equipped with laboratories for research in reacting and thermal fluids, high polymers, and lasers; and with analog, digital, and hybrid computers. The Nuclear Science and Computer Research Centers also service the department. LSU Library holdings near 1,300,000 volumes.

Undergraduate enrollment is 190; and graduate enrollment, 90 (70 master's, and 20 doctoral candidates). Last year, 74 degrees were awarded, including 55 bachelor's, 13 master's, and 6 doctoral degrees.

LSU, a campus of about 19,000 students, is located in Baton Rouge, a major petrochemical center and inland port, capital city, 80 miles north of New Orleans.

For more information, contact:

Dr. Joseph A. Polack, Head
Department of Chemical Engineering
Louisiana State University
Baton Rouge, La. 70803



RESEARCH INTERESTS

Bioengineering
Chemical Kinetics and Reactor Design
Ecology and Pollution Control
Estuarine Studies
Microbiological Laser Irradiation
Physical, Chemical and Thermodynamic Properties of Materials
Polymer Chemistry
Process Control and Dynamics
Pulp and Paper Research
Sugar Technology
Synthetic Foods
Transport Phenomena

THE FACULTY

Philip A. Bryant, Associate Professor, Ph.D.
Clayton D. Callihan, Professor, Ph.D.
Jesse Coates, Alumni Professor, Ph.D.
James B. Cordiner, Professor, Ph.D.
Armando B. Corripio, Assistant Professor, Ph.D.
Richard C. Farmer, Associate Professor, Ph.D.
David B. Greenberg, Associate Professor, Ph.D.
Frank R. Groves Jr., Professor, Ph.D.
Douglas P. Harrison, Assistant Professor, Ph.D.
Adrain E. Johnson, Jr., Professor, Ph.D.
Edward McLaughlin, Professor, Ph.D.
Paul W. Murrill, Professor, Provost and Vice-Chancellor, Ph.D.
Ralph W. Pike, Associate Professor, Ph.D.
Jerome A. Planchard, Jr., Assistant Professor, Ph.D.
Joseph A. Polack, Professor and Head, Sc.D.
Bernard S. Pressburg, Professor and Associate Dean of Engineering, Ph.D.
Roger W. Richardson, Professor and Dean of Engineering, Ph.D.
John J. Seip, Associate Professor and Superintendent of the Audubon Sugar Factory, Ph.D.
Cecil L. Smith, Associate Professor and Chairman, Computer Science Department, Ph.D.
Edgar C. Tacker, Associate Professor, Ph.D.
Alexis Voorhies Jr., Visiting Professor, Honoris Causa.
Albert H. Wehe, Associate Professor, Ph.D.
Bert Wilkins, Associate Professor, Ph.D.



DEPARTMENT OF
CHEMICAL ENGINEERING

UNIVERSITY OF MARYLAND

COLLEGE PARK, MARYLAND 20740

The Department offers graduate work in chemical, materials, and nuclear engineering leading to the M.S. and Ph.D. degrees. Some of the fields of specialization of the faculty are:

Chemical Engineering

Process Control Systems
Heat and Mass Transfer
Turbulent Transport
Solvent Extraction
Design and Cost Studies
Reaction Kinetics
Catalysis
Multiphase Flow
Process Dynamics
Computer Simulation

Biological and

Environmental Engineering

Aerosol Mechanics
Membrane Separations
Artificial Organs
Bioengineering
Environmental Health
Air Pollution Control

Nuclear Engineering

Nuclear Reactor Physics
Nuclear Reactor Design
Nuclear Reactor Operation
Radiation Induced Reactions
System Dynamics
Radiation Shielding
Radiation Engineering
Thermionics

Engineering Materials

Reaction of Solid Surfaces
Solid State Behavior
Composite Materials
Statistical Thermodynamics
Structure of Metallic Solutions

Applied Polymer Science

Polymer Physics
Graft Polymerization
Polymerization Kinetics
Non-Newtonian Flow

The general requirements are set forth in the Graduate Catalog. The chemical engineering program is designed for qualified bachelors chemical engineering students. The materials and nuclear engineering programs are open to qualified students holding bachelors degrees in engineering, the physical sciences, and mathematics.

Address inquiries to

Dean, Graduate School or Chairman Department of Chemical Engineering

Department of Chemical Engineering

UNIVERSITY OF MISSOURI — ROLLA

ROLLA, MISSOURI 65401

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

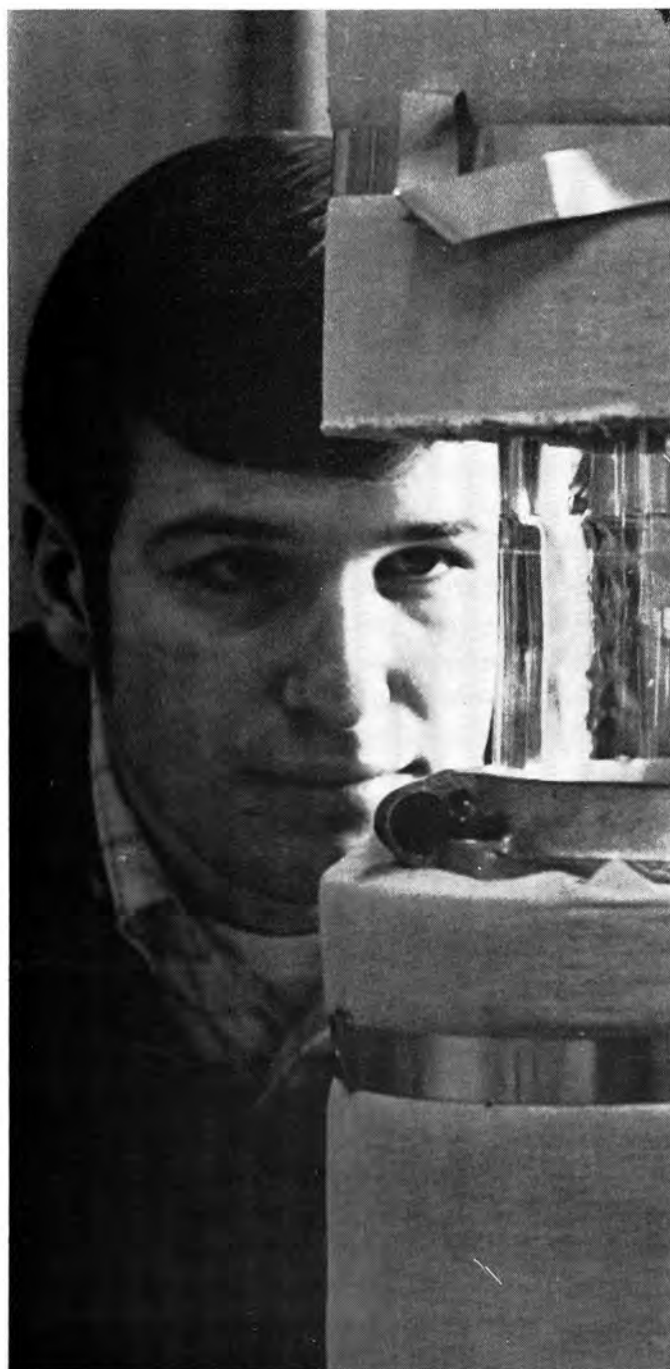
In addition, research projects are being carried out in the following areas:

- (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
- (h) Thermodynamics, Vapor-Liquid Equilibrium—Dr. D. B. Manley



Financial aid is obtainable in the form of Graduate and Research Assistantships, Industrial Fellowships and Federal Sponsored Programs. Aid is also obtainable through the Materials Research Center.

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



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

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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 School of Chemical Engineering has also undergone considerable change and growth, attracting national attention because of its rapid rise to excellence.

SCHOOL OF CHEMICAL ENGINEERING

FACULTY

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William C. Cohen, Ph.D. (Princeton)
William C. Forsman, Ph.D. (Pennsylvania)
David J. Graves, Sc.D. (M.I.T.)
A. Norman Hixson, Ph.D. (Columbia)
Arthur E. Humphrey, Ph.D. (Columbia)

RESEARCH SPECIALTIES

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

For further information on graduate studies in this dynamic setting, write to: Dr. D. D. Perlmutter, School of Chemical Engineering, Univer-

Ronald L. Klaus, Ph.D. (R.P.I.)
Mitchell Litt, D. Eng. (Columbia)
Alan Myers, Ph.D. (California)
Melvin C. Molstad, Ph.D. (Yale)
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The Department offers a wide range of graduate courses and conducts significant research programs in

- | | |
|--|---|
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| <input type="checkbox"/> Fluid dynamics | <input type="checkbox"/> Optimization |
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For details and applications, contact Prof. I. F. Miller, Head, Chemical Engineering Department, Polytechnic Institute of Brooklyn, 333 Jay Street, Brooklyn, New York 11201; telephone (212) 643-2852.



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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 systems and design, 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; 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, Thermodynamics, 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; TADAO KOTAKA, Ph.D., Kyoto University, Polymer Science; 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; KENNETH H. McCORKLE, Ph.D., Tennessee, Colloidal Systems; CARL J. McHARGUE, Ph.D., Kentucky, Physical Metallurgy; ROY A. VANDERMEER, Ph.D., Illinois Institute of Technology, Physical Metallurgy; JACK S. WATSON, Ph.D., Tennessee, Fluid Mechanics.

Laboratories and Shops

Analog computer (Expanded EAI, PACE 221R) and digital computer (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, AMR 900), 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 13 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 interests, 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 50 full-time graduate students enrolled at present.

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

BRIGHAM YOUNG UNIVERSITY
Chemical Engineering Department
M.S. AND Ph.D. PROGRAMS

Areas of Interest

Transport/kinetic processes
Solution thermodynamics
High pressure technology
Environmental Control
Nuclear engineering

Special Research Organizations

Center for Thermochemical Studies
Engineering Fluid Mechanics Research
Group
High Pressure Laboratory
Center for Environmental Studies

Faculty

Dee H. Barker
James J. Christensen
Dwight P. Clark
Ralph H. Coates
Joseph M. Glassett
H. Tracy Hall
Richard W. Hanks
M. Duane Horton
Bill J. Pope
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L. Douglas Smoot, Chairman
Grant M. Wilson

FOR INFORMATION CONTACT

Dr. Richard W. Hanks
Graduate Coordinator
234 ELB, Chemical Engineering
Brigham Young University
Provo, Utah 84601



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 and liquid-liquid extraction; thermodynamics; mathematical applications in chemical systems; reaction kinetics; process dynamics and control; metallurgy and the science of materials; nuclear 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
N. A. Dougharty:	Catalysis, Chemical Kinetics
A. P. Jackman:	Process Dynamics, Thermal Pollution
B. J. McCoy:	Molecular Theory, Transport Processes
J. M. Smith:	Water Pollution, Reaction Design
S. Whitaker:	Fluid Mechanics, Interfacial Phenomena

Write To:

Graduate Student Advisor
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University of California, Santa Barbara 93106**



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Chemical Engineering Department

M.S. and Doctoral Programs

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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

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Newark, Delaware 19711

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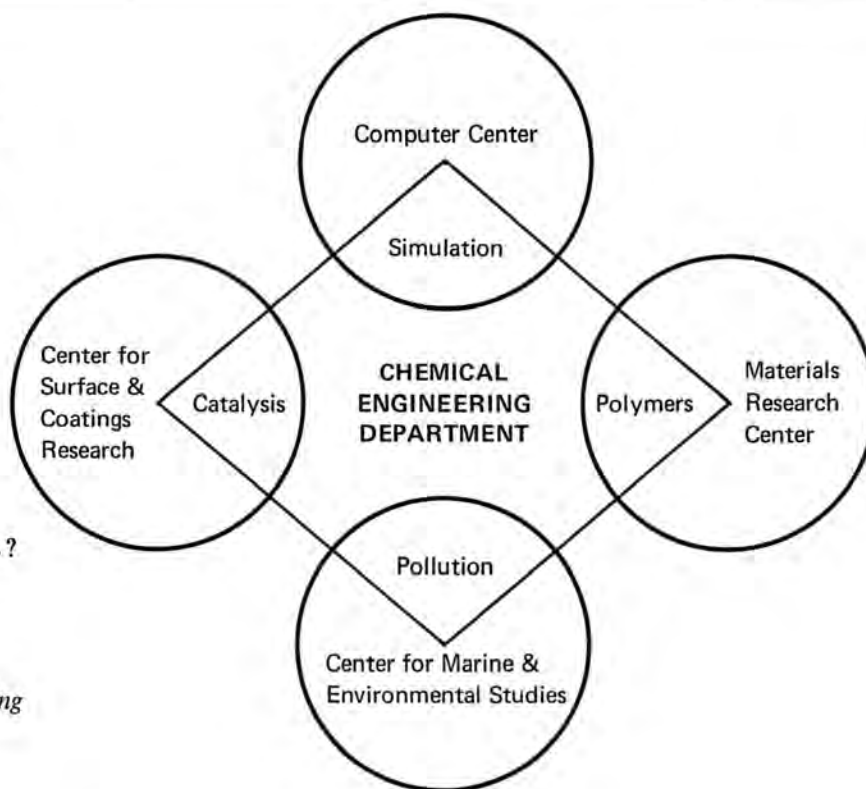
FOR MORE INFORMATION WRITE TO

Professor B. G. Kyle
Department of Chemical Engineering
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Chairman of the Graduate Committee
The University of Michigan
Department of Chemical Engineering
Ann Arbor, Michigan 48104

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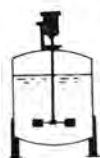
- Gas Absorption with Reaction
- Waste Treatment Engineering
- Process Dynamics
- Biochemical Engineering
- Fluid - Particle Mechanics
- Mixing of Liquids
- Submerged Combustion

ries should be addressed to the Chairman of Department, Professor O. E. Potter.

Postal Address: Monash University, Wellington Road, Clayton, Victoria, 3168, Australia.



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Prof W. A. Scheller, Chairman, Department of Chemical Engineering
University of Nebraska, Lincoln, Nebraska 68508



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FOR FURTHER INFORMATION ADDRESS:

Mr. Alex Bedrosian, Assistant Dean
Graduate Division
Newark College of Engineering
323 High Street, Newark, N. J. 07102

GRADUATE STUDY IN CHEMICAL ENGINEERING

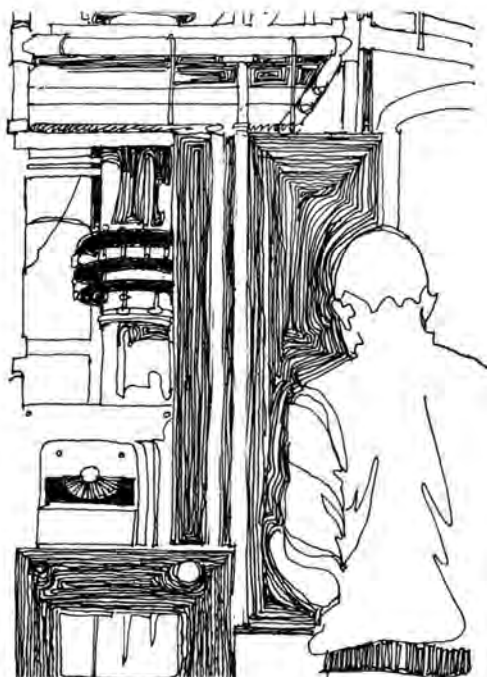
THE OHIO STATE UNIVERSITY

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 - Thermodynamics
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 - Process Dynamics and Simulation

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Kinetics & Reactor Design, Computer Applications
Glass Science & Technology, Thermodynamics
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For information write: J. R. Ferron, Chairman



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nate program of study, the Master of Engineering degree consists of thirty-two credit hours of course work and a four-credit-hour research paper, which is often a literature review and need not be an original contribution to the chemical engineering literature.

STAFF

R. G. Anthony, Polymer Kinetics, Phase Equilibria
 Ronald Darby, Rheology, Biomedical Engineering, Electrochemistry
 R. R. Davison, Desalination, Liquid Solution Thermodynamics
 L. D. Durbin, Process Dynamics and Control
 P. T. Eubank, Gas Phase Thermodynamics
 D. T. Hanson, Bio-Engineering
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 W. D. Harris, Heat Transfer
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 W. W. Meinke, Bio-Engineering
 E. A. Schweikert, Activation Analysis
 R. E. Wainerdi, Activation Analysis

PROGRAM OF STUDY

The Department of Chemical Engineering at Texas A&M University offers programs of study for the Master of Science, Master of Engineering, and Doctor of Philosophy degrees.

Thirty-two credit hours consisting of twenty-four credit hours of course work and an eight-credit hour research thesis are required for the Master of Science degree. As an alter-

For information concerning the graduate program contact Dr. P. T. Eubank, Graduate Advisor, Texas A&M University, Department of Chemical Engineering, College Station, Texas 77843

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M.S. AND Ph.D. PROGRAMS**



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PROF. K. A. VAN WORMER, JR.
 DEPARTMENT OF CHEMICAL ENGINEERING
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Department of Chemical Engineering
West Virginia University
Morgantown, West Virginia 26506

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Write to: Dr. W. L. Kranich

Department of Chemical Engineering
Worcester Polytechnic Institute
Worcester, Mass. 01609

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Chairman, Graduate Committee
Chemical Engineering Department
University of Colorado, Boulder

McMASTER UNIVERSITY

Hamilton, Ontario, Canada

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DEPTH

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Computer-Aided Analysis
Water & Waste Water Treatment
Polymers
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Chemical Reaction Engineering
Transport Phenomena

Contact: Dr. C. M. Crowe, Chairman
Dept. of Chemical Engineering

UNIVERSITY OF NEW BRUNSWICK

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FINANCIAL AID: The range of assistantship available is presently from \$3800 p.a. to \$5500 p.a. The Department has an Atlantic Sugar Fellowship (Atlantic Provinces students) and an Alcan Fellowship (open to foreign students). Several research contracts are held (assistantships open to foreign students) as well as NRC grants for research (assistantships restricted to Canadian citizens or landed immigrants.)

INFORMATION: Please direct all enquiries to:

Dr. David R. Morris
Director of Graduate Studies
Department of Chemical Engineering
Sir Edmund Head Hall
University of New Brunswick
Fredericton, New Brunswick, Canada

NEW MEXICO STATE UNIVERSITY

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CHEMICAL ENGINEERING

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DEPARTMENT OF
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Doctor of Science

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TO DEPARTMENT CHAIRMEN:

The staff of CHEMICAL ENGINEERING EDUCATION wishes to thank the 55 departments whose advertisements appear in this third 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 1969 and 1970. 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 the 1969 and 1970 Fall issues available.

We would like to thank the departments not only for their support of CEE through advertising, but also through bulk subscriptions. Each year since we began publication at the University of Florida the number of departments supporting us has increased—largely through the efforts of Professor Stuart Churchill who has served as our university representative.

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