MASTER OF SCIENCE IN ENGINEERING IN CHEMICAL ENGINEERING

Option Coordinator

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Option Description

Chemical engineers apply scientific and engineering knowledge to design and produce a wide variety of consumer and industrial products, including food, fuels, plastics, pharmaceuticals, etc. Chemical engineers find exciting global career opportunities in the chemical, biomedical, nuclear, pharmaceutical, and energy fields. Graduate study in chemical engineering provides students with the scientific and professional knowledge necessary for their field of interest and develops student abilities to formulate solutions to new and complex problems in the context of current environmental, social, and economic considerations. These objectives are accomplished by flexible plans of study designed to meet the needs of the program's graduate students. The Chemical Engineering program offers five different plans, including thesis, non-thesis, engineering management, internship, and an accelerated 4+1 MSE plans.

Facilities for advanced study and research are located in Moser Hall, which houses a variety of well-equipped laboratories. These include the heat transfer lab, distillation lab, and biochemical engineering lab. In addition, the college computer lab provides access to a large number of modern PCs with high-speed internet connections.

Admission Requirements

DEGREE PROGRAMS

Applicants must meet all of the general requirements for admission to the College of Graduate Studies. Admission to the program is selective and based on the qualifications of the applicant, the needs of the program, and the availability of funding. Applicants with lesser qualifications may be granted provisional graduate student status based on evaluation of their undergraduate records, standardized test (e.g. GRE) results, work experience, and other professional qualifications. Graduate assistantship is offered to highly qualified applicants based on the needs of the program and the availability of funding.

The Master of Science in Engineering may be characterized as being both career-oriented and flexible. Five different program plans are available to accommodate the needs of nearly every engineering graduate student. Graduate students enrolled in the Chemical Engineering graduate program must complete:

- 30 semester hours for the thesis plan,
- 33 semester hours for the nonthesis plan,
- 33 semester hours for the management plan,
- 30 semester hours for the internship or industrial project plan, or
- 30 semester hours for the Accelerated 4+1 plan.

*The accelerated 4+1 MSE plan is only available to students already in the YSU Chemical Engineering undergraduate program.

The degree requirements consist of core courses, technical courses, graduate internships, and thesis or project courses. The management plan requires a series of business courses. The internship plan requires 6-9 semester hours of graduate-level internship courses. The graduate internship must be in the chemical engineering discipline and comparable to graduate course work.

These degree programs are designed to provide graduate students with the knowledge and skills to excel in professional careers and/or pursue a PhD in Chemical Engineering. To obtain a list of core and technical course required in the Chemical Engineering program, students should contact the Graduate Program Coordinator.

Program Plans

Thesis Plan

Graduate students choosing the thesis plan are required to complete 30 semester hours of graduate coursework. This generally consists of:

- 15 semester hours of core courses,
- 9 semester hours of technical concentration courses, and
- 6 semester hours of thesis.

This plan is strongly recommended for all candidates who wish to continue their graduate studies beyond the master's degree. The thesis provides firsthand research experience with experimental design, literature searches, research methodology, technical report writing, and oral presentation of research results. Additionally, the thesis option can lead the graduate student to a higher level of expertise in the chosen area of specialization. Students enrolled in this plan are required to have a thesis proposal approved by their faculty advisor and the Graduate Program Director before the end of their second semester in the Chemical Engineering graduate program.

Non-thesis Plan

The non-thesis plan is designed for students who wish to enhance their knowledge and skills to succeed in careers as practicing engineers, but are unlikely to pursue a PhD. A total of 33 semester hours of coursework is required for this plan. In addition to 15 semester hours of core courses, every student enrolled in this option is required to complete 15 semester hours of technical courses related to their discipline, and a 3-semester-hour graduate project course, under the guidance of a faculty advisor. Students enrolled in this plan are required to have a project proposal approved by their faculty advisor and the Graduate Program Director before the end of their second semester in the Chemical Engineering graduate program. A graduate student enrolled in a graduate project course will be required to defend the results of his or her project by giving a presentation to the engineering faculty and students.

Management Plan

Students who have been in the work arena and are moving into an engineering management role may wish to choose the management plan. A total of 33 semester hours of coursework is required for this plan. This consists of:

- 15 semester hours of core courses,
- 9-12 semester hours of business courses,
- 6-9 semester hours of technical courses, and
- a 3-semester-hour graduate project.

Students enrolled in this plan are required to have a project proposal approved by the faculty advisor and the Graduate Program Director before the end of their second semester . A graduate student enrolled in a graduate project course will be required to defend the results of his or her project by giving a presentation to the engineering faculty and students. Students with the Management Plan should consult the Graduate Program Director and the faculty advisor to develop their course plan.

INTERNSHIP PLAN

This option is suitable for students who would like to gain practical experience in the industry before graduating with a master's degree. A total of 30 semester hours of coursework is required for this plan. The internship plan consists of:

- 15 semester hours of core courses,
- 9 semester hours of technical courses, and
- 6-9 semester hours of graduate-level internship courses.

Students enrolled in this plan are required to have an internship proposal approved by the Graduate Program Director before the end of their second semester into the program. The graduate internship must be approved by the Chemical Engineering Graduate Program Director on a case by case basis for graduate course credit. The internship shall be in the chemical engineering discipline and be comparable to graduate course work. The graduate internship will require at least 400 hours of work for 3 semester hours of graduate credit, 300 hours of work for 2 semester hours of graduate credit, and 200 hours of work for 1 semester hour of graduate credit. Internship students are strongly encouraged to consult with the STEM Professional Practices Office to seek internship opportunities.

Accelerated 4+1 MSE PLAN

Undergraduate students already in the YSU Chemical Engineering undergraduate program can apply for admission into the accelerated 4+1 MSE in the Chemical Engineering graduate program after completing 78 semester hours with a GPA of 3.3 or higher. After being admitted into the accelerated 4+1 MSE program, students will be allowed a maximum of nine semester hours of graduate coursework to be double-counted towards both bachelor's and master's degrees upon approval by the Graduate Program Director. An additional three hours of graduate coursework can be completed as an undergraduate and used exclusively for graduate credit.

Chemical Engineering Requirements

At the time of initial enrollment, the student will select a program plan (thesis, non-thesis, management, or internship) and technical area of interest (e.g. chemical processes, biochemical, environmental, materials) available through faculty expertise and consultation. The degree requirements for each plan are listed above under Program Plans. Lists of required courses and possible electives are shown below.

In cooperation with an assigned faculty advisor, each student will establish a set of academic goals and desired outcomes, and a coursework plan to meet those objectives. Upon completion of the graduate program, all students will complete either a written or an oral assessment of the effectiveness of the program in meeting their established goals and outcomes.

Thesis students who have registered for all required thesis hours and have completed all course requirements but have not finished the thesis are required to maintain current student status if they expect to utilize any University service (e.g., parking, computers, library, advisors' assistance, thesis defense, etc.). This can normally be accomplished by registering for at least one hour of thesis credit.

COURSE	TITLE	S.H.
Core Courses		15 Total Hours
MATH 6910	Advanced Engineering Mathematics 1	3
MATH 6911	Advanced Engineering Mathematics 2	3
CHEN 6981	Advanced Chemical Reaction Engineering	3
CHEN 5811	Advanced Transport Phenomena	3
CHEN 5800M	Special Topics Advanced Chemical Engineering Thermodynamics	3
Technical Courses Examples		Select 2-3 Courses
CHEN 5845	Corrosion Engineering	3
CHEN 5821	Fundamentals of Polymer Science	3
CHEN 5805	Principles of Biomedical Engineering	3
CHEN 5800E	Special Topics Material Science and Engr	3
MECH 6915	Failure Analysis	3
STAT 6943	Mathematical Statistics 1	3
STAT 6944	Mathematical Statistics 2	3
STAT 6949	Design and Analysis of Experiments	3
Choose One:		Minimum Required
CHEN 6990	Thesis	6
CHEN 5800	Special Topics	3
STEM 5890	STEM Graduate Internships	6

Learning Outcomes

- an ability to formulate and solve advanced engineering problems;
- an ability to apply advanced knowledge of chemistry, biology and/or material science in chemical engineering.
- an ability to design and conduct research projects;
- technical writing and oral communication skills.

CHEN 5805 Principles of Biomedical Engineering 3 s.h.
Application of engineering principles and methods of analysis to processes in the human body. Rheological, physical and chemical properties of body fluids. Dynamics of the circulatory system. The human thermal system. Transport through cell membranes. Analysis and design of artificial organs.
Prereq.: CHEN 2684 or consent of instructor.

CHEN 5811 Advanced Transport Phenomena 3 s.h.
Development of basic differential balance equations for mass, momentum and energy. Analytical and approximate solutions to the equation of change with application to the analysis of common engineering problems.
Prereq.: CHEN 3786.

CHEN 5820 Industrial Pollution Control 3 s.h.
Types, sources and effects of industrial and hazardous waste; principles of industrial and hazardous waste control; discussion and design of biological, physical, and chemical treatment processes.
Prereq.: CHEN 2684 or consent of instructor.

CHEN 5821 Fundamentals of Polymer Science 3 s.h.
The survey of polymerization mechanisms, polymer structure-property relationships, transport properties, flammability-related plasticizers and solvents as well as design applications.
Prereq.: CHEN 2684 or consent of instructor.

CHEN 5830 Nuclear Reactors 3 s.h.
Neutron interactions and scattering; moderation ratio, the steady state reactor core and four factor equation, the diffusion equation for various reactor geometries and the reflected reactor core.
Prereq.: CHEN 3726 or consent of instructor.

CHEN 5835 Introduction to Nuclear Fusion 3 s.h.
Fusion reactors; the kinetics of fusion reactions. Plasma confinement technology.
Prereq.: CHEN 3726.

CHEN 5845 Corrosion Engineering 3 s.h.
Introduction to causes and forms of corrosion, corrosion rate calculations, electrode potentials, electrochemistry, corrosion testing, and effects of corrosion on mechanical properties. Theory and use of corrosion inhibition methods.
Prereq.: CHEN 2684.

CHEN 5850 Industrial Processes 3 s.h.
A fundamental approach to the design of industrial chemical processes. Emphasis upon flow-charting, chemical reactions, separations involved, thermodynamics, and economic considerations. Food and pharmaceutical processing is a major focus.
Prereq.: CHEN 2684 or consent of instructor.

CHEN 5854 Corrosion Engineering 3 s.h.
Introduction to causes and forms of corrosion, corrosion rate calculations, electrode potentials, electro-chemistry, corrosion testing, and effects of corrosion on mechanical properties. Theory and use of corrosion inhibition methods.
Prereq.: Junior or Senior Standing or Approval of the Instructor.

CHEN 5883 Mathematical Methods in Chemical Engineering 3 s.h.
The applications of advanced mathematics to the solution of chemical engineering problems. Topics covered include treatment and interpretation of engineering data, modeling of chemical engineering systems and formulation of ordinary and partial differential equations governing chemical engineering operations and their solutions by use of numerical and analytical techniques.
Prereq.: CHEN 3786.

CHEN 5886 Nuclear Reactor Design 3 s.h.
The steady state reactor core; four-factor equation, resonance escape probability, neutron flux distribution in various geometrics, two-group and multigroup theories. Transient reactor behavior and control; effect of delayed neutrons, fission product poisoning, nuclear fuels, nuclear heat transfer and burnout problems, reactor economy; fuel burnup and power cost. Thermal breeder and fast reactors. Neutron flux distribution measurements. Radiation detection and monitoring.
Prereq.: CHEN 3726 or consent of instructor.

CHEN 6981 Advanced Chemical Reaction Engineering 3 s.h.
Advances topics in chemical reaction engineering including non-elementary reaction kinetics, reactor design for autocatalytic reactions, temperature and energy effects in chemical reactions, heterogeneous catalysis, catalyst preparation, fabrication and activation.
Prereq.: CHEN 4880.

CHEN 6983 Modern Power Sources 3 s.h.
Analytical and descriptive study of modern power plants. Combustion and environmental problems with fossil-fueled power plants. Electromagnetic circuits and devices with emphasis on the principles of electromechanical energy conversions.

CHEN 6984 Nuclear Fission and Fusion Power Sources 3 s.h.
Energy available from fission and fusion nuclear reactions, on setting and maintaining chain reaction. Mechanical and electromagnetic confinement techniques. Reactor design, heat removal, and safety problems.

CHEN 6985 Electromechanical Motion Devices 3 s.h.
Thermodynamics of batteries, and electric and fuel cells. Power from nuclear isotopes. Features common to rotating electromagnetic fields. Analysis and design of electromechanical power components.

CHEN 6990 Thesis 1-9 s.h.
Research selected and supervised by departmental advisor. May be repeated for a maximum of nine semester hours.
Prereq.: Acceptance by departmental committee.