

# MASTER OF SCIENCE IN ENGINEERING

The Rayen School of Engineering and Engineering and Technology, as part of the College of Science, Technology, Engineering, and Mathematics, offers a graduate program leading to the Master of Science degree in engineering. Admission to any of the five engineering options, including chemical, civil and environmental, electrical, industrial and systems, and mechanical engineering, is granted to qualified applicants who have been judged to have a good chance of succeeding in the program and obtaining a graduate degree. Several technical concentration areas are available in each option. Students may select a thesis, non-thesis, or management curriculum plan. These opportunities serve the practicing engineer, as well as the student, who wants to pursue advanced graduate study and research. Courses offered on campus are usually held during the evenings. The educational opportunities include traditional classroom and laboratory courses, seminars, and research projects guided by experienced members of the graduate faculty.

Teaching or research assistantships are available to qualified applicants on a competitive basis upon review and recommendation by the home department. In addition, the College of Graduate Studies may offer scholarships or grants-in-aid to qualified students. Students desiring assistantships or scholarships must submit an application to the College of Graduate Studies by the specified deadlines.

This description provides an overview of admission and degree requirements, advising, and program plans. Information concerning course scheduling and prospective course offerings can be obtained from the YSU website or the individual engineering departments. Further assistance with any matter related to engineering graduate programs may be obtained by telephone, email, or personal visit to the program option coordinator in the student's area of interest.

## 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 Assistantships

Students interested in a graduate assistantship position must submit a separate application along with three recommendations to the College of Graduate Studies. Further details are provided elsewhere in the Graduate Catalog under Financial Assistance. The College of Graduate Studies will forward the application to the department. Each engineering department has established a process for evaluating applicants. Applicants should contact the option coordinator in their field of interest for details. Final recommendations are forwarded to the dean of the College of Graduate Studies. Applicants are notified by mail of the dean's decision.

In cases where the applicant is not fully prepared for their intended graduate program, completion of undergraduate deficiency courses may be required. This is common when the applicant's undergraduate degree is in a different discipline than the intended graduate program. Such applicants may be granted provisional admission as long as they require no more than 9 semester hours of undergraduate deficiency courses. In addition, some programs may require stronger evidence of academic ability (e.g. higher GPA) for applicants having undergraduate degrees outside the discipline.

### Non-Degree Admission

Students meeting all requirements for admission to the College of Graduate Studies, but who do not intend to pursue a Master of Science degree, may apply for non-degree admission. In addition, an applicant whose academic record does not meet the required standards for admission to a Master of Science program may apply for non-degree admission to the College of Graduate Studies. For students wishing to pursue a Master of Science in Engineering degree, non-degree admission provides an opportunity to demonstrate his/her academic capability. Non-degree students completing nine semester hours of appropriate graduate courses with grades of B or better may apply for admission to a specific engineering degree option with regular or provisional status to continue his/her study for the Master of Science in Engineering.

### Advisement

The Rayen School of Engineering and Engineering Technology requires an advisor for each individual graduate student. An advisor is recommended by the option coordinator in the student's discipline and assigned by the College of Graduate Studies upon acceptance. It is the responsibility of the student to initiate contact with his or her advisor, and this should be done as soon as possible before registering for the first time and at the time of course registration each semester. The student, with the help of his or her advisor, shall develop a study plan that includes goals and desired outcomes, and a coursework plan. The plan may be revised, if necessary, as the study progresses, with the approval of the advisor and option coordinator.

## Chemical Engineering

### Option Coordinator

Douglas M. Price  
2068 Moser Hall  
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dmprice@ysu.edu (scmartin@ysu.edu)

### 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 program includes thesis, non-thesis, and engineering management 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.

## Civil and Environmental Engineering

### Option Coordinator

Anwarul Islam  
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### Program Description

Civil and environmental engineers apply scientific and engineering knowledge to protect and improve the infrastructure, public health and environment. Graduate study in civil and environmental engineering provides students with advanced scientific and engineering knowledge in their field of interest and

develops their 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 individual graduate students. Graduates find fulfilling careers in public and private industries and consulting practices, and are prepared for doctoral-level work leading to research/teaching careers. The program includes thesis, non-thesis, and management plans. The civil and environmental engineering program offers opportunities for advanced study in two main areas:

- structural/geotechnical engineering and
- environmental/water resources engineering.

Facilities for advanced study and research are located in Moser Hall, which houses a variety of well-equipped laboratories. These include the infrastructure research lab, strength of materials lab, hydraulics/fluid mechanics lab, environmental engineering lab, geotechnical engineering lab, and concrete mixtures lab. In addition, the college computer lab provides access to a large number of modern PCs equipped with high-speed internet connections and latest software for modeling in various fields of research.

## Electrical Engineering

### Option Coordinator

Jalal Jalali  
2055 Moser Hall  
(330) 941-3012  
jjalali@ysu.edu

### Option Description

The Department of Electrical and Computer Engineering provides opportunities for post-baccalaureate study toward the Master of Science in Engineering. These opportunities serve the practicing engineer as well as the student who wants to pursue advanced graduate study and research. Thesis, non-thesis, and management options/plans are available. Areas of study include control systems, digital systems, computer engineering, RF communications, computer-aided design, device and circuit modeling, solid-state devices, sensors, power systems and energy, power electronics, electromagnetic fields, electromechanical systems, and system analysis and design. The student is encouraged to interact with the faculty and explore these opportunities.

## Industrial and Systems Engineering

### Option Coordinator

Hojjat Mehri  
2500 Moser Hall  
(330) 941-3023  
hmehri@ysu.edu

### Option Description

The industrial engineering program option provides opportunities for interdisciplinary graduate studies toward the Master of Science in Engineering with specialization in engineering management or industrial/manufacturing systems engineering. Students can also pursue study focused on specialized areas of industrial and systems engineering, such as operations research.

All study plans are interdisciplinary and include some coursework from outside the department. They are designed to serve practicing engineers, as well as those students who want to pursue advanced graduate studies beyond the Master of Science in engineering.

## Mechanical Engineering

### Option Coordinator

Virgil Solomon  
2505 Moser Hall

(330) 941-1730  
vcsolomon@ysu.edu

### Option Description

The program option in mechanical engineering offers the Master of Science in Engineering with specialization within the general mechanical engineering disciplines. Specializations are available in the areas of mechanical analysis/design and fluid thermal systems. The thesis and non-thesis plans are for students who seek to deepen their theoretical knowledge and strengthen their ability to solve more advanced engineering problems, while the management plan is for those who wish to include managerial training in their program of preparation.

The Department of Mechanical Engineering has excellent computer and laboratory facilities that provide for the following design and research capabilities: solid modeling, FEA in stress analysis, structural dynamics and heat transfer, experimental stress analysis, vibrations and noise control, computational and experimental heat transfer and fluid dynamics, and advanced machine design.

## Chemical Engineering

**Martin A. Abraham**, Ph.D., Professor  
Green engineering; sustainability

**Pedro Cortes**, Ph.D., Associate Professor  
Structure-property relationships of polymers; composites and hybrid materials; smart materials and structures; development of chem-bio sensing platforms based on carbon nanotubes

**Jeanette M. Garr**, Ph.D., Professor

## Civil and Environmental Engineering

**Shakir Husain**, Ph.D., Professor

**AKM Anwarul Islam**, Ph.D., Professor  
Impact of blast on highway bridges; use of CFRP in enhancing structural strength of concrete members; structural health monitoring of bridges using wireless sensor network

**Suresh Sharma**, Ph.D., Assistant Professor  
Complex hydrologic and water quality modeling using various types of data driven, conceptual, physically based and distributed and semi-distributed watershed models in climate change/variability context

**Anthony S. Vercellino**, Ph.D., Assistant Professor

## Electrical and Computer Engineering

**Jalal Jalali**, Ph.D., Professor  
Electromagnetic; power systems; power electronics; FR engineering; energy efficiency

**Frank Xiyang Li**, Ph.D., Professor  
Electron spin resonance imaging; EMC, RF, and software engineering; networks; applied magnetic fields

**Faramarz Doc Mossayebi**, Ph.D., Associate Professor  
Control systems; nonlinear dynamic systems; chaos theory; digital signal processing

## Industrial and Systems Engineering

**Martin Cala**, Ph.D., Professor  
Human factors; quality and productivity

**Brett P. Conner**, Ph.D., Associate Professor  
Materials and process development for additive manufacturing also known as 3D printing; functionally graded materials (FGMs); high-strain rate behavior

of AM materials; 3D printing of metal casting tooling; business models for additive manufacturing

## Mechanical Engineering

**Kyosung Choo**, Ph.D., Assistant Professor

Jet impingement; two-phase flow; electronics cooling; energy audit of building and data center; microchannel heat exchanger; thermal management of energy systems

**Hazel Marie**, Ph.D., Associate Professor

FEA/CFD modeling applied to solid-fluid interaction of thin film lubrication sealing; mechanical material modeling of soft biological tissue

**Stefan Moldovan**, Ph.D., Assistant Professor

Multi-scale computational fluid dynamics; experimental techniques as applied to crystal growth within reactors, finger seals, hydrodynamic bearings and dampers; wet friction materials in torque converters

**Jae Joong Ryu**, Ph.D., Assistant Professor

Mechanical contact, fatigue, fracture, wear and environmental corrosion on structured surfaces under applied forces; fundamental investigation of tribo-corrosion of metallic joint replacements in physiological environment

**Elvin B. Shields**, Ph.D., Professor

**Virgil C. Solomon**, Ph.D., Associate Professor

Synthesis of shape memory alloys, ceramic-metal composites and nanostructures and their characterization using metallography, thermal analysis and analytical scanning and transmission electron microscopy techniques.

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

- 30 semester hours for the thesis plan,
- 33 semester hours for the nonthesis plan, or
- 36 semester hours for the management plan.

The degree requirements consist of core courses, technical courses, and project courses. The management plan also requires a series of business courses. These degree programs are designed to provide graduate students with the knowledge and skills to excel in professional careers and/or pursue a PhD or doctorate degree in engineering. To obtain a list of core and technical course requirements for a particular engineering discipline, students should contact the option coordinator for the program of interest.

## Program Plans

### Thesis Plan

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

- six to nine semester hours of core courses,
- 15-18 semester hours of technical concentration courses, and
- six 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 experience with experimental design, literature searches, research methodology, technical report writing, and oral presentation of results. Additionally, the thesis option can lead the graduate student to a higher level of expertise in the chosen area of specialization.

### 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 or doctorate degree. A total of 33 semester hours of coursework is required for this plan. In addition to 6-9 semester hours of core courses, every student enrolled in this option is required to complete 21-24 semester hours of technical courses related to their discipline, and a 3-semester-hour graduate project course. 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 36 semester hours of coursework is required for this plan. This consists of:

- 6-9 semester hours of core courses,
- 9-12 semester hours of business courses,
- 12-18 semester hours of technical courses, and
- a 3-semester-hour graduate project.

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.

### Chemical Engineering Requirements

At the time of initial enrollment, the student will select a program plan (thesis, non-thesis, or management) and technical area of interest (e.g. chemical processes, biochemical, environmental, materials). The degree requirements for each program plan are listed in the general description of the Master of Science in Engineering program. A list of required courses and possible electives for each plan may be obtained from the graduate program's option coordinator.

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.

### Civil and Environmental Engineering Requirements

At the time of initial enrollment, the student will select a program plan (thesis, non-thesis, or management) and technical concentration area (structural/geotechnical or environmental/water resources). The requirements for each program plan are listed in the general description of the Master of Science in Engineering program. Lists of required courses and possible electives for each plan may be obtained from the graduate program coordinator.

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.

Non-thesis students must complete a graduate project under the guidance of a faculty member. Students with management option should consult the graduate program coordinator to develop their coursework plan.

## Electrical Engineering Requirements

The basic degree requirements for each program plan are described under the general program description for the Master of Science in Engineering. Descriptions of course requirements and available electives for each program plan in the electrical engineering master's program can be obtained from the graduate option coordinator.

Within the first semester of graduate study, every graduate student must complete an option plan form signed by the student, academic advisor, and the department graduate option coordinator. The student may seek another advisor in case of interest changes. Likewise, the student-advisor relationship may be terminated at the advisor's recommendation. The graduate option coordinator is available to discuss these and other issues as appropriate.

Selected electrical engineering (ECEN) graduate courses are offered each semester based on the available teaching resources and student needs. Each graduate candidate is required to receive advising each semester from the department graduate option coordinator before registration. Based on the graduate student's academic background, work experience, and academic goals, the department graduate option coordinator may approve a student's request to substitute a graduate course not listed on the applicable program plan description.

## Industrial and Systems Engineering Requirements

At the time of initial enrollment, the student will select a program plan (thesis, non-thesis, or management) and technical concentration area (engineering management, industrial/manufacturing systems engineering, operations research, etc.) The requirements for each option are enumerated in the general description of the Master of Science in Engineering program. Lists of required courses and possible electives for each plan may be obtained from the graduate program option coordinator. Every graduate student is responsible for selecting an area of specialization by signing a special form designed for this purpose. A student may change his or her area of concentration or program of study in consultation with his or her advisor.

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. Courses taken without the permission of the advisor may not be used to meet the degree requirements.

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 in ISEN 6990 Special Topics.

## Mechanical Engineering Requirements

At the time of initial enrollment, the student will select a program plan (thesis, non-thesis, or management) and technical concentration area (mechanical analysis/design of rigid and deformable bodies, analysis/design of thermal-fluid systems, etc.). The requirements for each option are listed in the general description of the Master of Science in Engineering program. Lists of required courses and possible electives for each plan may be obtained from the graduate program option coordinator. In cooperation with an assigned faculty adviser, each student will establish a set of academic goals and desired outcomes, and a coursework plan to meet those objectives.

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 in MECH 6990 Thesis.

## Learning Outcomes Chemical Engineering

- 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.

## Learning Outcomes: Electrical Engineering

The Department graduate program offers diverse educational opportunities with its high-standard multidisciplinary curriculum and prepares its students to: Advance their mathematical knowledge and application of electrical engineering;

- Obtain depth of knowledge in specific electrical engineering disciplines;
- Conduct research and develop new ideas for engineering practice;
- Understand methodologies and their applications;
- Enhance their technical writing and oral communication skills