MECHANICAL ENGINEERING, MS

Degree: Master of Science (MS)
Field of Study: Mechanical Engineering

Program Overview

The Department of Mechanical and Aerospace Engineering offers a Master of Science degree in Mechanical Engineering.

A Mechanical Engineering BS/MS program is also offered for our undergraduate students.

The Department of Mechanical and Aerospace Engineering participates in the practice-oriented Master of Engineering Program offered by the Case School of Engineering. The Master of Engineering degree is available exclusively online.

Graduate Policies

For graduate policies and procedures, please review the School of Graduate Studies section of the General Bulletin.

Program Requirements

MS Track Options

A Mechanical Engineering MS is also available exclusively online.

Thesis-Focused Track

For a thesis-focused Mechanical Engineering MS, students must complete a minimum of 30 credit hours of graduate-level credits, including:

a. a minimum of 18 to 21 credit hours of approved graduate-level courses, and
b. 9 to 12 credit hours of MS thesis research, EMAE 651

Project-Focused Track

For a project-focused Mechanical Engineering MS, students must complete a minimum of 30 credit hours of graduate-level credits, including:

a. a minimum of 21 to 27 credit hours of approved graduate-level courses, and
b. 3 to 9 credit hours of MS project research, EMAE 695

Course-Focused Track

For a course-focused Mechanical Engineering MS, students must complete a minimum of 30 credit hours of graduate-level credits, including:

a. a minimum of 30 credit hours of approved graduate-level courses, and
b. satisfactory completion of the culminating course-focused experience, i.e. passing the course ENGR 600. To pass ENGR 600, students must earn at least a 3.00 grade in each of the three courses required for their concentration area.

Concentration Requirements

Depending on the area of interest, students should select courses from the list below with the approval of their advisor. Other technical, math and science courses within and outside of EMAE may be also acceptable with approval of their advisor.

Aeronautics

Code	Title	Hours
Required Courses:		
EMAE 453	Advanced Fluid Dynamics I	3
EMAE 482	Propulsion	3
EMAE 483	Flight Mechanics	3
Recommended Courses:		
EMAE 454	Advanced Fluid Dynamics II	3
EMAE 457	Combustion	3
EMAE 471	Computational Fluid Dynamics	3

Biomechanics

Code	Title	Hours
Required Courses:		
EMAE 414	Nanobiomechanics in Biology	3
EMAE 415	Introduction to Musculo-skeletal Biomechanics	3
EMAE 456	Micro-Electro-Mechanical Systems in Biology and Medicine (BioMEMS)	3
Recommended Courses:		
EBME 427	Movement Biomechanics and Rehabilitation	3
EBME 474	Biotransport Processes	3
EMAE 480	Fatigue of Materials	3

Dynamics, Control and Manufacturing

Code	Title	Hours
Required Courses:		
EMAE 481	Advanced Dynamics I	3
EMAE 489	Robotics I	3
EMAE 487	Vibration Problems in Engineering	3
or EMAE 560	Sustainable Manufacturing	
Recommended Courses:		
ECSE 475	Applied Control	3
EMAE 479	Mechanics and Control of Compliant Robotics	3
EMAE 540	Advanced Dynamics II	3

Fluids and Thermal Sciences

Code	Title	Hours
Required Courses:		
EMAE 453	Advanced Fluid Dynamics I	3
EMAE 455	Advanced Thermodynamics	3
EMAE 459	Advanced Heat Transfer	3
Recommended Courses:		
EMAE 454	Advanced Fluid Dynamics II	3
EMAE 457	Combustion	3
EMAE 460	Theory and Design of Fluid Power Machinery	3
EMAE 461	Chemistry of Fire Safe Polymers and Composites	3
EMAE 463	Fire Dynamics	3

EMAE 471	Computational Fluid Dynamics	3
EMAE 494	Energy Systems	3
EMAE 554	Turbulent Fluid Motion	3
EMAE 557	Convective Two-Phase Flow and Heat Transfer	3

Solid Mechanics

Code	Title	Hours
Required Courses:		
ECIV 413	Theory of Elasticity and Plasticity	3
EMAE 401	Mechanics of Continuous Media	3
EMAE 475	Finite Element Analysis	3
Recommended Courses:		
EMSE 421	Fracture of Materials	3
EMAE 450	Advanced Mechanical Engineering Analysis	3
EMAE 480	Fatigue of Materials	3

Interdisciplinary

Take any three of the above required courses with the consent of your advisor and satisfy the other degree requirements.

Mechanical Engineering MS with Specialization

Fire Science and Engineering

The Case School of Engineering at Case Western Reserve University offers a Mechanical Engineering MS graduate program with a specialization in Fire Science and Engineering. Students can choose either a Mechanical Engineering MS or Macromolecular Science MS, both with a concentration in fire science. Case Western Reserve offers a unique intersection of expertise in macromolecular and combustion science and mechanical and chemical engineering, making us singularly suited to cover all aspects of fire protection, safety, and flammability.

Through a 30 credit hour curriculum, students explore and learn how to apply the fundamental principles of fire behavior and dynamics, protection and suppression systems, polymeric materials structure, properties and selection and more. The program is designed to be completed in 12 months, but can be spread out over multiple years. Students have the option of completing a thesis or research project at their employers' laboratories with Case Western Reserve faculty members as co-advisors. This fire protection engineering degree is offered over three semesters: 12 credit hours in the fall semester; 12 credit hours in the spring semester; and 6 credit hours in the summer. See the university's academic calendar.

The Fire Science and Engineering program at Case Western Reserve covers all aspects of combustion and fire suppression. After graduating from this degree program, students will be ready to apply their thorough understanding of:

- The chemistry of fire and materials
- Flammability logistics
- Fire dynamics and fire behavior
- Fire risk assessment
- Fire protection engineering
- Combustion
- Fire and safety-related codes
- Human behavior and life safety analysis
- Structural fire protection
- Passive fire protection systems
- Polymer engineering

Fire Science and Engineering Specialization Minimum Requirements

Thesis-Focused Track

a. Completion of at least 15 credit hours of graduate coursework at or above the 400 level. The coursework should consist of the following:
   i. 6 credit hours (two of the three core courses) from the Fluids and Thermal Sciences area in Mechanical and Aerospace Engineering.
   ii. 9 credit hours (three of the five core courses) from the Fire Science and Engineering concentration.
b. Completion of 9 credit hours of thesis work culminating in a thesis examination given by at least three professors, plus approval by the chair of the department offering the degree,
c. Completion of another 3 credit hours by completing one of the following:
   i. 3 credit hours of MS thesis, or
   ii. a 3 credit hour graduate class, or
   iii. taking the 1 credit hour seminar course for 3 semesters.
d. Completion of 3 credit hours taken in any of the Concentration Areas listed above

Project-Focused Track

Completion of at least 30 credit hours of graduate coursework at or above the 400 level. The coursework should consist of the following:

a. 6 credit hours (two of the three core courses) from the Fluids and Thermal Sciences area in Mechanical and Aerospace Engineering.
b. 15 credit hours (all five of the core courses) from the Fire Science and Engineering concentration.
   i. Among these courses, up to two can be replaced by Special Problem coursework (i.e. project).
   ii. The Special Problem topic needs to be in Fire Science and Engineering field and be approved by the chair of the department offering the degree. The Special Problem course may be carried out at the student's place of employment with nominal supervision by a faculty advisor or in the school's laboratories under direct supervision.
c. 3 credit hours (one additional course) at or above the 400 level. Students should consult their advisor regarding selection of this course.
d. Completion of another 3 credit hours by completing one of the following:
   i. 3 credit hours of MS project, or
   ii. a 3 credit hour graduate class, or
   iii. taking the 1 credit hour seminar course for 3 semesters.
e. Completion of 3 credit hours taken in any of the Concentration Areas listed above

Five core fire protection engineering courses are required. Other courses can be chosen from the elective course list for mechanical engineering. The Mechanical Engineering MS with specialization follows a traditional mechanical engineering/combustion approach to fire protection and suppression, but with specialization classes in polymers.

Code	Title	Hours
Required Courses:		
EMAC 404	Polymer Foundation Course IV: Engineering	3

EMAE 457	Combustion	3
EMAC/EMAE 461	Chemistry of Fire Safe Polymers and Composites	3
EMAC/EMAE 463	Fire Dynamics	3
EMAC/EMAE 464	Fire Protection Engineering	3
Choose three of the following:		*9*
EMAE 453	Advanced Fluid Dynamics I	
EMAE 455	Advanced Thermodynamics	
EMAE 459	Advanced Heat Transfer	
EMAE 557	Convective Two-Phase Flow and Heat Transfer	

How to Apply

Application to the Fire Science and Engineering program is handled through the university's School of Graduate Studies. Students will need to know whether they wish to apply for the Mechanical Engineering MS or the Macromolecular Science and Engineering MS.

Students interested in applying to the Fire Science and Engineering program should already have a bachelor's degree in Chemistry, Chemical Engineering, Mechanical Engineering or Materials Science & Engineering and have taken the GRE. Additional application requirements include a statement of objectives, academic transcripts, and three letters of recommendation. International students will also need to take the Test of English as a Foreign Language (TOEFL). Read more about the university's full application procedure requirements.

For additional information, please contact: Ya-Ting Liao, Associate Professor in the Department of Mechanical and Aerospace Engineering.