

BACHELOR OF ENGINEERING IN MECHANICAL ENGINEERING

Welcome to the Youngstown State University (YSU) Mechanical Engineering program webpage. We offer Bachelor of Engineering (BE) and Master of Science in Engineering (MSE) degrees in Mechanical Engineering. The undergraduate program provides a strong background in mathematics, the sciences, and fundamentals of engineering, as well as tracks in the design and analysis of solid mechanics systems, thermal fluid flow systems, and dynamic systems. In addition to a quality education, most students participate in co-op or internship job assignments during their time with us, making them more marketable upon completion of their degrees. Graduates of the program enjoy placement in many areas of the diverse mechanical engineering job market.

I hope that you find this web page informative. If you have any additional questions, please contact me.

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Mechanical engineering is the branch of the engineering profession that deals with:

- the conversion and use of energy
- the design of machines and engines
- the instrumentation and control of physical processes, systems and environments

The challenge of mechanical engineering is to use the principles of mathematics, along with the physical and thermal sciences, to develop and construct well designed machines and machine systems. Mechanical engineers are concerned with the practical purpose and function of a machine or system, as well as its design for strength, reliability, safety, economy, and appearance.

Program Mission

The mission of the mechanical engineering program is to further the missions and objectives of the University and the College of Science, Technology, Engineering and Mathematics by providing an opportunity for a quality education in Mechanical Engineering to the people it serves, particularly those in northeast Ohio and western Pennsylvania. The program also strives to provide professional service to the local and regional industry and to the public. The program is committed to meeting regional and state-wide priorities in higher education by providing its students with a broad, general education and an up-to-date technological curriculum in a four-year undergraduate program, and an application-oriented evening graduate program, offering a Master of Science in Engineering degree to practicing engineers and recent engineering graduates. The program also strives to enhance quality research and scholarly activities to be integrated with teaching and meet the needs of the region by providing area schools, businesses, industries, and government agencies with technical expertise.

Program Educational Objectives

The program educational objectives of the mechanical engineering undergraduate program are to educate graduates who will be professional,

productive, and ethical members of society. As they progress professionally after graduation, our alumni will do the following:

1. Demonstrate **successful application of mechanical engineering knowledge and skills** through:
 - a. employment in leadership roles in industry, academia, government, or other organizations
 - b. engagement in research and development in graduate study or industry
 - c. analytical problem solving in less traditional careers such as law, medicine, business, public policy, secondary education, service industries, etc.
 - d. mentorship of younger engineers in careers involving management or entrepreneurship
2. Demonstrate the **commitment to lifelong learning** through:
 - a. active participation in professional development opportunities in their disciplines; such as conferences, short courses, graduate education
 - b. development of new knowledge and skills necessary for new areas of expertise or careers
 - c. adaption of their fundamental engineering knowledge for effectiveness in changing global markets and workforce trends
3. Demonstrate **active engagement in professional service** through:
 - a. application of their engineering knowledge to advance society and to help solve technical and societal problems
 - b. engagement in activities that promote sustainable economic development that enhances the quality of life
 - c. promotion of the engineering profession as a source of societal good
 - d. participation in community activities where their engineering knowledge adds significantly to their contributions

These Program Educational Objectives describe long-term accomplishments for which we seek to prepare the graduates of Youngstown State University mechanical engineering program. It is expected that progress toward these objectives is measurable.

Program Outcomes

The YSU mechanical engineering program student outcomes ensure that our graduates have been given the skills to attain the program educational objectives after graduation. Student outcomes for direct assessment are ABET specified outcomes (a) through (k). Our students are expected to graduate with:

- (a) An ability to apply knowledge of mathematics, science, and engineering.
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental social, political, ethical, health and safety, manufacturability, and sustainability.
- (d) An ability to function on multi-disciplinary teams.
- (e) An ability to identify, formulate, and solve engineering problems.
- (f) An understanding of professional and ethical responsibility.
- (g) An ability to communicate effectively.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- (i) A recognition of the need for, and an ability to engage in life-long learning.
- (j) A knowledge of contemporary issues.
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Accreditation

The baccalaureate degree Mechanical Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology (ABET). This process guarantees a quality program of high standards and excellence, evaluated by experts in industry, academia and government. The program was last reviewed with a site visit on campus in 2013, resulting in the maximum 6 year approved accreditation. The next on campus review date is scheduled for 2019. This link offers more information on this accreditation board.

<http://www.abet.org/>.

Annual Enrollment and Graduation Data

Term	Enrollment
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Fall 2012	154
Fall 2013	167
Fall 2014	194
Fall 2015	210
Fall 2016	253
Fall 2017	252
Fall 2018	239

Academic Year	Degree Awarded
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2012-2013	27
2013-2014	34
2014-2015	46
2015-2016	41
2016-2017	59
2017-2018	65

Vision Statement

Mechanical engineering and mechanical engineering education, in particular, face dramatic challenges in the future due to rapidly changing technologies and a new pattern of societal and industrial demands. The vision of the program is to meet these challenges and exceed the expectations of its constituents by focusing on the following primary strategies of the program:

- Continuous improvement of an educational environment for outstanding teaching and learning
- Development of a productive research program through a strategic focus on technology development in emerging areas such as green energy, computer simulation, and nanotechnology
- Successful co-op and internship programs that provides students with on-the-job training opportunities
- An assessment program and procedures in order to insure a high quality program focusing on the needs of the program's constituents (the students, alumni, employers, faculty, administrations, community and the general public)
- Healthy enrollment that facilitates diversification of curriculum and faculty research and professional development

In order to achieve its educational objectives and to further the missions and objectives of the University and the College, the program provides an educational environment, teeming with opportunities for students to learn and acquire essential knowledge and skills that are defined in the ABET Criteria

2000, through its curriculum and extra-curricular activities. The program maintains undergraduate and graduate curricula that are well balanced in engineering fundamentals, state-of-the-art technology, and real-world engineering applications, in the primary specialty areas of fluid thermal sciences, and mechanics of deformable bodies. The undergraduate curriculum also contains courses that foster:

- critical and independent thinking
- decision making
- development of interpersonal communication and a life-long learning attitude
- working within a team
- integration of knowledge, skills, ethics, and personal responsibility

Although the program intends to cultivate the capabilities of its students' problem solving, fundamental and advanced engineering analyses, design, research, and development, it also intends to provide the students with maximum exposure to hands-on, experimental skills to insure the high quality of its graduates. Through courses like stress analysis, thermal fluid applications, and finite element analysis, students will acquire strong tools for design and pertinent knowledge to solve real-world engineering problems. Our emphasis on engineering applications, computer simulation, and hands-on experience are complementary to each other and encourage students to apply analytical methods to engineering problems.

This approach enhances the effectiveness of teaching and also facilitates the students' understanding of abstract and difficult subjects. The ultimate goal of the program is to provide the society and industry with "whole person" mechanical engineers with superior technical capability.

Mechanical Engineering Laboratories

The mechanical engineering program maintains six physical experimental laboratories in Moser Hall. A wide array of modern equipment, instrumentation devices, and department-owned computers are housed in spacious rooms that support academic instruction and research activities in applied thermodynamics, heating and air conditioning, fluid mechanics, heat transfer, stress analysis, vibrations, and material property characterization. Other mechanical engineering laboratories are simulation and computing-related laboratories that include computer-aided design, machine design, kinematic and dynamic systems, and finite-element analysis. The College and the mechanical engineering program maintain modern computing facilities in Moser Hall and constantly upgrade hardware and software. The students and faculty also use the university computing facilities in Meshel Hall and Kilcawley Center.

For more information, visit **Mechanical Engineering** (<http://www.ysu.edu/academics/science-technology-engineering-mathematics/mechanical-engineering-major>).

Cooperative Education

The mechanical engineering program strongly encourages its students to actively participate in the optional cooperative education program. The parallel co-op arrangement which combines work and study each semester is recommended. However, full time employment in the summer can also be included. Students must register for a co-op course and submit documentation as specified by professional practice office.

Advisement

The mechanical engineering program specifies mandatory advisement. Every student in the program is advised every semester before his or her registration. Students cannot finalize their registration without approval of the faculty advisor or chair.

Industrial Advisory Board

The Industrial Advisory Board is another valuable resource in ensuring a quality program. It is composed of members of various local industries, having a vital interest and purpose in the school and/or department. The industry advisory board members can also serve as mentors on an industry sponsored project, as well as to advise the department in the area of curriculum development and research. Our board members include:

David Drabison – Board Chair
Design Engineer
Babcock & Wilcox Company, Nuclear Operations Group

John Divitto
Business Development Manager
Babcock & Wilcox Company, Power Generation Group

Tony Ghioldi
Vice President Sales
Quality Bridge & Fab, Inc.

Don Helle
Director – Global Process Engineering
The Goodyear Tire & Rubber Company

Patrick Kiraly
Tooling Specialist
V&M Star

Mike Malito
Babcock & Wilcox Company (Retired)

Anthony J Nackino
Engineering Manager
Advanced Recycling Systems, Inc.

Gorman Ng
Regional Manager
O.E.M. and Government
Linde Hydraulics Corporation

David Peterson
Babcock & Wilcox Company (Retired)

Courtney A. Puhl
Delphi Corporation

Richard Ulam
Business Development Manager
ABB Power Systems Power Generation

Douglas Verenski
President and Chief Engineer
Hunter Lift

COURSE	TITLE	S.H.
Mechanical Engineering Program Curriculum Sheet		
General Education Requirements		
Core Competencies		
ENGL 1550	Writing 1	3-4
	or ENGL 1549 Writing 1 with Support	
ENGL 1551	Writing 2	3
CMST 1545	Communication Foundations	3
Knowledge Domains		
	Arts and Humanities	6
PHIL 2625	Introduction to Professional Ethics	3
	Arts and Humanities elective	3

Social Sciences		6
ECON 2610	Principles 1: Microeconomics	3
Social Science elective		3
Natural Sciences		6-7
Social and Personal Awareness		6
First Year Experience (ENGR 1500 fulfills this requirement)		

Mechanical Engineering Courses		
MECH 1560	Engineering Communication with CAD	2
MECH 2603	Thermodynamics 1	3
MECH 2604	Thermodynamics 2	3
MECH 2606	Engineering Materials	3
MECH 2641	Dynamics	3
MECH 3708	Dynamic Systems Modeling	4
MECH 3720	Fluid Dynamics	3
MECH 3720L	Fluid Dynamics Laboratory	1
MECH 3725	Heat Transfer 1	3
MECH 3742	Kinematics of Machines	3
MECH 3751	Stress and Strain Analysis 1	3
MECH 3751L	Stress and Strain Analysis 1 Laboratory	1
MECH 3762	Design of Machine Elements	3
MECH 3762L	Design of Machine Elements Laboratory	1
MECH 4808	Mechanical Systems Design 1	2
MECH 4808L	Mechanical Systems Design Laboratory	1
MECH 4809	Mechanical Systems Design 2	3
MECH 4809L	Mechanical Systems Design Laboratory 2	1
MECH 4825L	Heat Transfer and Thermodynamics Laboratory	1
MECH 5881	Mechanical Vibrations	3
MECH 5881L	Mechanical Vibrations Laboratory	1
MECH electives (3)		9

Other Engineering Courses		
ENGR 1500	Engineering Orientation	1
ENGR 1550	Engineering Concepts	2
ENGR 1560	Engineering Computing	2
CEEN 2601	Statics	3
CEEN 2602	Strength of Materials	3
CEEN 2602L	Strength of Materials Lab	1
ECEN 2614	Basics of Electrical Engineering	3
ISEN 3710	Engineering Statistics	3

Mathematics courses		
MATH 1571	Calculus 1	4
MATH 1572	Calculus 2	4
MATH 2673	Calculus 3	4
MATH 3705	Differential Equations	3

Chemistry and Physics courses		
CHEM 1515	General Chemistry 1	4
PHYS 2610	General Physics 1	4
PHYS 2611	General Physics 2	4

Communication courses		
	Arts and Humanities elective (1)	3
	Social Studies elective (1)	3
	Social and Personal Awareness electives (2)	6

Year 1		
Fall		S.H.
ENGL 1550	Writing 1	3-4
	or ENGL 1549 or Writing 1 with Support	
MATH 1571	Calculus 1	4

CHEM 1515	General Chemistry 1	4
ENGR 1500	Engineering Orientation	1
ENGR 1550	Engineering Concepts	2
GER Elective (SPA)		3
Semester Hours		17-18

Spring

ENGL 1551	Writing 2	3
MATH 1572	Calculus 2	4
PHYS 2610	General Physics 1	4
CMST 1545	Communication Foundations	3
ENGR 1560	Engineering Computing	2
Semester Hours		16

Year 2**Fall**

MECH 1560	Engineering Communication with CAD	2
MECH 2606	Engineering Materials	3
MATH 2673	Calculus 3	4
PHYS 2611	General Physics 2	4
CEEN 2601	Statics	3
Semester Hours		16

Spring

MECH 2603	Thermodynamics 1	3
MECH 2641	Dynamics	3
MATH 3705	Differential Equations	3
CEEN 2602	Strength of Materials	3
CEEN 2602L	Strength of Materials Lab	1
ECEN 2614	Basics of Electrical Engineering	3
Semester Hours		16

Year 3**Fall**

MECH 3720	Fluid Dynamics	3
MECH 3742	Kinematics of Machines	3
MECH 3751	Stress and Strain Analysis 1	3
MECH 3751L	Stress and Strain Analysis 1 Laboratory	1
ISEN 3710	Engineering Statistics	3
ECON 2610	Principles 1: Microeconomics	3
Semester Hours		16

Spring

MECH 2604	Thermodynamics 2	3
MECH 3708	Dynamic Systems Modeling	4
MECH 3720L	Fluid Dynamics Laboratory	1
MECH 3725	Heat Transfer 1	3
MECH 3762	Design of Machine Elements	3
MECH 3762L	Design of Machine Elements Laboratory	1
Semester Hours		15

Year 4**Fall**

MECH 4808	Mechanical Systems Design 1	2
MECH 4808L	Mechanical Systems Design Laboratory	1
MECH 4825L	Heat Transfer and Thermodynamics Laboratory	1
MECH 5881	Mechanical Vibrations	3
PHIL 2625	Introduction to Professional Ethics	3
MECH Elective		3
GER Elective (SS)		3
Semester Hours		16

Spring

MECH 4809	Mechanical Systems Design 2	3
MECH 4809L	Mechanical Systems Design Laboratory 2	1
MECH 5881L	Mechanical Vibrations Laboratory	1
MECH Elective		3
MECH Elective		3
GER Elective (AH)		3
GER Elective (SPA)		3
Semester Hours		17
Total Semester Hours		129-130

Mechanical Engineering Electives

COURSE	TITLE	S.H.
Heat & Fluid Flow		
MECH 4800	Special Topics	3
MECH 4823	Heating, Ventilation, and Air Conditioning	3
MECH 4835	Thermal Fluid Applications	3
MECH 5825	Heat Transfer 2	3
MECH 5836	Fluid Power and Control	3
MECH 5885	Computational Fluid Dynamics	3
Soild Mechanics		
MECH 4800	Special Topics	3
MECH 5842	Kinetics of Machines	3
MECH 5852	Stress and Strain Analysis 2	3
MECH 5884	Finite Element Analysis	3
MECH 5892	Control of Mechanical Systems	3

Student Outcomes

The YSU mechanical engineering program student outcomes ensure that our graduates have been given the skills to attain the program educational objectives after graduation. Student outcomes for direct assessment are ABET specified outcomes (1) through (7). Our students are expected to graduate with:

- 1. Engineering Expertise** - an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- 2. Design Expertise** - an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- 3. Communication Skills** - an ability to communicate effectively with a range of audiences
- 4. Professional Responsibility** - an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- 5. Teamwork Competency** - an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- 6. Experimental Competency** - an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- 7. Life-long Learning** - an ability to acquire and apply new knowledge as needed, using appropriate learning strategies