

Department of

# Mechanical Engineering



## Garth Miller, Department Chair

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## Department of Mechanical Engineering

The Mechanical Engineering Department has two engineering programs from which to select a career path. These are:

- 4-Year Bachelor of Science in Mechanical Engineering, BSME (470)
- 2-Year Associate of Applied Science in Engineering (351)

These programs are available to students entering Brigham Young University–Idaho on any admission track. These engineering programs are designed to provide students with the competencies necessary to work in a variety of exciting fields within engineering. These majors offer excellent placement potential, professional job satisfaction, and substantial salaries. Students entering either of these two programs can expect a well designed and rigorous curriculum based on industry standards. The baccalaureate degree program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). The 2-year associate program also allows students to continue their engineering education at a 4-year university in engineering fields other than mechanical engineering. Areas of emphasis available in the associate program include chemical, civil, electrical and mechanical engineering.

Students in the BSME program are encouraged to take the Fundamentals of Engineering (FE) exam before they graduate. This is an important milestone of achievement for each ME engineering student in preparing him/her for future licensing as a Professional Engineer.

Using techniques, skills, and modern engineering modeling tools, students must demonstrate their abilities to apply mathematics, engineering science, and technology principles necessary for analyzing, modeling, and solving engineering problems. Students must communicate effectively in written and oral presentation. Each student must gain an understanding of professional and ethical behavior in the workplace. Finally, students should understand that learning is a life-long process and develop a desire to continue to enhance their abilities as a professional engineer.

Mathematics and physical sciences are critical components of any engineering curriculum. The normal entry level mathematics class for engineering is Calculus I (FDMAT 112). Entering freshman students

should consult with their advisor to ensure they are beginning with the mathematics course for which they are prepared. Students with weak mathematics skills are advised to enroll in a preparatory mathematics course to strengthen their skills. For engineering students the normal entry level chemistry course is General Chemistry (Chem 105).

These engineering programs are specialized degrees at Brigham Young University–Idaho. The BSME degree is designed for completion in the 120 credit hours, and the AASE degree in 60-62 credits hours. It is imperative that students develop and follow a plan of study that will allow them to complete all the required courses within these credit hour limits. Due to the credit hours limit, no minor programs are available within the Mechanical Engineering program. Courses in the ME curriculum have prerequisite courses that must be taken. Each student must consult with his/her advisor early to make sure his/her educational plan is correct. The Advising Center and each faculty advisor have a sample curriculum flow chart that can be used as an example plan.

### Program Educational Objectives

The program objectives for the baccalaureate degree in mechanical engineering are to produce engineering graduates who:

1. Demonstrate and maintain faith in God, and exhibit high standards of personal integrity and professional ethics through lifelong service to family, church, profession, and community. [Service]
2. Provide leadership in their chosen field of endeavor through the application of effective interpersonal, communication, and teamwork skills. [Leadership]
3. Apply fundamental principles of design and analysis to develop innovative solutions in an industrial and societal context. [Design]
4. Maintain currency in their field through continued learning and education. [Lifelong Learning]

### Program Outcomes

To achieve the program educational objectives, the following outcomes will be measured during the course of study within the program. Assessment methods consistent with accreditation recommendations will be used to determine how each student meets these outcomes. Students will:

1. Demonstrate their knowledge and application of engineering mechanical systems, thermal systems, and the laws of physical and natural science to engineering analysis and design problems.
2. Demonstrate their ability to analyze and interpret the behavior of a physical system through experimentation.
3. Use acquired math skills (calculus, linear algebra, ordinary differential equations, and statistical analysis) in solving engineering design and analysis problems.
4. Use modern engineering computer software and hardware tools to create models of physical systems in order to predict behavior and develop solutions to engineering problems.
5. Competently present their technical findings to peers, supervisors, and the faculty in both oral and written format.
6. Exhibit and maintain high ethical, moral and professional standards expected of members of the Church of Jesus Christ of Latter–Day Saints, and as graduates from Brigham Young University–Idaho.
7. Design, model, and manufacture components, systems, or processes necessary to meet product specifications for a competitive market environment.
8. Demonstrate an understanding of modern manufacturing procedures and project management techniques as applied to the development, manufacture, and delivery of customer products.
9. Learn to function as a contributing team member in a multi-discipline work environment.
10. Develop an understanding of the impact engineering design has on the world.
11. Continue their educational processes beyond baccalaureate degree in graduate studies and/or enhancement of skills within the work environment.

## AAS in Engineering (351)

Take required Foundations courses

### Major Requirements

*No Double Counting of Major Courses - Students must maintain a minimum grade of C- in their major courses*

<i>Take these courses:</i>		Select One Option			
CHEM 105	4	<b>Chemical Engineering Option</b>	<b>Civil Engineering Option</b>	<b>Electrical Engineering Option</b>	<b>Mechanical Engineering Option</b>
MATH 113	3				
MATH 214	3				
MATH 371	3				
PH 220	3				
	16				
<i>Take 1 course:</i>					
MATH 321	3				
MATH 341	3				
	3				
		<i>Take these courses:</i>	<i>Take these courses:</i>	<i>Take these courses:</i>	<i>Take these courses:</i>
		CHEM 106	CONST 340	CS 124	ME 131
		4	3	3	2
		CHEM 351	ME 142	CS 165	ME 142
		4	2	3	2
		CHEM 352	ME 172	CS 235	ME 172
		4	3	3	3
		ME 142	ME 201	CS 237	ME 201
		2	2	3	2
		PH 121	ME 202	COMPE 150	ME 202
		3	3	3	3
		*Technical Elective	ME 204	COMPE 224	ME 204
		6	3	3	3
		Elective	ME 218	COMPE 250	ME 218
		2	1	4	1
		25	3	25	3
			PH 123	PH 121	ME 250
			3	3	3
			Elective		ME 280
			2		3
			25		3
					PH 123
					25
					<i>Take 1 course:</i>
					ME 132A
					2
					ME 132B
					2
					2
<b>Total Major Credits=44</b>					
This major is available on the following tracks:					
Fall-Winter----	YES	Winter-Spring----	YES	Spring-Fall----	YES

## BS in Mechanical Engineering (470)

Take required Foundations courses

### Major Requirements

*No Double Counting of Major Courses - Students must maintain a minimum grade of C- in their major courses*

<i>Take these courses:</i>		<i>Cont. from previous column</i>		<i>Take 7 credits:</i>		<i>Take 1 course:</i>		<i>Program Notes:</i>	
CHEM 105	4	ME 250	3	COMPE 470	3	ME 132A	2		
COMPE 305	3	ME 280	3	ME 332	3	ME 132B	2		
MATH 215	4	ME 322	3	ME 337	3		2		
MATH 316	4	ME 330	3	ME 398	1-3				
ME 131	2	ME 342	3	ME 422	3				
ME 142	2	ME 360	3	ME 425	3				
ME 172	3	ME 370	3	ME 438	3				
ME 201	2	ME 380	3	ME 445	3				
ME 202	3	ME 410	3	ME 460	3				
ME 204	3	ME 423	3	ME 465	3				
ME 210	1	ME 480	3	ME 470	3				
ME 218	1	PH 123	3	ME 482	3				
Cont. next column		PH 220	3	ME 490	1-3				
		3		ME 495R	1-3				
		71		7					
<b>Total Major Credits=80</b>									
This major is available on the following tracks:									
Fall-Winter----	YES	Winter-Spring----	YES	Spring-Fall----	YES				



# Mechanical Engineering

Brigham Young University-Idaho 2009-2010

Course Descriptions	Credits*	
<b>ME 105 Essentials of Welding</b> Fee: \$30.00 A course in beginning welding designed to teach the fundamentals of arc welding including: safety, power sources, electrodes, oxyfuel cutting, and oxyacetylene welding with an introduction to weld symbols, metallurgy, and metal identification.	<b>(4.0:2:4)</b>	
<b>ME 115 Computerized Technical Illustration</b> This course will explore the basic system of technical illustration, the use of construction aids and grids, and special techniques in rendering an animation. Students will be introduced to 3D Solids modeling and rendering using the computer software (3D Studio VIZ R3) and animation techniques. This course is designed heavily around the use of 3D drawings. Students will learn to accurately portray any given object three dimensionally (both manually and using the computer). (As needed)	<b>(2.0:2:0)</b>	
<b>ME 131 Manufacturing Processes I</b> Integration of manufacturing processes. Emphasis on principles of mechanical mass reducing and surface finishing processes, machining parameters, measurement, and material selection. (Fall, Winter, Spring)	<b>(2.0:2:1)</b>	
<b>ME 132A Manufacturing Processes II - CNC Lab Emphasis</b> Prerequisite: ME 131, ME 172 Continuation of manufacturing processes with major focus on CNC, CAM, and GD&T. (Fall, Winter, Spring)	<b>(2.0:2:1)</b>	
<b>ME 132B Manufacturing Processes II - Joining Processes Lab Emphasis</b> Prerequisite: ME 131, ME 172 Continuation of manufacturing processes with major focus on joining processes. (Fall, Winter, Spring)	<b>(2.0:2:1)</b>	
<b>ME 142 Engineering Computation I</b> Prerequisite: FDMAT 112 This course provides an introduction to computation in the context of engineering problem solving. Fundamental principles of computation, such as computer representation of numbers and round-off error, are presented. Basic numerical methods, including numerical integration, differentiation, and root finding, are covered. An introduction to computer programming, including flowcharts, loops, condition statements, and functions, is given. Emphasis is placed on using MS Excel to solve computational problems, and using VBA within Excel to create computer programs. A brief introduction to commercial math software packages is also given. (Fall, Winter, Spring)	<b>(2.0:2:0)</b>	
<b>ME 172 Visualization in Engineering Design</b> Fundamentals of 3D parametric modeling and engineering design concepts including: orthographic projection, auxiliary views, sectioning, dimensions, working drawings, assembly modeling, parametric modeling fundamentals, and standards (ANSI and ISO). Instruction in computer-aided design tools with application to Mechanical Engineering.	<b>(3.0:3:0)</b>	
<b>ME 201 Engineering Mechanics: Statics</b> Prerequisite: FDMAT 112 Concepts of forces, moments and other vector quantities; free body diagrams; particle and rigid body statics; trusses, frames and machines; friction; centroids and moments of inertia. Vector analysis used. (Fall, Winter, Spring)	<b>(2.0:2:1)</b>	
<b>ME 202 Strength of Materials</b> Prerequisite: ME 201 Review of equations of static equilibrium; introduction to engineering stress and strain; thermal loading; stress distributions resulting from axial, torsional, and transverse (beam) loadings; combined loading problems; stress and strain transformation, Mohr's circle; deflection of axial members, torsional members, and beams including statically indeterminate structures; column buckling. (Fall, Winter, Spring)	<b>(3.0:3:0)</b>	
<b>ME 204 Engineering Mechanics: Dynamics</b> Prerequisite: ME 201 The study and application of the concepts of dynamics to particles, systems of particles, and rigid bodies. Scalar and vector analysis used. (Fall, Winter, Spring)	<b>(3.0:3:0)</b>	
		<b>ME 210 Measurement and Instrumentation</b> <b>(1.0:0:2)</b> Prerequisite: ME 142 This course provides an introduction to mechanical measurements and instrumentation techniques. Topics related to instrumentation, such as calibration, bias and precision error, and sample rates are covered. The basic operation of several types of sensors, including strain gages, thermocouples, accelerometers, load cells, LVDTs, and pressure transducers are discussed. Professional software (LabVIEW) is used to perform experiments in data acquisition. (Fall, Winter, Spring)
		<b>ME 218 Materials Lab</b> <b>(1.0:0:2)</b> Prerequisite: ME 202 Laboratory investigations in materials science and strength of materials. (Fall, Winter, Spring)
		<b>ME 250 Materials Science</b> <b>(3.0:3:0)</b> Prerequisite: Chem 105; FDMAT 112 Atomic and microstructure of engineering materials, including metals, ceramics, polymers, and composites. Factors influencing the fabrication, processing, and selection of materials in engineering analysis and design. Case studies of engineering material failures. Use of material selection software. (Fall, Winter, Spring)
		<b>ME 280 ME Design I</b> <b>(3.0:2:2)</b> Prerequisite: ME 142, ME 132A or ME 132B, ME 202 This course focuses on the practical aspects of mechanical design and teaches concepts such as the integration of engineering analysis and design, the strategic use of CAD in making design decisions, the effective use of vendor off-the-shelf mechanical components, and manufacturing process considerations in design. The concepts are taught in the context of small design projects where students design and build mechanical devices throughout the semester. (Fall, Winter, Spring)
		<b>ME 322 Thermodynamics I</b> <b>(3.0:3:2)</b> Prerequisite: ME 204 Fundamentals of classical thermodynamics. Thermodynamic property relationships for ideal gasses, vapors, liquids and solids. First and second law analysis of open and closed systems. Energy and entropy concepts in power and refrigeration cycles. Laboratory experiences with thermodynamic devices. (Fall, Winter, Spring)
		<b>ME 330 Engineering Statistics</b> <b>(3.0:3:0)</b> Prerequisite: Math 215 Introduction to statistical methods for science and engineering. Review of basic statistical concepts of central tendency, dispersion of data, probability laws, hypothesis testing, and confidence intervals. Introduces statistical process control, design of experiments, statistical tolerance analysis, and concepts of six sigma quality. (Fall, Winter, Spring)
		<b>ME 332 Advanced CNC</b> <b>(3.0:2:2)</b> Prerequisite: ME 132A or ME 132B Automated machine control through Computer-Aided Manufacturing (CAM) and Computer Numerical Control (CNC). Students gain practical laboratory experience on CAM, CNC, and manual programming on a variety of CNC equipment (machining center, lathe, wire EDM, and plasma cutter). Principles of machining variables, tooling, and setups will be reviewed. (As Needed)
		<b>ME 337 Kinematics</b> <b>(3.0:3:0)</b> Prerequisite: ME 204 Relative motion of links in mechanisms; velocities and accelerations of machine parts; rolling contact; cams; synthesis of mechanisms. Includes computer-aided engineering techniques. (As needed)
		<b>ME 342 Engineering Computation II</b> <b>(3.0:3:0)</b> Prerequisite: ME 142, ME 202, ME 204, Math 316 or Math 371 This course builds on the basics of engineering computation from ME 142. Additional numerical methods, including curve fitting, optimization, and ordinary differential equations are covered. Additional topics in computer programming are also presented. Computational techniques are implemented in MS Excel, VBA within Excel, and a commercial math software package. (Fall, Winter, Spring)

# Mechanical Engineering

Brigham Young University–Idaho 2009-2010

<p><b>ME 360 Fluid Mechanics</b> (3.0:3:2)            Prerequisite: ME 342            Introduction to fluid mechanics and incompressible fluid flow, fluid statics, fluid dynamics, control volume and differential analysis of fluid flow, dimensional analysis and scale models, internal and external viscous flow, turbomachinery. Flow measurement lab included.            (Fall, Winter, Spring)</p>	<p><b>ME 445 Mechanics of Composite Materials</b> (3.0:3:0)            Prerequisite: ME 342, ME 250            An introduction to laminated composite materials and structures. An investigation of the micromechanical and macromechanical behavior of anisotropic plies. Development of classical lamination theory for predicting the mechanical behavior of laminated composite plates. Laboratory work involving fabrication and testing of composite laminates.            (As needed)</p>
<p><b>ME 370 Mechanical Systems Design</b> (3.0:3:2)            Prerequisite: ME 280            Analysis, modeling and design of mechanical components and systems; materials, processes and structural analysis; static and dynamic failure theories; analysis and design of machine elements. Use of computer-aided design tools emphasized.            (Fall, Winter, Spring)</p>	<p><b>ME 460 Fundamentals of Finite Element Analysis</b> (3.0:3:0)            Prerequisite: ME 342, ME 370            This course provides an introduction to the finite element method. Characteristics and limitations of several basic finite elements are evaluated. The finite element method is applied to both structural and thermal problems. Applications of the finite element method are carried out with commercial software.            (As needed)</p>
<p><b>ME 380 ME Design II: Product Design</b> (3.0:2:2)            Prerequisite: ME 370            This course introduces a structured design methodology for product development. The methodology includes such topics as product specifications, concept generation, concept selection, and prototyping. Other topics that are associated with the design process, such as economic analysis and intellectual property, are also presented.            (Fall, Winter, Spring)</p>	<p><b>ME 465 Fluid Power Fundamentals</b> (3.0:2:2)            Prerequisite: ME 360            This course is a technical elective in Mechanical Engineering and teaches fundamentals of fluid power. Students will explore hydraulic and pneumatic systems including hydraulic fluids, air preparation components, pumps, compressors, cylinders, motors, valves, circuits, controls, and commercial applications.            (As Needed)</p>
<p><b>ME 398 Internship</b> (1.0-3.0:0:0)            Prerequisite: Consent of Instructor            Industrial work experience.            (Fall, Winter, Spring)</p>	<p><b>ME 470 Mechatronics</b> (3.0:3:0)            Prerequisite: ME 410, CompE 305            This course provides an introduction to systems that contain both electrical and mechanical elements. Methods for modeling and controlling the behavior of such systems are discussed. Several computer-based methods and tools are presented, including the use of programmable logic controllers and data acquisition software.            (As needed)</p>
<p><b>ME 410 System Dynamics</b> (3.0:3:2)            Prerequisite: ME 204, ME 210, MATH 316 or MATH 371            This course provides an introduction to dynamic system modeling and analysis. Major topics covered in this course include lumped parameter models of dynamic systems, derivation of state equations, analytical and numerical solution of state equations, and frequency response analysis. Professional software is used in obtaining numerical solutions of state equations.            (Fall, Winter, Spring)</p>	<p><b>ME 480 ME Design III: Capstone Design</b> (3.0:2:2)            Prerequisite: Senior Standing, ME 322, ME 360, ME 380            Comprehensive one-semester integrated design experience using the engineering design process and skills gained in engineering science classes. Product conception, development, design, and manufacture.            (Fall, Winter, Spring)</p>
<p><b>ME 422 Thermodynamics II</b> (3.0:3:2)            Prerequisite: ME 322            Application of principles of thermodynamics to air standard cycles (Otto, Diesel, Brayton, Sterling, and Ericsson), steam power cycles (Rankine), and refrigeration and heat pump cycles. Property calculations for gas mixtures. Processes involving air water mixtures, psychrometric charts, etc. with applications to air-conditioning and drying processes. Introduction to thermodynamic calculations for combustion chemical reactions. Laboratory experience analyzing thermodynamic systems.            (As needed)</p>	<p><b>ME 482 Capstone Project II</b> (3.0:2:2)            Prerequisite: Senior Standing, ME 480            Second semester of an integrated design experience using the engineering design process and skills gained in engineering science classes. Product conception, development, design, and manufacture.            (As needed)</p>
<p><b>ME 423 Heat Transfer</b> (3.0:3:2)            Prerequisite: ME 322, ME 342            Fundamentals of conduction, convection, and radiant modes of heat transfer; fundamental equations for steady and unsteady conduction; heat exchanger analysis and design; design of systems involving multi-mode heat transfer. Heat transfer lab included.            (Fall, Winter, Spring)</p>	<p><b>ME 490 Special Problems in Mechanical Engineering</b> (1.0-3.0:0:0)            Prerequisite: Consent of Instructor.            Students complete individual major projects or research in engineering, under the supervision of a faculty member.            (Fall, Winter, Spring)</p>
<p><b>ME 425 Fluid Mechanics II</b> (3.0:3:2)            Prerequisite: ME 322, ME 360            This course is a follow-on course to the introductory fluid mechanics course. Some topics including integral momentum, modeling and similitude, and analysis of piping systems from the introductory course will be explored in greater depth and detail. New topics covered may include potential flow, compressible flow, computational fluid dynamics, and turbulence. This course will analyze more involved fluid systems.            (As needed)</p>	<p><b>ME 495R Special Topics in Mechanical Engineering (3.0:2:2)</b>            Prerequisite: Consent of Instructor.            Automated machine control through Computer-Aided Manufacturing (CAM) and Computer Numerical Control (CNC). Students gain practical laboratory experience on CAM, CNC, and manual programming on a variety of CNC equipment (machining center, lathe, and EDM). Principles of machining variables, tooling, and setups will be reviewed.            (As needed)</p>
<p><b>ME 438 CAE Modeling and Digital Simulation</b> (3.0:3:0)            Prerequisite: ME 380            A study of advanced Computer-Aided Design and engineering applications in design, modeling, simulation and customization. The use of CAD and engineering software tools is stressed. Topics include engineering design process, project management, advanced solids modeling techniques, kinematic analysis, digital simulation techniques, and customization techniques.            (As needed)</p>	