

# Materials Engineering

Chair: Kathy Lu, PhD

Degree Offered	Bachelor of Science in Materials Engineering
Accreditation	The Bachelor of Science in Materials Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, <a href="https://www.abet.org">https://www.abet.org</a> , under the commission's General Criteria and Program Criteria for Materials, Metallurgical, Ceramics and Similarly Named Engineering Programs.
Website	<a href="https://www.uab.edu/engineering/mme/about/about-materials-engineering">https://www.uab.edu/engineering/mme/about/about-materials-engineering</a>
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Materials engineering utilizes the interrelationships among structure, properties, and processing to achieve performance in the application of metals, ceramics, polymers, and composites to meet the needs of society. Students learn how to select the optimum material, design new materials and processes, and predict behavior under various environmental and service conditions. Materials Engineers are employed in every major industry, including aerospace, chemical, automotive, energy, defense, metals casting, biomedical, and microelectronics.

In addition to Blazer Core, students take a core of fundamental engineering coursework and a sequence of materials engineering courses in addition to courses in mathematics, calculus-based physics, and chemistry. The required materials engineering courses address ceramics, polymers, composite materials, and metals. Materials engineering elective courses are also offered to introduce students to leading-edge materials engineering topics. Students can specialize in Biomaterials by proper selection of their electives (see Concentration in Biomaterials). The curriculum prepares graduates to enter industry, pursue graduate studies, or enter a professional school, such as medicine or dentistry. The department has active research programs in metal casting, biomaterials, ceramic materials, and composite materials. The department also offers courses of study leading to the Master of Science in Materials Engineering and Doctor of Philosophy degrees in both Materials Engineering and Materials Science. These programs are described in the UAB Graduate School Catalog.

**Please refer to the School of Engineering overview for policies regarding admission; change of major; transfer credit; transient status; dual degree programs; reasonable progress; academic warning, probation, and suspension; reinstatement appeals; and graduation requirements.**

## Vision

To be a nationally and internationally recognized research-oriented program - a first choice for undergraduate and graduate education

## Mission

To excel in research for the benefit of society while educating students at all levels to be immediately productive.

## Program Educational Objectives

Our Materials Engineering undergraduate program will produce functioning professionals who:

1. are able to solve a wide range of materials engineering-related problems at the regional, national, and international levels.
2. advance and lead in materials engineering or related professional positions.
3. continue to develop intellectually and professionally and serve the materials engineering professional community and beyond.
4. apply sustainability principles to provide improved engineering solutions for society.

## Student Outcomes

Upon completion of the BSMtE degree program, our graduates will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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. an ability to communicate effectively with a range of audiences
4. 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. 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. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## Bachelor of Science in Materials Engineering

Requirements	Hours
<b>Blazer Core Requirements</b>	<b>43</b>
CH 115 & 115R & CH 116	General Chemistry I and General Chemistry I Recitation and General Chemistry I Laboratory
EH 101	English Composition I
EH 102	English Composition II
EGR 103	Computer Aided Graphics and Design
EGR 200	Introduction to Engineering <sup>1</sup>
MA 125 & 125L	Calculus I and Calculus I Lab

PH 221 & 221L & 221R	General Physics I and General Physics Laboratory I and General Physics I Recitation
PH 222 & 222L & 222R	General Physics II and General Physics Laboratory II and General Physics II - Recitation
Academic Foundations: Reasoning	
Thinking Broadly: History & Meaning	
Thinking Broadly: Creative Arts	
Thinking Broadly: Humans & Their Societies	
City as a Classroom <sup>2</sup>	
<b>Other Required Courses</b>	<b>73</b>
CE 210	Statics
CE 220	Mechanics of Solids
CH 117 & 117R & CH 118	General Chemistry II and General Chemistry II Recitation and General Chemistry II Laboratory
EE 312	Electrical Systems
EGR 150	Computer Methods in Engineering
EGR 265	Math Tools for Engineering Problem Solving <sup>3</sup>
MA 126	Calculus II
ME 251	Introduction to Thermal Sciences
MSE 280	Engineering Materials
MSE 281 & 281L	Physical Materials I and Physical Materials I Laboratory
MSE 380	Thermodynamics of Materials
MSE 381	Physical Materials II
MSE 382	Mechanical Behavior of Materials
MSE 401	Materials Processing
MSE 413	Composite Materials
MSE 425	Statistics and Quality
MSE 430 & 430L	Polymeric Materials and Polymeric Materials Laboratory
MSE 464 & 464L	Metals and Alloys and Metals and Alloys Laboratory
MSE 465 & 465L	Characterization of Materials and Characterization of Materials Laboratory
MSE 470 & 470L	Ceramic Materials and Ceramic Materials Laboratory
MSE 498	Capstone Design Project I
MSE 499	Capstone Design Project II
<b>Materials Engineering Elective<sup>4</sup></b>	<b>3</b>
Choose one from the following:	
MSE 405	Frontiers of Automotive Materials
MSE 408	Nanobiomaterials
MSE 409 & 409L	Principles of Metal Casting and Principles of Metal Casting Laboratory
MSE 433	Nondestructive Evaluation of Materials
MSE 462	Composites Manufacturing
MSE 474	Metals and Alloys II
<b>Mathematics/Science Elective<sup>5</sup></b>	<b>3</b>
<b>Engineering/Mathematics/Science Electives<sup>4,6</sup></b>	<b>6</b>
<b>Total Hours</b>	<b>128</b>

<sup>1</sup> EGR 200 preferred; other FYE courses accepted<sup>2</sup> CE 280 preferred; other CAC courses accepted<sup>3</sup> May substitute MA 227 and MA 252 for EGR 265 and one approved Math/Science elective<sup>4</sup> Completion of Departmental Honors Program satisfies three credits of either a Materials Engineering Elective or an Engineering/Mathematics/Science Elective.<sup>5</sup> Math/Science Elective Options:

- Any Biology (BY) courses numbered BY 108 or above
- Any Chemistry (CH) courses numbered CH 201 or above
- MA 260 Introduction to Linear Algebra
- MA 360 Scientific Programming
- MA 361 Mathematical Modeling
- Any Mathematics (MA) courses numbered MA 434 or above
- Any Physics (PH) courses numbered PH 223 or above

<sup>6</sup> Engineering/Math/Science Elective Options:

- CS 103 Introduction to Computer Science in Python
- CS 203 Object-Oriented Programming in Java
- Any course listed in the Mathematics/Science Electives section, footnote 5
- Any engineering course not required in the major except CE 344, EE 300, EE 305, EE 314, EGR 301, ME 241, ME 302, MSE 350, or any capstone/senior project course, or any honors research hours from another program

## Residency Requirement

In addition to UAB's residency requirement, to earn a Bachelor of Science in Materials Engineering from UAB, the program requires that students complete the following courses at UAB:

Requirements	Hours
Three courses from the following:	9
MSE 401 Materials Processing	
MSE 413 Composite Materials	
MSE 430 Polymeric Materials	
MSE 464 Metals and Alloys	
MSE 465 Characterization of Materials	
MSE 470 Ceramic Materials	
MSE 498 Capstone Design Project I	3
MSE 499 Capstone Design Project II	3
<b>Total Hours</b>	<b>15</b>

## Concentration in Biomaterials

Students seeking the degree of BSMtE may add a concentration in Biomaterials by appropriate selection of their MSE Elective and Science/Mathematics/Engineering Electives (9 credit hours total).

Requirements	Hours
BME 311 Biomaterials for Non-Majors	3
<b>Elective Courses</b>	
Select two from the following:	6
BME 420 Implant-Tissue Interactions	
BME 435 Tissue Engineering	
MSE 408 Nanobiomaterials	
<b>Total Hours</b>	<b>9</b>

## Concentration in Metallurgy

Students seeking the degree of BSMtE may add a concentration in Metallurgy by appropriate selection of their MSE Elective and Science/Mathematics/Engineering Electives (9 credit hours total).

Requirements	Hours
<b>Elective Courses</b>	
Select three from the following:	9
MSE 405 Frontiers of Automotive Materials	
MSE 409 Principles of Metal Casting	
MSE 433 Nondestructive Evaluation of Materials	
MSE 474 Metals and Alloys II	
<b>Total Hours</b>	<b>9</b>

## Concentration in Polymer Matrix Composites

Students seeking the degree of BSMtE may add a concentration of Polymer Matrix Composites by appropriate selection of their MSE Elective and Science/Mathematics/Engineering Electives (10 credit hours total). CH 235/CH 236 may be used as the Science/Mathematics Elective instead of one of the Science/Mathematics/Engineering Electives.

Requirements	Hours
CH 235 Organic Chemistry I	3
CH 236 Organic Chemistry I Laboratory	1
<b>Elective Courses</b>	
Select two from the following:	6
MSE 405 Frontiers of Automotive Materials	
MSE 408 Nanobiomaterials	
MSE 433 Nondestructive Evaluation of Materials	
MSE 462 Composites Manufacturing	
<b>Total Hours</b>	<b>10</b>

## Curriculum for the Bachelor of Science in Materials Engineering (BSMtE)

### Freshman

First Term	Hours	Second Term	Hours
CH 115 & 115R & CH 116 <sup>^</sup>		4 CH 117 & 117R & CH 118	4
EGR 200 <sup>1</sup>		3 EGR 103 <sup>#</sup>	3
EH 101 <sup>%</sup>		3 EGR 194	1
MA 125 & 125L <sup>*</sup>		4 MA 126	4
		PH 221 & 221L & 221R <sup>^</sup>	4
		<b>14</b>	<b>16</b>

### Sophomore

First Term	Hours	Second Term	Hours
CE 210		3 CE 220	3
EGR 265 <sup>2</sup>		4 EE 312	3
EH 102 <sup>%</sup>		3 EGR 150	3
MSE 280		3 ME 251	2

PH 222 & 222L & 222R <sup>^</sup>		4 MSE 281 & 281L	4
		Blazer Core: Reasoning <sup>3</sup>	3
		<b>17</b>	<b>18</b>

### Junior

First Term	Hours	Second Term	Hours
MSE 380		3 MSE 382	3
MSE 381		3 MSE 464 & 464L	4
MSE 401		3 MSE 470 & 470L	4
MSE 425		3 Math/Science Elective <sup>2,4</sup>	3
MSE 465 & 465L		4 Blazer Core: Creative Arts <sup>3</sup>	3
		<b>16</b>	<b>17</b>

### Senior

First Term	Hours	Second Term	Hours
MSE 413		3 MSE 430 & 430L	3
MSE 498		3 MSE 499	3
Math/Science/Engineering Elective <sup>4</sup>		3 Materials Engineering Elective	3
Blazer Core: City as a Classroom <sup>5</sup>		3 Math/Science/Engineering Elective <sup>4</sup>	3
Blazer Core: Humans & Their Societies <sup>3</sup>		3 Blazer Core: History & Meaning <sup>3</sup>	3
		<b>15</b>	<b>15</b>

**Total credit hours: 128**

<sup>1</sup> EGR 200 preferred; other FYE courses accepted

<sup>2</sup> May substitute MA 227 and MA 252 for EGR 265 and one approved MA/SCI elective

<sup>3</sup> Please refer to Blazer Core as specified for Engineering majors

<sup>4</sup> Math/Science Elective Options, excluding courses already required for the degree or an approved course for any section of Blazer Core except those in Scientific Inquiry or Quantitative Literacy:

- Any Biology (BY) courses numbered BY 108 or above
- Any Chemistry (CH) courses numbered CH 201 or above
- MA 260 Introduction to Linear Algebra
- MA 360 Scientific Programming
- MA 361 Mathematical Modeling
- Any Mathematics (MA) courses numbered MA 434 or above
- Any Physics (PH) courses numbered PH 223 or above

<sup>5</sup> Completion of Departmental Honors Program satisfies three credits of either a Materials Engineering Elective or an Mathematics/Science/Engineering Elective

<sup>^</sup> Satisfies Blazer Core: Scientific Inquiry

<sup>%</sup> Satisfies Blazer Core: Writing

<sup>#</sup> Satisfies Blazer Core: Communicating in a Modern World

<sup>\*</sup> Satisfies Blazer Core: Quantitative Literacy

<sup>\$</sup> CE 280 preferred, other City as a Classroom courses accepted