Department of Materials Science and Engineering

Program of Materials Science and Engineering for International Students (2023)

I. Introduction

The major of Materials Science and Engineering is a discipline, which systematically studies fundamental theories and experiment skills of materials science and engineering as well as applies these knowledge/abilities for materials' syntheses, preparation, structure characterization/evaluation, and performance controlling in various broad fields based on the principles of materials science, chemistry, and physics. Materials Science and Engineering is an integrated discipline for application science closely related to engineering technology.

Materials are the bases for human survival and development. In the 1970s, people viewed information, materials, and energy as the mainstay of social civilization. In the 1980s, with the rise of high technologies, materials science, information technology, and biotechnology were listed as important symbols of the new technology revolution. Nowadays, materials have become important parts of the national economy, national defense, and people's livelihood.

Academic subject areas: Materials

Program code: 080401

II. Objectives and Learning Outcomes

Materials Science and Engineering (MSE) will cultivate high-quality science and technology talents with firm theoretical knowledge of Materials Science and Engineering, abilities of mastering frontier materials' R&D and characterization techniques, and capabilities of utilizing English and computer technology very well for high-tech R&D in interdisciplinary fields. These trained students possess the capability not only for researching in their disciplines and related fields, designing and developing new materials, teaching and managing, but also for practice innovation, cooperation, and leadership. These graduates can not only engage in conventional material industrial production, new materials creation, and development of new processes and technologies, but also continue their postgraduate studies in Materials Science and Engineering

and serve in the research, development, and management in top-ranked corporations, scientific research institutes, colleges, and government.

III. Study Length, Degree, and Graduation Requirements

1. Study length: 4 years.

2. Degree conferred: Students who complete and meet the degree requirements of the undergraduate program will be awarded a bachelor's degree in engineering.

3. The minimum credit requirement for graduation: 161 credits. The specific requirements are as follows.

Module		**Category**	**Minimum Credit Requirement**
General Education Courses	Chinese Language and Culture Module	Chinese Language and Culture	16
	Arts and Physical Education Module	Physical Education	4
		Arts	2
	Competence Development Module	Computer Programming	3
		Writing	2
		Foreign Languages	14
	Humanities and Social Sciences Module	Humanities	6
		Social Sciences	
		Chinese Studies	2
	Mathematics and Natural Sciences Module	Mathematics	12
		Physics	10
		Chemistry	3
		Geoscience + Life science	3
	GE to Majors Bridging Module	Introduction to Majors	2
Major Courses	Major Required Courses	Major Foundational Courses	33
		Major Core Courses	17
		Practice-based Learning (Undergraduate Thesis, Internships, Research projects, etc.)	16
	Major Elective Courses	Major Elective Courses	16
Total			**161**
Note: please see the General Education Requirement for more details on Chinese Language and Culture Module, Arts and Physical Education Module, Competence Development Module（Foreign Languages & Writing）, Humanities and Social Sciences Module, and GE to Majors Bridging Module.			

IV. Course Requirements for the Mathematics and Natural Sciences Module and Computer Programming

Course Category	Course Code	Course Name	Credits	Terms	Prerequisite	Dept.
Mathematics	MA117	Calculus I	4	1 Fall	None	MATH
	MA127	Calculus II	4	1 Spring	Calculus I	
	MA113	Linear Algebra	4	1 Spring & Fall	None	
Physics	PHY105	College Physics I	4	1 Fall	None	PHY
	PHY106	College Physics II	4	1 Spring	College Physics I	
	PHY104 B	Experiments of Fundamental Physics	2	1-2 Spring & Fall	None	
Chemistry	CH103/ CH105	General Chemistry/ Chemistry: the Central Science	4/3	1-2 Spring & Fall	None	CHEM
Geoscience + Life science	BIO103/ BIO102 B/ EOE100	Principles of Biology/ Introduction to Life Science/ Introduction to Earth Sciences	3	1-2 Spring & Fall	None	DBIO, ESS, OCE, ESE
Computer Programming	CS109/ CS110/ CS111/ CS112/ CS113	Introduction to Computer Programming / Introduction to Java Programming / Introduction to C Programming / Introduction to Python Programming / Introduction to Matlab Programming	3	1-2 Spring & Fall	None	CSE

V. Prerequisites for Major Declaration

<table>
<tr><th>Major Declaration Time</th><th>Course Code</th><th>Course Name</th><th>Prerequisite</th></tr>
<tr><td rowspan="9">Declare major at the end of the first academic year</td><td>MA117</td><td>Calculus I</td><td>None</td></tr>
<tr><td>MA127</td><td>Calculus II</td><td>Calculus I</td></tr>
<tr><td>MA113</td><td>Linear Algebra</td><td>None</td></tr>
<tr><td>PHY105</td><td>College Physics I</td><td>None</td></tr>
<tr><td>PHY106</td><td>College Physics II</td><td>College Physics I</td></tr>
<tr><td>PHY104B</td><td>Experiments of Fundamental Physics</td><td>None</td></tr>
<tr><td>CH103/CH105</td><td>General Chemistry/ Chemistry：the Central Science</td><td>None</td></tr>
<tr><td colspan="3">Notes: At least 5 of the above courses will be completed in the first year, and the results should be qualified. For Mathematics, students who have completed MA101a & MA102a are not required to take MA117 & MA127. For Physics, students who have completed PHY101 & PHY102 are not required to take PHY105 & PHY106.</td></tr>
<tr><td rowspan="10">Declare major at the end of the second academic year</td><td>MA117</td><td>Calculus I</td><td>None</td></tr>
<tr><td>MA127</td><td>Calculus II</td><td>Calculus I</td></tr>
<tr><td>MA113</td><td>Linear Algebra</td><td>None</td></tr>
<tr><td>PHY105</td><td>College Physics I</td><td>None</td></tr>
<tr><td>PHY106</td><td>College Physics II</td><td>College Physics I</td></tr>
<tr><td>PHY104B</td><td>Experiments of Fundamental Physics</td><td>None</td></tr>
<tr><td>CH103/CH105</td><td>General Chemistry/ Chemistry：the Central Science</td><td>None</td></tr>
<tr><td>BIO103/BIO102B/ EOE100</td><td>Principles of Biology/ Introduction to Life Science/ Introduction to Earth Sciences</td><td>None</td></tr>
<tr><td>CS109/CS110/CS111/CS112/CS113</td><td>Introduction to Computer Programming/ Introduction to Java Programming/ Introduction to C Programming/ Introduction to Python Programming/ Introduction to Matlab Programming</td><td>None</td></tr>
<tr><td colspan="3">Notes: All of the above courses should be completed in the second year, and the results should be qualified. For Mathematics, students who have completed MA101a & MA102a are not required to take MA117 & MA127. For Physics, students who have completed PHY101 & PHY102 are not required to take PHY105 & PHY106.</td></tr>
</table>

Note:

1. If the number of students entering a major at the end of the first academic year in the department is greater than or equal to the total number of the teaching-research faculty (PI)*2*60%, all majors in the department may implement the prerequisites for major declaration at the end of the second academic year.
2. If the number of students entering a major at the end of the first academic year in the department is less than the total number of the teaching-research faculty (PI)*2*60%, all majors in the department do not implement the prerequisites for major declaration at the end of the second academic year.
3. Suppose the number of students applying for a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), then the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).
4. For departments that do not implement prerequisites for major declaration at end of the second academic year, if the cumulative number of students applying for a major at the end of the second academic year and the number of students who have entered a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).

VI: Major Course Arrangement

Table 1: Major Required Courses

Program of Materials Science and Engineering

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Major Foundational Courses	ME102	CAD Engineering Drawing	3	1.5	1 Spring	None	MEE
	MSE001	Fundamentals of Materials Science and Engineering*	3		2 Fall	PHY106 CH103/CH105	MSE
	MSE002	Experiments for Fundamentals of Materials Science and Engineering*	1	1	2 Fall	PHY106 CH103/CH105	MSE
	MSE205	Fundamentals of Circuits and Electronics	3		2 Fall	MA127 PHY106	MSE
	MSE203	Crystallography	2		2 Fall	None	MSE
	MSE213	Mechanics of Materials B	3		2 Spring	None	MSE
	MSE202	Physical Chemistry*	3		2 Spring	MA127 CH103/CH105	MSE
	MSE204	Physical Chemistry Experiments*	1	1	2 Spring	MA127 CH103/CH105	MSE
	MSE301	Materials Chemistry	3		3 Fall	MSE001 MSE002	MSE
	MSE307	Comprehensive Experiments of Materials I	4	4	3 Fall	MSE001 MSE002	MSE
	MSE328	Physics of Materials	3		3 Spring	MA127 MSE001	MSE
	MSE304	Comprehensive Experiments of Materials II	4	4	3 Spring	MSE307	MSE
	Total		**33**	**11.5**			
	Note: *Please choose MSE001 and MSE002 at the same semester; Please choose MSE202 and MSE204 at the same semester.						
Major Core Courses	MSE306	Materials Characterization Techniques	3		2 Spring	MSE001	MSE
	MSE313	Polymer Materials	3		2 Spring	MSE001	MSE
	MSE319	Physical Metallurgy A	3		3 Fall	MSE001 MSE002	MSE
	MSE317	Ceramic Materials	3		3 Fall	MSE001	MSE
	MSE345	Experiments for Advanced Materials Science and Engineering I	1	1	3 Fall	MSE002	MSE
	MSE311	Thermodynamics of Materials	3		3 Spring	MSE001	MSE
	MSE346	Experiments for Advanced Materials Science and Engineering II	1	1	3 Spring	MSE345	MSE
	Total		**17**	**2**			
Practice-based Courses	MSE470-17	Industrial Practice	4	4	3 Summer	None	MSE
	MSE492	Thesis (Graduation Project)*	12	12	4 Spring	None	MSE
	Total		**16**	**16**			
	Note: *Students who have completed Comprehensive Design I&II（COE493 & COE494）are not required to						

	take the MSE492 Thesis (Graduation Project).			
Total		**66**	**29.5**	

Table 2: Major Elective Courses

Program of Materials Science and Engineering

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Restricted Electives Courses	**Materials Chemistry Track**						
	MSE210	General Organic Chemistry*	3		2 Spring	CH103/CH105	MSE
	MSE212	Basic Experiments for Organic Chemistry*	1	1	2 Spring	CH103/CH105	MSE
	MSE332	Fundamentals of Electrochemisty	3		3 Fall	None	MSE
	MSE325	Functional Polymers	3		3 Fall	None	MSE
	MSE338	Biomaterials*	2		3 Spring	MSE001	MSE
	MSE340	Experiments for Biomaterials*	2	2	3 Spring	MSE002	MSE
	Total		**14**	**3**			
	Materials Physics Track						
	MSE344	Applied Quantum Mechanics	3		2 Spring	PHY106	MSE
	MSE335	Applied Solid State Physics	3		3 Fall	MA127 PHY106	MSE
	MSE310	Semiconducting Materials, Devices and Technology	3		3 Spring	None	MSE
	MSE5021	Computational Materials Science	3		3 Spring	None	MSE
	MSE338	Biomaterials*	2		3 Spring	MSE001	MSE
	MSE340	Experiments for Biomaterials*	2	2	3 Spring	MSE002	MSE
	Total		**16**	**2**			
	Note: 1. The Restricted Electives Courses are divided into Materials Physics Track and Materials Chemistry Track. Under the guidance of the research tutor, the students should choose at least 8 credits in one direction. 2. MSE210 & MSE212 , MSE338 & MSE340 are co-required courses, please take them in the same semester. Both courses co-required must be completed, and their credits can count as Restricted Electives Courses.						
Unrestricted Electives Courses	MSE103	Magic Materials	1	1	1 Fall	None	MSE
	MA212	Probability and Statistics	3		2 Fall	MA127	MATH
	MSE207	Engineering Mathematical Physics	3		2 Fall	MA127 MA113	MSE
	MSE209	Heat and Mass Transfer	3		2 Spring	MA127 PHY106	MSE
	MSE356	Electronic Information Materials and Devices	3		3 Fall	MSE001	MSE
	MSE413	3D Printing and Lase-based Additive Manufacturing	3		3 Fall	None	MSE
	MSE407	Advanced Thin Film Technology	3		3 Fall	None	MSE
	MSE322	Composite Materials	3		3 Spring	None	MSE
	MSE337	Crystal Growth	3		3 Spring	MSE001	MSE

	MSE339	Optical Materials and Devices	3		3 Spring	PHY106	MSE
	MSE349	Integrated Circuit Processing Technology	3		3 Spring	MSE001	MSE
	MSE320	Introduction to Photovoltaics and Photo-thermal	3		3 Spring	None	MSE
	MSE410	Experiments of Circuit Design	2	2	4 Fall	MSE205	MSE
	MSE404	Electronic Component Reliability and Failure Analysis	3		4 Fall	MSE306	MSE
	MSE480	Projects of Science and Technology Innovation	2	2	3-4 Spring & Fall	None	MSE
	Total		**41**	**5**			
	Notes: At least 8 credits are required for Unrestricted Electives Courses.						

Table 3: Overview of Practice-based Learning

Program of Materials Science and Engineering

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
MSE103	Magic Materials	1	1	1 Fall	None	MSE
ME102	CAD Engineering Drawing	3	1.5	1 Spring	None	MEE
MSE002	Experiments for Fundamentals of Materials Science and Engineering	1	1	2 Fall	PHY106 CH103/CH105	MSE
MSE204	Physical Chemistry Experiments	1	1	2 Spring	MA127 CH103/CH105	MSE
MSE212	Basic Experiments for Organic Chemistry	1	1	2 Spring	CH103/CH105	MSE
MSE307	Comprehensive Experiments of Materials I	4	4	3 Fall	MSE001 MSE002	MSE
MSE345	Experiments for Advanced Materials Science and Engineering I	1	1	3 Fall	MSE002	MSE
MSE304	Comprehensive Experiments of Materials II	4	4	3 Spring	MSE307	MSE
MSE346	Experiments for Advanced Materials Science and Engineering II	1	1	3 Spring	MSE345	MSE
MSE340	Experiments for Biomaterials	2	2	3 Spring	MSE002	MSE
MSE410	Experiments of Circuit Design	2	2	4 Fall	MSE205	MSE
MSE480	Projects of Science and Technology Innovation	2	2	3-4 Spring & Fall	None	MSE
MSE470-17	Industrial Practice	4	4	3 Summer	None	MSE
MSE492	Thesis (Graduation Project)	12	12	4 Spring	None	MSE
Total		**39**	**37.5**			

Materials Science and Engineering

Mathematics and Natural Sciences Module

Calculus I
Calculus II
Linear Algebra
College Physics I
College Physics II
Experiments of Fundamental Physics
General Chemistry/ Chemistry: the Central Science
Principles of Biology/ Introduction to Life Science/ Introduction to Earth Sciences

Computer Programming

(select one of following courses)

Introduction to Computer Programming
Introduction to Java Programming
Introduction to C Programming
Introduction to Python Programming
Introduction to Matlab Programming

Major Foundational Courses

CAD Engineering Drawing
Fundamentals of Materials Science and Engineering
Experiments for Fundamentals of Materials Science and Engineering
Fundamentals of Circuits and Electronics
Crystallography
Mechanics of Materials B
Physical Chemistry
Physical Chemistry Experiments
Materials Chemistry
Comprehensive Experiments of Materials I
Physics of Materials
Comprehensive Experiments of Materials II

Major Core Courses

Materials Characterization Techniques
Polymer Materials
Physical Metallurgy A
Ceramic Materials
Experiments for Advanced Materials Science and Engineering I
Thermodynamics of Materials
Experiments for Advanced Materials Science and Engineering II

Practice-based Courses

Industrial Practice

Restricted Electives Courses

(choose at least 8 credits in one direction)

Materials Chemistry Track
General Organic Chemistry
Basic Experiments for Organic Chemistry
Fundamentals of Electrochemisty
Functional Polymers
Biomaterials
Experiments for Biomaterials

Materials Physics Track
Applied Quantum Mechanics
Applied Solid State Physics
Semiconducting Materials, Devices and Technology
Computational Materials Science
Biomaterials
Experiments for Biomaterials

Unrestricted Electives Courses

(choose at least 8 credits)

Magic Materials
Probability and Statistics
Engineering Mathematical Physics
Heat and Mass Transfer
Electronic Information Materials and Devices
3D Printing and Lase-based Additive Manufacturing
Advanced Thin Film Technology
Composite Materials
Crystal Growth
Optical Materials and Devices
Integrated Circuit Processing Technology
Introduction to Photovoltaics and Photo-thermal
Experiments of Circuit Design
Electronic Component Reliability and Failure Analysis
Projects of Science and Technology Innovation

Note: please see the General Education Requirement for more details on Chinese Language and Culture Module, Arts and Physical Education Module, Competence Development Module （Foreign Languages & Writing）, Humanities and Social Sciences Module, and GE to Majors Bridging Module.

Thesis (Graduation Project)