Department of Materials Science and Engineering

Program of Electronic and Photonic Materials and Devices for International Students (2023)

I. Introduction

The major of Electronic and Photonic Materials and Devices is based on the principles of materials science and engineering, chemistry and physics, and integrates with electronics, photons, integrated circuits, information, and other disciplines. It focuses on various materials related to electronic science and engineering, information science and engineering, including semiconductor materials, photons and electromagnetic materials, functional and sensing materials, quantum information materials, and other core and key materials required for information processing and transmission. And materials' structure characterization/evaluation, performance test, process technology, manufacturing equipment, and device application. Cultivate new engineering talents with basic knowledge and application ability in the fields of materials and electronics, photonics, information, etc.

Academic subject areas: Materials

Program code: 080418T

II. Objectives and Learning Outcomes

The major of Electronic and Photonic Materials and Devices will cultivate high-quality science and technology talents with firm theoretical knowledge of Electronic and Photonic Materials and Devices, 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 research in the fields of materials and electronics, photonics, and information, for designing and developing new materials and devices, for 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 the fields of materials, electronics, photonics and

information, 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.

<table>
<tr><th colspan="2">Module</th><th>Category</th><th>Minimum Credit Requirement</th></tr>
<tr><td rowspan="15">General Education Courses</td><td rowspan="2">Chinese Language and Culture Module</td><td>Chinese Language and Culture</td><td>16</td></tr>
<tr><td rowspan="2">Arts and Physical Education Module</td><td>Physical Education</td><td>4</td></tr>
<tr><td>Arts</td><td>2</td></tr>
<tr><td rowspan="3">Competence Development Module</td><td>Computer Programming</td><td>3</td></tr>
<tr><td>Writing</td><td>2</td></tr>
<tr><td>Foreign Languages</td><td>14</td></tr>
<tr><td rowspan="3">Humanities and Social Sciences Module</td><td>Humanities</td><td rowspan="2">6</td></tr>
<tr><td>Social Sciences</td></tr>
<tr><td>Chinese Studies</td><td>2</td></tr>
<tr><td rowspan="4">Mathematics and Natural Sciences Module</td><td>Mathematics</td><td>12</td></tr>
<tr><td>Physics</td><td>10</td></tr>
<tr><td>Chemistry</td><td>3</td></tr>
<tr><td>Geoscience + Life Science</td><td>3</td></tr>
<tr><td>GE to Majors Bridging Module</td><td>Introduction to Majors</td><td>2</td></tr>
<tr><td rowspan="4">Major Courses</td><td rowspan="3">Major Required Courses</td><td>Major Foundational Courses</td><td>24</td></tr>
<tr><td>Major Core Courses</td><td>20</td></tr>
<tr><td>Practice-based Learning (Undergraduate Thesis, Internships, Research projects, etc.)</td><td>16</td></tr>
<tr><td>Major Elective Courses</td><td>Major Elective Courses</td><td>22</td></tr>
<tr><td colspan="3">Total</td><td>161</td></tr>
<tr><td colspan="4">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.</td></tr>
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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	
	PHY104B	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/ BIO102B/ 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="8">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>
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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 Electronic and Photonic Materials and Devices

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Major Foundational Courses	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
	MSE207	Engineering Mathematical Physics	3		2 Fall	MA127 MA113	MSE
	MSE344	Applied Quantum Mechanics	3		2 Spring	PHY106	MSE
	MSE213	Mechanics of Materials B	3		2 Spring	None	MSE
	MSE335	Applied Solid State Physics	3		3 Fall	MA127 PHY106	MSE
	MSE301	Materials Chemistry	3		3 Fall	MSE001 MSE002	MSE
	Total		**24**	**1**			
	Note: *Please choose MSE001 and MSE002 at the same semester.						
Major Core Courses	MSE306	Materials Characterization Techniques	3		2 Spring	MSE001	MSE
	MSE209	Heat and Mass Transfer	3		2 Spring	MA127 PHY106	MSE
	MSE333	Comprehensive Experiments of Electronic and Photonic Materials and Devices I	4	4	3 Fall	MSE001 MSE002	MSE
	MSE311	Thermodynamics of Materials	3		3 Spring	MSE001	MSE
	MSE337	Crystal Growth	3		3 Spring	MSE001	MSE
	MSE357	Comprehensive Experiments of Electronic and Photonic Materials and Devices II	4	4	3 Spring	MSE333	MSE
	Total		**20**	**8**			
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			**60**	**25**			

Table 2: Major Elective Courses

Program of Electronic and Photonic Materials and Devices

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Restricted Electives Courses	MSE407	Advanced Thin Film Technology	3		3 Fall	None	MSE
	MSE356	Electronic Information Materials and Devices	3		3 Fall	MSE001	MSE
	MSE339	Optical Materials and Devices	3		3 Spring	PHY106	MSE
	MSE310	Semiconducting Materials, Devices and Technology	3		3 Spring	None	MSE
	MSE349	Integrated Circuit Processing Technology	3		3 Spring	MSE001	MSE
	MSE404	Electronic Component Reliability and Failure Analysis	3		4 Fall	MSE306	MSE
	MSE409	Packaging Materials and Technology	3		4 Fall	MSE001	MSE
	Total		**21**				
	Note: At least 12 credits are required for Restricted Electives Courses.						
Unrestricted Electives Courses	MSE103	Magic Materials	1	1	1 Fall	None	MSE
	MSE313	Polymer Materials	3		2 Spring	MSE001	MSE
	MSE319	Physical Metallurgy A	3		3 Fall	MSE001 MSE002	MSE
	MSE332	Fundamentals of Electrochemisty	3		3 Fall	None	MSE
	MSE317	Ceramic Materials	3		3 Fall	MSE001	MSE
	MSE352	The Fundamental of Plasma Technology	3		3 Fall	PHY106	MSE
	MSE413	3D Printing and Lase-based Additive Manufacturing	3		3 Fall	None	MSE
	MSE325	Functional Polymers	3		3 Fall	None	MSE
	MSE322	Composite Materials	3		3 Spring	None	MSE
	MSE320	Introduction to Photovoltaics and Photo-thermal	3		3 Spring	None	MSE
	MSE328	Physics of Materials	3		3 Spring	MA127 MSE001	MSE
	MSE351	Principle of Sensors	3		3 Spring	PHY106	MSE
	MSE354	Introduction to Electron Photon Source	3		3 Spring	None	MSE
	MSE355	Information Storage Materials and Devices	3		3 Spring	MSE337	MSE
	MSE5019	Photonic Materials and Matematerials	3		3 Spring	None	MSE
	MSE410	Experiments of Circuit Design	2	2	4 Fall	MSE205	MSE
	MSE402	Lithographic Materials and Processing	3		4 Fall	None	MSE
	MSE408	Optoelectronic Materials and Device	3		4 Fall	None	MSE
	MSE480	Projects of Science and Technology Innovation	2	2	3-4 Spring & Fall	None	MSE
	Total		**53**	**5**			
	Note: At least 10 credits are required for Unrestricted Electives Courses.						

Table 3: Overview of Practice-based Learning

Program of Electronic and Photonic Materials and Devices

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
MSE103	Magic Materials	1	1	1 Fall	None	MSE
MSE002	Experiments for Fundamentals of Materials Science and Engineering	1	1	2 Fall	PHY106 CH103/CH105	MSE
MSE333	Comprehensive Experiments of Electronic and Photonic Materials and Devices I	4	4	3 Fall	MSE001 MSE002	MSE
MSE357	Comprehensive Experiments of Electronic and Photonic Materials and Devices II	4	4	3 Spring	MSE333	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		**30**	**30**			

Electronic and Photonic Materials and Devices

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

Fundamentals of Materials Science and Engineering
Experiments for Fundamentals of Materials Science and Engineering
Fundamentals of Circuits and Electronics
Crystallography
Engineering Mathematical Physics
Applied Quantum Mechanics
Mechanics of Materials B
Applied Solid State Physics
Materials Chemistry

Major Core Courses

Materials Characterization Techniques
Heat and Mass Transfer
Comprehensive Experiments of Electronic and Photonic Materials and Devices I
Thermodynamics of Materials
Crystal Growth
Comprehensive Experiments of Electronic and Photonic Materials and Devices II

Practice-based Courses

Industrial Practice

Restricted Electives Courses

(choose at least 12 credits)

Advanced Thin Film Technology
Electronic Information Materials and Devices
Optical Materials and Devices
Semiconducting Materials, Devices and Technology
Integrated Circuit Processing Technology
Electronic Component Reliability and Failure Analysis
Packaging Materials and Technology

Unrestricted Electives Courses

(choose at least 10 credits)

Magic Materials
Polymer Materials
Physical Metallurgy A
Fundamentals of Electrochemisty
Ceramic Materials
The Fundamental of Plasma Technology
3D Printing and Lase-based Additive Manufacturing
Functional Polymers
Composite Materials
Introduction to Photovoltaics and Photo-thermal
Physics of Materials
Principle of Sensors
Introduction to Electron Photon Source
Information Storage Materials and Devices
Photonic Materials and Matematerials
Experiments of Circuit Design
Lithographic Materials and Processing
Optoelectronic Materials and Device
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)