

Department of Materials Science and Engineering

Materials Science and Engineering

I. Introduction

The major of Materials Science and Engineering is a discipline, which systematically studies fundamental theories and experiment skills for 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 major is an integrated discipline for application science closely related to engineering technology.

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

II. Objectives

Materials Science and Engineering (MSE) will cultivate high-quality science and technology talents with firm theory knowledge of Materials Science and Engineering, abilities of mastering frontier materials' R&D and characterization technology, and capabilities of utilizing English and computer technology very well for high-tech R&D in interdisciplinary fields. These trained students possess not only the capability for researching in their disciplines and related fields, for designing and developing new materials, 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 new processes and technologies' developing, but also continue their postgraduate studies in Materials Science and Engineering and serve in the research, developing and management in top-ranked corporations, scientific research institutes, colleges, and government.

Graduates should acquire the following knowledge and abilities:

- Mastering knowledge for mathematics, chemistry, and physics needed for their professional work;
- Mastering basic theories for materials science and engineering as well as professional knowledge for various materials;
- Mastering knowledge and skills in materials' design, preparation, processing, structure characterization and performance evaluation;
- Possessing innovative awareness, knowing and understanding materials science and technology's state-of-the-art progress and development trends;
- Being aware of the important policies, laws and regulations related to the subject and industry;
- Having strong interpersonal skills, team work spirit and organizational management skills;
- Owning international perspective, cross-cultural communication, and cooperation; being able to read professional materials written by foreign language and communicate using foreign language.
- Being able to use modern information technology for self- promotion basing on lifelong learning awareness.

III. Period of Study and Degree Requirement

Time length: 4 years

Degree conferred: Bachelor of Engineering

The minimum credit requirement for graduation: 152.5 credits

IV. Discipline

Materials Science and Engineering

V. Main Courses

Fundamentals of Materials Science and Technology, Physical Chemistry, Materials Chemistry, Physics of Materials, Mechanics of Materials, Crystallography, Physical Metallurgy, Ceramic Materials, Polymer Materials, Semiconducting Materials, Devices and Technology, General Organic Chemistry, Introduction to Energy Materials, Biomaterials, and Materials Characterization Techniques are the main courses. Undergraduate major in Materials Science and Engineering (MSE) provides a thorough knowledge of engineering and science principles.

Curriculum is set not only to meet the understanding of the basic knowledge for materials science and engineering, but also to meet the needs for the five main research directions of our faculties. Due to the multi-interdisciplinary nature of materials science and engineering, the curriculum will also let our students meet the basic requirements for other engineering disciplines (aerospace, biomedical, chemical, civil, computer, electrical, environmental and mechanical engineering).

In the first two years, students learn the courses of Calculus, General Physics, General Chemistry, Linear Algebra, Foundation of Physics, Computer Programming Design and Application. Within these two years, students master the basic knowledge of mathematics, chemistry, and physics, establishing the foundation for learning professional knowledge related to materials major. In the third year, required courses are set as Physical Chemistry, Materials Chemistry, Physics of Materials, Mechanics of Materials, Crystallography, and Digital Circuit. These courses includes the fundamental courses for three categories of materials - metal materials, ceramic

materials, and polymer materials; basic engineering courses such as Engineering Drawing and Analog Circuit; and some technical courses closely related to applications in various fields including Transport Phenomenon Theory, Fundamental of Organic Materials and Devices, Introduction to Energy Materials, Biomaterials, Fundamentals of Electrochemistry, Semiconducting Materials, and Nanomaterials and Nanotechnologies.

VI. Practice-Based Courses

Main practical teaching includes: experiments, industrial practice (summer break of Grade 3), thesis, undergraduates' innovation experiments (starting from Year 2, undergraduates with excellent scores can work in labs to conduct research under the guidance of their supervisors; research period can include summer break), and various academic and overseas undergraduate competitions (see Table 3).

VII. Course Structure and Credit Requirements

General Education (GE) Required Courses: 66.5 credits;
(Calculus B, Linear Algebra I, General Physics A for students of Materials Science and Engineering)

General Education (GE) Elective Courses: 10 credits;
(open courses, applicable to all the majors in our university)

Major Foundational Courses: 42 credits;

Major Core Courses: 14 credits;

Major Elective Courses: 8 credits ;

(Open courses for certain Majors)

Undergraduate Thesis/Projects: 8 credits;

Research Projects: 2 credits;

The minimum credit requirement for graduation: 150.5 credits.

Note: the required course credits do not include practical course credits, but including the experimental courses with theoretical lessons.

VIII. Course Arrangement

Table 1: Major Required Course (Foundational and Core Courses)

Course Category	Course Code	Course Name	Credits	Lab Credits	Hours/week	Terms	to take the course	Advised term	Instruction language	Prerequisite	Dept.
Major Fundamental Courses	ME 102	CAD Engineering Design	3	1	4	Fall/ Spr.	1/Fall/ Spr.		C	NA	ME
	EE 201	Analog Circuit	4	1	5	Fall	2/Fall		C	GE101b GE102b MA103b PHY101a PHY102a EE104	EE
	MSE2 01	Fundamentals of Materials Science and Technology	4	1	5	Fall	2/Fall		E	PHY101 PHY102 CH101	MSE
	MSE2 03	Crystallography	2		2	Fall	2/Fall		C/E	NA	MSE
	MSE2 02	Physical Chemistry	3		3	Spr.	2/Spr.		E	GE101 GE102 CH101	MSE
	MSE2 04	Physical Chemistry Experiments	1	1	2	Spr.	2/Spr.		C/E	PHY101 PHY102 CH101 PHY104 MSE201	MSE
	MSE3 05	Mechanics of Materials	2		2	Spr.	2/Spr.		E	MSE201	MSE
	MSE3 01	Materials Chemistry	3		3	Fall	3/Fall		E	MSE201	MSE
	MSE3 11	Thermodynamics of Materials	3		3	Fall	3/Fall		E	PHY101 PHY102 GE101 GE102 CH101 MSE201	MSE
	MAE3 09	Principle of Transport Phenomena	3		3	Fall	3/Fall		C	NA	MA
	MSE3 07	Comprehensive Experiments of Materials-1	4	4	8	Fall	3/Fall		C	MSE313 MSE203	MSE

									MSE305 MSE301	
	MSE3 04	Comprehensive Experiments of Materials-2	4	4	8	Spr.	3/Spr.	C	MSE307	MSE
	MSE3 08	Physics of Materials	3		3	Spr.	3/Spr.	E	PHY101 PHY102 GE101 GE102 MSE201 MSE203	MSE
	MSE3 06	Material Characterization Techniques	3		3	Spr.	3/Spr.	C/E	NA	MSE
	MSE4 80	Research Projects	2	2	16			C/E		MSE
	MSE4 90	Undergraduate Thesis/Projects	8	8	16		4	C/E		MSE
	Total		52	22	86					
	Major Core Course	MSE2 08	General Organic Chemistry	4	1	5	Spr.	2/Spr.	E	CH101
MSE3 13		Polymer Science and Technology	3		3	Spr.	2/Spr.	E	MSE201	MSE
MSE3 15		Physical Metallurgy	3	1	4	Fall	3/Fall	C/E	PHY101 PHY102 CH101 MSE202	MSE
MSE3 17		Ceramic Materials	3		3	Fall	3/Fall	E	MSE201	MSE
MSE3 32		Fundamentals of Electrochemistry	3		3	Spr.	3/Spr.	E	CH101 MSE202	MSE
MSE3 18		Introduction to Energy Materials	3	1	4	Spr.	3/Spr.	C/E	PHY101 PHY102 PHY104 MSE201	MSE
MSE3 10		Semiconducting Materials, Devices and Technology	3		3	Spr.	3/Spr.	英	NA	MSE
MSE3 16		Biomaterials	4	2	6	Spr.	3/Spr.	英	MSE201	MSE
Total		26	5	31						
At least 14 credits.										

Table 2: Major Elective Courses

Course Code	Course Name	Credits	Lab Credits	Hours/week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept.
MSE 102	Frontier Seminars in Materials Science and Engineering	1		1	Spr.	1/Spr.	C/E	NA	MSE
MSE 460	Orientation Program of Dept. of Materials Science and Engineering	1	0.5	1.5	Smr.	1/2/Smr	C/E	NA	MSE
EE203	Solid-State Electronics	3		3	Fall	2/F	C/E	GE101b GE102b PHY101a PHY102a	EE
EE202	Digital Circuit	4	1	5	Spr.	2/Spr.	C	PHY101a PHY102a EE203 EE201	EE
MSE 450	Distinguish Lectures for Innovation and Entrepreneurship in Materials Science and Engineering	1		1	Smr..	2/Smr.	C/E	NA	MSE
PHY 326-15	Semiconductor Physics and Devices	4		4	Spr.	3/Spr.	C/E	PHY 321-15 PHY 203-15	PHY
PHY 321-15	Introduction to Solid State Physics	4		4	Fall	3/Fall	C/E	PHY 206-15	PHY
MSE 309	Seminars Frontiers of Modern Materials Science and Technology-1	1		1	Fal	3/Fal	C/E	MSE201	MSE
MSE 413	3D Printing and Lase-based Additive Manufacturing	3		3	Fall	3/Fall	E	GE101 GE102 PHY311	MSE
MSE 321	Advanced Materials Research 1	1	1	2	Fall	3/Fall	C/E	4/F	MSE
BMEB313	Biomedical Engineering I	3		3	Fall	3/Fall	E		BMEB
MSE 302	Seminars Frontiers of Modern Materials Science and Technology-2	1		1	Spr	3/Spr	C/E	MSE201	MSE
MSE	Advanced Materials Research 2	1	1	2	Spr.	3/Spr.	C/E	MSE317	MSE

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MSE 320	Introduction to Photovoltaic and Photo-thermal	3		3	Spr.	3/Spr.	C/E	PHY101 PHY102 EE201 PHY312	MSE
MSE 322	Composite Materials	3		3	Spr.	3/Spr.	E	MSE201 MSE305	MSE
ESE 302	Solid Waste Treatment, Disposal and Recycling	3		3	Spr.	3/Spr.	E		ESE
ESE 314	Environmental Materials Science	3		3	Spr.	3/Spr.	E		ESE
MSE 330	Powder metallurgy and 3D printing of metallic materials	3		3	Spr.	3/Spr.	E	MSE201 MSE315	MSE
MSE 403	Advanced Materials Characterization Techniques	3		3	Spr.	3/Spr.	E	NA	MSE
MSE 401	Advanced Materials Research 3	1	1	2	Fall	4/Fall	C/E	MSE328	MSE
MSE 407	Advanced Thin Film Technology	3	1	4	Fall	4/Fall	C/E	PHY101 PHY102 CH101 MSE201	MSE
EE419	Biosensors	3	1	4	Fall	4/Fall	E		EE
PHY 429	Advanced Electron Microscopy	3	1	4	Fall	4/Fall	C/E	PHY 321-15	PHY
ME 103	Awareness Practice of Manufacturing Engineering	3	2	5	Fall	4/Fall	C/E		ME
Total		59	9.5	69.5					
At least 8 credits.									

Table 3: Overview of Practice-Based Courses

Course Code	Course Name	Credits	Lab Credits	Hours/week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept.
EE201	Analog Circuit	4	1	5	Fall	2/Fall	C	GE101b GE102b MA103b PHY101a PHY102a EE104	EE
MSE 201	Fundamentals of Materials Science and Technology	4	1	5	Fall	2/Fall	E	PHY101 PHY102 CH101	MSE
MSE 208	General Organic Chemistry	4	1	5	Spr.	2/Spr.	E	CH101	MSE
EE202	Digital Circuit	4	1	5	Spr.	2/Spr.	C	PHY101a PHY102a EE203 EE201	EE
MSE 326-15	Semiconductor Physics and Devices	4		4	Spr.	3/Spr.	C/E	PHY321-1 5 PHY203-1 5	PHY
MSE 460	Orientation Program of Dept. of Materials Science and Engineering	1	0.5	1.5	Smr.	1/2/Smr.	C/E	无	MSE
MSE 307	Comprehensive Experiments of Materials-1	4	4	8	Fall	3/Fall	C	MSE313 MSE203 MSE305 MSE301	MSE
MSE 315	Physical Metallurgy	3	1	4	Fall	3/Fall	C/E	PHY101 PHY102 CH101 MSE202	MSE
MSE 321	Advanced Materials Research 1	1	1	2	Fall	3/Fall	C/E	MSE201	MSE
MSE 304	Comprehensive Experiments of Materials-2	4	4	8	Spr.	3/Spr.	C	MSE307	MSE
MSE 318	Introduction to Energy Materials	3	1	4	Spr.	3/Spr.	C/E	PHY101 PHY102 PHY104 MSE201	MSE

MSE 316	Biomaterials	4	2	6	Spr.	3/Spr.	E	MSE201	MSE
MSE 328	Advanced Materials Research 2	1	1	2	Spr.	3/Spr.	C/E	MSE317	MSE
ME 103	Awareness Practice of Manufacturing Engineering	3	2	5	Fall	4/Fall	C/E		ME
MSE 401	Advanced Materials Research 3	1	1	2	Fall	4/Fall	C/E	MSE328	MSE
MSE 407	Advanced Thin Film Technology	3	1	4	Fall	4/Fall	C/E	PHY101 PHY102 CH101 MSE201	MSE
EE419	Biosensors	3	1	4	Fall	4/Fall	C		EE
PHY 429	Advanced Electron Microscopy	3	1	4	Fall	4/Fall	C/E	PHY 321-15	PHY
MSE 480	Research Projects	2	2	16			C/E		MSE
MSE 490	Undergraduate Thesis/Projects	8	8	16		4	C/E		MSE
Total		64	34.5	110.5					

Table 4: Overview of Course Hours and Credits

Course Category	Total Course Hours	Total Credits	The Minimum Credit Requirement
General Education (GE) Required Courses	1312	66.5	66.5
General Education (GE) Elective Courses	3144	182.5	10
Major Foundational Courses	864	42	42
Major Core Courses	496	26	14
Major Elective Courses	1100.8	59	8
Research Projects and Undergraduate Thesis/Projects	320	10	10
Total	7236.8	385	150.5