Instructive Cultivation Plan for the Program of Materials Science and Engineering

(Grade 2019)

Course code: 080401

1. Orientation

The materials science and engineering program (direction of new energy materials and devices) is established to adapt to the development of national new energy, new materials and other national strategic emerging industries. The program is based on materials science and engineering, with the design and preparation engineering technology of new energy efficient conversion materials and devices related to the new energy industry, new energy efficient storage and transfer materials and devices, and new energy-efficient materials and devices. The CDIO (Conceive, Design, Implement, Operate) model with the project as the main body is adopted to cultivate application-oriented talents in the field of new energy materials and devices.

2. Cultivation Objective

1. General Objective

This program will cultivate application-oriented technical talents who are comprehensively developed on the aspects of morality, intelligence, physique, beauty and labor, possess the qualities of "firm belief, study hard, and take responsibility", master the basic theories, professional knowledge and application skills of materials science and engineering, adapt to the rapid development of new energy industry technology, meet the needs of economic construction in the country and the Yangtze River Delta region, and can be competent in the design, R&D, production, operation and management of new energy materials and devices in high-efficiency "capacity", "energy storage", "energy saving" emerging industries and new economic fields.

2. Cultivation Value

This program takes the idea of "strengthen moral education and cultivate people" as the foundation of education, practices the core values of socialism, highlights the spirit of model workers and craftsmen, and cultivates students to develop a rigorous, meticulous, dedicated and responsible work attitude, obtain the quality of "firm belief, hard work, and courage to take responsibility", and strive to promote the development of the country's new energy materials and their comprehensive development and utilization industries.

3. Five-Year Goal after Graduation：

(1) Professional foundation and skills: Have a solid knowledge of natural sciences such as mathematics, physics, chemistry, etc.; have basic engineering knowledge and certain engineering management knowledge in electrical and electronics, engineering drawing, computers, etc.; master professional knowledge and technology in the field of materials science and engineering, be able to analyze and study complex engineering problems in the fields of high-efficiency energy storage, high-efficiency energy transfer and high-efficiency energy conservation, and can propose systematic solutions.

(2) Career positioning: Be able to track cutting-edge technologies in new energy materials science and engineering and related fields, possess engineering practice capabilities and innovative thinking, be able to undertake the production, management, research and development, and design of new energy materials and devices, and can reach the level of engineer practice level.

(3) Basic Qualities: Familiar with important laws, regulations and policies of professions and industries related to materials and new energy; have good ideological and ethical qualities and

humanistic qualities; have a sense of law, environment and sustainable development, and abide by professional ethics and social responsibility.

(4) Social competence: Have good interpersonal skills, organizational management and execution skills, and have a team spirit, be able to integrate, drive or coordinate the organization and implementation of a project and can play a role effectively.

(5) Self-development: understand the law of new energy material technology development, be able to continuously improve one's application ability and level, have the habits and abilities of self-development and lifelong learning, and be able to actively adapt to the changes and development of the professional environment.

3. Requirement for Graduation

Graduation requirements 1: Engineering knowledge: Be able to use mathematics, natural sciences, engineering foundations and professional knowledge to solve complex engineering problems in the field of materials science and engineering.

1-1 Master the knowledge of advanced mathematics, probability theory, linear algebra, and the basic methods of applying the knowledge to the expression, modeling and solving of material science and engineering problems, and have strong logical thinking skills and mathematical application skills.

1-2 Master the basic knowledge of physics, chemistry, mechanics and other natural sciences that can be used in the design, calculation and analysis of complex material science and engineering problems.

1-3 Master engineering technical knowledge and engineering principles such as machinery, electrical and electronics, and be able to use relevant engineering basic knowledge for preliminary engineering design.

1-4 Master the basic theories and professional knowledge related to materials science and engineering and new energy, and by combining the knowledge of mathematics, natural science and engineering technology, be able to use the theories and knowledge learnt to solve complex engineering problems in the field of new energy materials science and engineering.

Graduation requirements 2: Problem analysis: Be able to apply basic principles of mathematics, natural sciences and engineering sciences to identify, express, and analyze complex engineering problems in the field of materials science and engineering through literature research, and can obtain effective conclusions.

2-1 Be able to use the basic principles of mathematics, natural sciences and engineering sciences to express and model complex materials science and engineering problems.

2-2 Be able to express scientific and engineering problems of complex new energy-related materials and devices based on the basic principles and relevant basic knowledge of materials science and engineering, and can seek solutions.

2-3 Be able to use the basic principles of relevant sciences to analyze complex engineering problems in the preparation/processing and application of new energy materials and their devices with the help of literature research, and obtain effective conclusions.

Graduation requirements 3: Design/development solutions: based on CDIO engineering concepts, be able to conceive and design solutions to complex engineering problems in the field of materials science and engineering, and design systems, units (components) or process flows that meet the specific needs of the new energy field, and be able to reflect the sense of innovation in the design process, and can consider social, health, safety, legal, cultural and environmental factors.

3-1 Master the basic methods of the whole process of material product development and process design, and understand the various factors that affect the product development process and process design.

3-2 Based on the basic laws of material composition, organization, structure and performance, be able to satisfy specific needs through rational design of process flow, correct selection of materials, and development of processing technology for complex engineering problems in the field of materials science and engineering.

3-3 Be able to consider social, health, safety, legal, cultural and environmental factors in the engineering design and development process of materials science and engineering, and can propose innovative design solutions.

Graduation requirement 4: Research: Be able to study complex engineering problems in the field of materials science and engineering based on scientific principles and by using scientific methods, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.

4-1 Be able to analyze related phenomena and characteristics in material science and engineering issues based on scientific principles, basic principles of engineering technology, and experimental analysis methods.

4-2 Be able to use the basic principles and scientific methods of materials science and engineering to select research paths and design experimental plans based on actual new energy engineering problems.

4-3 Be able to optimize experimental plans, select or build experimental platforms, collect experimental data scientifically, analyze and interpret experimental research results, and obtain reasonable and effective conclusions through information synthesis for complex engineering problems in the field of materials science and engineering.

Graduation requirement 5: Using modern tools: Be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in the field of materials science and engineering, including prediction and simulation of complex engineering problems in the fields of materials science and engineering and new energy, and be able to understand its limitations.

5-1 Master the principles and methods of engineering graphics and computer-aided design, and understand their limitations.

5-2 Be able to develop, select and use modern professional testing equipment and analysis methods for complex engineering problems in the field of materials science and engineering, can effectively use modern materials and device analysis tools to predict and simulate complex engineering problems, and be able to analyze and understand the limitations.

Graduation requirements 6: Engineering and society: Be able to conduct reasonable analysis based on engineering-related background knowledge, evaluate the impact of solutions to engineering practices and complex engineering problems in the field of materials science and engineering on society, health, safety, law, and culture, and can understand the responsibilities to be undertaken.

6-1 Understand knowledge of material science and engineering, new energy-related industrial technology standards, industrial policies, laws and regulations and culture, etc.

6-2 Be able to objectively analyze and evaluate the impact of solutions to engineering practices and complex engineering problems in the field of materials science and engineering on society, health, safety, law and culture, and understand the responsibilities that should be undertaken.

Graduation requirement 7: Environment and sustainable development: Be able to understand and evaluate the impact of professional engineering practices for complex engineering issues related to materials science and engineering on the environment and sustainable development of society.

7-1 Understand the national strategy for sustainable development of energy, environment, and society and related policies, laws and regulations, establish the concept of environmental protection and sustainable development and understand its connotation.

7-2 Be able to understand and evaluate the impact of engineering practices related to complex engineering issues in the field of materials science and engineering on environmental and social sustainable development.

Graduation requirements 8: Professional standards: Have humanities and social science literacy and a sense of social responsibility, and be able to understand and abide by engineering professional ethics and standards in the engineering practice of materials science and engineering, and can perform responsibilities.

8-1 Familiar with humanities knowledge such as literature, history, philosophy, law and ethics, understand national conditions and history, and possess humanities and social sciences.

8-2 Be able to understand and abide by professional ethics and codes of conduct in engineering practices in the field of materials science and engineering, consciously perform responsibilities, and have a sense of social responsibility.

Graduation requirements 9: Individuals and teams: Be able to assume the roles of individuals, team members and leaders in a team under a multidisciplinary background.

9-1 Have certain interpersonal skills and teamwork skills, be able to work independently or cooperatively in a team.

9-2 Be able to do a good job in a team with a multidisciplinary background, and can organize, coordinate and direct the team to carry out work.

Graduation requirement 10: Communication: Be able to effectively communicate and exchange with industry colleagues and the public on complex engineering issues in the field of materials science and engineering, including writing reports and design manuscripts, making presentations, expressing their opinions clearly and answering questions; master one foreign language, have a certain international perspective, and be able to communicate and exchange in a cross-cultural context.

10-1 Master the writing methods and presentation skills of technical documents or scientific papers, have the ability to write reports, design manuscripts, presentations and clear expressions, and be able to communicate with industry peers and the public effectively on complex engineering issues in the field of new energy-related materials science and engineering.

10-2 Master a foreign language, understand the international development trends and research hotspots in the field of materials science and engineering, and have a certain international perspective and the ability to communicate and exchange under a cross-cultural context.

Graduation requirements 11: Project management: understand and master the principles of engineering management, and be able to apply them in a multidisciplinary environment.

11-1 Master the relevant engineering management principles involved in the practical activities of energy engineering.

11-2 Be able to correctly use engineering management methods in the process of engineering design and technology development in the fields of new energy-related materials science and

engineering in a multidisciplinary environment.

Graduation requirements 12: Lifelong learning: Have the consciousness of independent learning and lifelong learning, and be able to continuously learn and adapt to development.

12-1 Under the background of social and technological development, realize the importance of continuous exploration and learning; have the ability to continuously acquire new knowledge through literature research, professional exchanges, engineering practice, etc., and possess the awareness of independent learning and lifelong learning.

12-2 Have a healthy physique, and the ability to continuously learn and adapt to development.

4. Schooling System

Four-year undergraduate education

5. Length of Study

Generally four years. The length of schooling can be flexible from no less than three years to no longer than six years.

6. Requirements for Graduation and Degree Conferring

Students of this program must complete the minimum credits required for each category of courses and complete all the content specified in extracurricular class according to the requirements of the instructional training plan, and the total credits must reach 150 credits for graduation; those who meet the requirements for bachelor's degree can be conferred bachelor degree in engineering.

7. Discipline

Materials Science and Engineering

8. Core Courses

1. Physical Chemistry

This course is an important basic course of this program. The course is based on the preliminary general courses "College Physics" and "College Chemistry", and from the study of the interrelationship between chemical phenomena and physical phenomena, explores the universal basic laws in chemical changes. What the course studies is universally applicable to the theoretical problems of various chemical branches. The teaching contents of the course is mainly based on thermodynamics, involves the basic concepts of thermodynamics, three basic laws of thermodynamics, principles and methods, multi-component system thermodynamics, phase equilibrium, chemical equilibrium, and thermodynamics in electrochemistry. Through the study of this course, students are required to have a systematic understanding of physical chemistry and understand its application in chemistry, chemical engineering, environment, materials, energy and other directions. In the course teaching process, inspirational stories of typical characters in the field of physical chemistry are used as the starting point to promote the spirit of model workers and craftsmanship.

2. Fundamentals of Materials Science

This course is an important professional basic course of materials science and engineering program. This course will introduce the development history of material science in China based on national conditions, and cultivate students' patriotism and scientific literacy. This course will systematically and comprehensively introduce the basic theoretical knowledge of materials, such

as material associative key, material crystal structure, crystal structure defects, material phase structure and phase diagram, material solidification, material diffusion, material plastic deformation and strengthening, and material metastable state. This course focuses on the basic issues of materials, starting from the basic theories of metal materials, and combines high molecular polymer materials, ceramic materials, composite materials, etc., so that students can grasp the commonality of materials and become familiar with the characteristics of materials. This course also provides the foundation for subsequent courses of materials science and engineering program, such as nanomaterials and technology, thin film materials and device preparation technology, semiconductor lighting principles and technology, etc.

3. Introduction to Solid State Physics

This course is a professional basic course of materials science and engineering program. This course will systematically introduce the physical properties, microstructures, various particle motion forms of solid matter and their relationships. Solid-state physics is particularly important for students of in the direction of semiconductor lighting green light source and photovoltaic power generation studying the follow-up professional core courses, such as semiconductor device physics and technology, optoelectronic technology, LED epitaxy technology and chip manufacturing technology, solar photovoltaic technology, etc. Through the study of this course, students will master the necessary basic knowledge of solid physics and scientific research methods, and cultivate their scientific thinking ability and innovative consciousness. Based on the basic laws of solid-state physics and the dialectical materialist world outlook and scientific research methods contained therein, students are guided to establish a scientific world outlook and methodology.

4. Material Structure and Properties

This course is an important professional basic course for this program. The main contents of this course include the atomic and electronic structure of materials, the structure and properties of steel materials, the structure and properties of light alloys, the structure and properties of magnetic materials, amorphous alloys and superconducting materials. The focus is on explaining the relationship between the organizational structure of different materials and material properties. Through the study of this course, students can understand the research and development of materials from the perspective of material organization structure design, and lay a solid foundation for subsequent module courses. The content of this course combines the explanation of various influencing factors between structure and performance to enable students to establish correct materialist values and outlook on life.

5. Material Chemistry

This course is an important basic course for this program. This course is the concrete embodiment and application of basic theories such as "Physical Chemistry" and "Basics of Materials Science". Together with "Material Structure and Properties", it becomes a solid foundation for the follow-up material professional courses and modular courses. This course focuses on understanding the relationship between the structure and properties of materials from the molecular level to the macro-scale, so as to adjust the composition, structure and synthesis technology of the improved material and related analysis techniques, and develop new advanced materials with excellent properties and properties. The course introduces the synthetic development process of various materials in our country and the related scientific research results of cutting-edge materials based on China's national conditions, so as to cultivate students' patriotism and national pride and honor. By studying this course, students will have a systematic understanding on the relationship between the chemical composition and properties of materials.

6. Nanometer Material Technology

This course mainly introduces the basic concepts, structural properties and characterization methods, preparation technology, latest research progress of nanometer materials, the application

of nanometer materials in various fields, as well as the knowledge of functional nanometer materials. By studying this course, students will have a certain understanding on the popular nanometer materials and their application development trends, master the basic knowledge of nanometer materials, understand the research status of nanometer materials and their applications in different fields, expand their scope of knowledge, and also lay a foundation for their future research on nanometer materials. This course will cultivate innovative talents who meet the needs of socialist modernization and material industry development.

7. Electrochemical Power Source

This course systematically introduces various major electrochemical power sources based on explaining the basic principles of electrochemistry and the basic concepts of chemical power sources, such as the working principle, structure and manufacturing process of zinc manganese batteries, lead-acid batteries, nickel hydrogen batteries, zinc silver batteries, lithium ion batteries, flow cell, fuel cells, super capacitors, etc. Through the study of this course, students will have a comprehensive understanding of the principle, composition, materials, device assembly and application of electrochemical power sources, and will understand the characteristics and development prospects of various chemical power sources. The course will introduce the development state and related cutting-edge achievements of domestic new chemical power sources based on national conditions, thus inspiring students' patriotism and national pride. This course will lay a solid foundation for the development of secondary projects in the follow-up practice links, and also lays a solid foundation for students to engage in research and development in chemical power and related fields after graduation.

8. New Energy Technology and Application

This course is based on the basic knowledge of new energy science, new technology frontiers, new energy economy and policy, etc., combines the basic knowledge with the development frontier, and involves the current hot issues of new energy, such as the concept of new energy, new energy technologies, including the foundation and frontiers of solar energy, wind energy, hydrogen energy, ocean energy, biomass energy, nuclear energy, and geothermal energy, as well as new energy economy and policies. Through the study of this course, students will master the basic knowledge of new energy, related technologies, economics and policies, and this course will also lay a foundation for subsequent courses such as "Photovoltaic Power Generation Technology" and "Hydrogen Energy and Fuel Cell". Through this course, students will establish the concept of low-carbon and environmental protection and devote themselves to the development and utilization of new energy technologies in China.

9. Thin film materials and device preparation technology

This course is a specific application of the basic theories of "Material Chemistry" and "Fundamentals of Materials Science", and mainly introduces the basic knowledge of vacuum technology commonly used in thin film technology, various physical and chemical vapor deposition techniques and methods, and the generation and growth theory of thin film materials, etc. Through the study of this course, students will have an in-depth understanding on the preparation technology and formation principles of thin film materials, enrich and broaden their knowledge about thin film materials, and at the same time, they will also understand some of the current frontier research progress in this field, broaden the horizon, and help them to better invest in scientific research in the future. This course enables students to realize that although thin film materials are thin, the film has great value in the national economy and daily life. With the view to individuals, this course will teach the student to start with small things and rise based on accumulation.

10. Fundamentals of Materials Engineering

This course is a professional course of the materials science and engineering program. Focusing on the engineering theories mainly involved in the material production process, this course mainly

introduces the basic theories and basic research methods related to them. Through the study of this course, students will master the basic knowledge about the smelting of steel materials, commonly used metal materials and their preparation, the casting and molding of metal materials and its process control, the plastic forming and process control of metal materials, welding and process control of metal materials, steel heat treatment and surface treatment, inorganic non-metallic material preparation and processing technology, composite materials and related knowledge of their preparation, etc.; master the basic knowledge of relevant engineering theories in the material production process, and have certain engineering research capabilities. In the course teaching process, this course will take the current situation and existing problems of the material industry as the starting point, to guide students to pay attention to professional courses, learn professional courses well, contribute their strength to solve the common problems faced by the above-mentioned industries in the future, and cultivate and establish a sense of social responsibility.

9. Practical Training (Related courses)

1. Level 1 Project I (Introduction to New Energy Materials and Devices)

The level 1 project is the prerequisite course for the level 2 project of this program. By introducing the concept of CDIO to students, students will be able to understand the professional courses and practical courses they will learn in the future. This course focuses on cultivating students' personal abilities and collaboration skills, especially project organization, design, development and implementation skills, as well as strong communication and coordination skills, so as to cultivate students' sense of innovation, collaborative spirit and the style of study that integrate theory with practice. Students are required to experience the various aspects of CDIO reform and practice under the guidance of instructors, with the concept of innovative thinking and teamwork and by the means of team work. Meanwhile, they are required to consult relevant materials, analyze and discuss the materials, and propose the concept and design of the project, thus laying a solid foundation for the smooth development of the future level 2 projects. This project takes the research and development of new energy materials and devices as well as the practical application in the fields of national defense, aerospace, military and other fields as the starting point, so as to stimulate students' patriotic enthusiasm and pride, and encourage them to study hard for the revitalization of the country and the prosperity of the nation.

2. Level 1 Project II (Design of Advanced New Energy Materials and Device)

Level 1 Project II is a post-position course of the level 2 project of this program. Through the study of various level 2 project practical courses, students have experienced the realization and operation of the project, and have a further understanding of the concept of CDIO. Students are required to use the concept of innovative thinking and the means of teamwork to further review and organize materials under the guidance of the instructor, regularly provide the instructor with the project progress, and constantly improve the concept and design of the CDIO project, so as to lay a good foundation for the smooth development of the future graduation design. Through the means of inviting entrepreneurs to attend classes and go to companies for internship visits, etc., students will have a preliminary understanding of the operation process of modern enterprises and the requirements of modern enterprises for talents, so as to plan their future careers purposefully and systematically. The open teaching practice of the entire level 1 project provides students with the opportunity to organically link their usual learning with the knowledge acquired on the Internet, learn to acquire and apply knowledge through self-study, and cultivate the ability of lifelong learning. This project allows students to understand the status quo and existing problems of the new energy materials and device industries, and cultivates students' craftsmanship spirit, that is, hardworking, struggling, striving for perfection, and practical innovation.

3. Level 2 Project (Module A)

The energy storage level 2 project support courses include: material chemistry, chemical power, energy electrochemistry, lithium-ion battery principles and key technologies, hydrogen energy and

fuel cell technology, and basic manufacturing skills training for battery engineering, etc. This course will teach students to use the knowledge and skills of these courses to solve specific problems in engineering practice related to the course group, so that theoretical teaching and engineering practice are closely integrated and mutually supportive, thus guiding students to understand and abide by professional ethics and codes of conduct in engineering practices, and training students' professional ability, communication ability, team spirit and leadership ability. This project trains students in the basic skills of new energy efficient storage and transfer materials and devices, and cultivates students' tenacious will, quality and sense of responsibility during the implementation of the project.

4. Level 2 Project (Module B)

High-efficiency and energy-saving level 2 project support courses include: Introduction to Solid State Physics, Semiconductor Physics and Devices, Semiconductor Luminescent Materials and Devices, Phase Change Materials and Phase Change Energy-saving Technology and other main courses. After learning the basic knowledge and skills of the main courses, through the basic skills operation training related to energy-saving materials, devices and systems, it will guide students to understand and abide by professional ethics and codes of conduct in engineering practice, and train students' professional ability and communication ability, team spirit and leadership. Through the close integration and mutual support of theoretical teaching and engineering practice, students will be able to master specific problems in new-type high-efficiency energy-saving engineering practices. In the process of project implementation, it will focus on cultivating students' sense of teamwork and the ability to communicate and solve problems.

5. Level 2 Project (Module C)

The supporting courses for the energy conversion level 2 project include: photovoltaic power generation technology, new functional materials, new solar cell materials, solar power generation systems and applications and other main courses. It will teach students to use the knowledge and skills of these courses to solve specific problems in the practice of new energy conversion engineering related to the course group, so that theoretical teaching and engineering practice are closely integrated and mutually supportive, thus guiding students to understand and abide by professional ethics and codes of conduct in engineering practice. It trains students' professional ability, communication ability, team spirit and leadership ability. This project trains students on the technical foundation and basic skills of new energy efficient conversion materials and devices, and cultivates students' sense of teamwork and communication and problem-solving skills during the implementation of the project.

10. Course Structure and Course Hours (excluding extracurricular class)

Category	Total Credit	%	Total Course Hours	Theory Learning	Practical Training
Public Course	50	33	944	880	64
Basic Course	33	22	528	480	48
Professional Course	25	17	400	400	0
Practical Training	31	21	864	0	864
General Course	10	7	160	160	0
Total	149	100	2896	1920	976
Theory : Practice（%）	66：34				

11. Teaching Schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
Public Course	Required	School of Marxism	b1080001	Basic principles of Marxism	Test	3	48	42	6	Spring semester 1
	Required	School of Marxism	b1080003	Ideological and moral cultivation and legal foundation	Non-test	3	48	42	6	Spring semester 1
	Required	School of Marxism	b1080006	Outline of Chinese Modern History	Non-test	3	48	42	6	Autumn semester 1
	Required	School of Marxism	b1080004	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics I	Test	3	48	42	6	Autumn semester 2
	Required	School of Marxism	b1080007	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics II	Test	2	32	28	4	Spring semester 2
	Required	School of Marxism	-----	Situation and Policy (Module 1～4)	Non-test	2	32	28	4	Autumn semester 1～Spring semester 2
	Required	College of Arts and Sciences	b1020080+	Advanced Mathematics A1	Test	4	64	64		Autumn semester 1
	Required	College of Arts and Sciences	b1020081+	Advanced Mathematics A2	Test	4	64	64		Spring semester 1
	Required	College of Arts and Sciences	b1020012	Linear algebra	Test	2	32	32		Autumn semester 2
	Required	College of Arts and Sciences	b1020013	Probability Theory and Mathematical Statistics	Test	2	32	32		Autumn semester 2
	Required	College of Arts and Sciences	b1020018	College Chinese	Non-test	2	32	32		Spring semester 1
	Required	College of Arts and Sciences	b1020064	College Physics A(Module 3)	Test	3	48	48		Spring semester 1
	Required	College of Arts and Sciences	b1020065	College Physics B	Test	2	32	32		Autumn semester 2
	Required	College of Arts and Sciences	b1020066	College Physics C	Non-test	1	32		32	Autumn semester 2
	Required	Department of Physical Education	-----	Physical Education I～VI	Non-test	3	160	160		Autumn semester 1～Autumn semester 4
	Required	Others	b1110003	Military skills	Non-test	0.5	2W			Autumn semester 1
	Required	College of Arts and Sciences	b1110002	Military theory	Non-test	0.5	32	32		Spring semester 1
	Required	College of Arts and Sciences	b1020003	General English III	Test	3	48	48		Autumn semester 1
	Required	College of Arts and Sciences	b1020004	General English IV	Test	3	48	48		Spring semester 1
	Required	College of Arts and Sciences	b1020005	General Academic English A	Test	2	32	32		Autumn semester 2
	Required	College of Arts and Sciences	---	English development	Non-test	2	32	32		Spring semester 2
Sub-total (Public Course)						50	944	880	64	
General Course	Required	College of Engineering	b1020018	Scientific paper writing and document retrieval	Non-test	2	32	32		Autumn semester 4
	Required	College of Engineering	b1010005	Fundamentals of College Computer	Non-test	2	32	32		Spring semester 1
	Selective	Others	b0-----	Social Science and Humanities Literacy （4 credits） Public Art （2 credits）	Non-test	6	96	96		Autumn, Spring
Sub-total (General Course)						10	160	160	0	

11. Teaching Schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
Basic Course	Required	College of Engineering	b2013098	Introduction to Materials Science and Engineering	Non-test	1	16	16		Autumn semester 1
	Required	College of Engineering	b2013153	College chemistry	Test	4	64	64		Spring semester 1
	Required	College of Engineering	b2013081	Physical Chemistry	Test	4	64	48	16	Autumn semester 2
	Required	College of Engineering	b2013133	Fundamentals of Materials Science I	Test	2	32	32		Autumn semester 2
	Required	College of Engineering	b2013148	Fundamentals of Materials Science II	Test	2	32	32		Spring semester 2
	Required	College of Engineering	b2013147	Mechanics of Materials	Test	2	32	32		Autumn semester 2
	Required	College of Engineering	b2013146	Mechanical Drawing	Test	4	64	48	16	Spring semester 2
	Required	Engineering Training Center	b2090009	Electrician and Electronics	Test	4	64	48	16	Spring semester 2
	Required	College of Engineering	b2013114	Introduction to Solid State Physics	Test	2	32	32		Spring semester 2
	Required	College of Engineering	b2013010	Material Chemistry	Test	3	48	48		Autumn semester 3
	Required	College of Engineering	b2013013	Material Structure and Properties	Test	3	48	48		Autumn semester 3
	Required	College of Engineering	b2013131	Material analysis and testing	Test	2	32	32		Autumn semester 3
Sub-total (Basic Course)						33	528	480	48	
Professional Course	Required	College of Engineering	b2013041	Electrochemical Power Source	Test	3	48	48		Spring semester 2
	Required	College of Engineering	b2013132	New Energy Technology and Application	Test	3	48	48		Autumn semester 3
	Required	College of Engineering	b2013009	Fundamentals of Materials Engineering	Test	2	32	32		Autumn semester 3
	Required	College of Engineering	b2013034	Polymer Materials	Test	3	48	48		Autumn semester 3
	Required	College of Engineering	b2013072	Nano Material Technology	Test	2	32	32		Spring semester 3
	Required	College of Engineering	b2013005	Thin film materials and device preparation technology	Test	2	32	32		Spring semester 3
	Required	College of Engineering	b2013134	Energy Engineering Management	Non-test	2	32	32		Spring semester 3
	Sub-total (Required professional courses)					17	272	272		
	★Selective by module 8 credits	Module A	b2013149	Energy electrochemistry	Non-test	2	32	32		Autumn semester 3
			b2013087	New energy power generation technology	Non-test	2	32	32		Spring semester 3 (Selective 6 credits)
			b2013135	Principles and key technologies of lithium-ion batteries	Non-test	2	32	32		
			b2013136	Hydrogen energy and fuel cell technology	Non-test	2	32	32		
			b2013150	Carbon-based new energy materials and technologies	Non-test	2	32	32		
			b2013137	Power battery technology and application	Non-test	2	32	32		
		Module B	b2013003	Semiconductor Physics and Devices	Non-test	2	32	32		Autumn semester 3
			b2013138	Heat Transfer Theory	Non-test	2	32	32		Spring semester 3 (Selective 6 credits)
			b2013151	Thermoelectric materials and devices	Non-test	2	32	32		
			b2013152	Phase-change materials and phase-change energy storage technology	Non-test	2	32	32		
			b2013141	Semiconductor luminescent materials and devices	Non-test	2	32	32		
			b2013068	Introduction to Computational Materials	Non-test	2	32	32		
		Module C	b2011064	Photovoltaic power generation technology	Non-test	2	32	32		Autumn semester 3
			b2013120	New functional materials	Non-test	2	32	32		Spring semester 3 (Selective 6 credits)
			b2013143	Solar power generation system and application	Non-test	2	32	32		
			b2013121	New solar cell materials	Non-test	2	32	32		
			b2013122	Building energy-saving technology and energy-saving materials	Non-test	2	32	32		
			b2013123	Sensitive materials and devices	Non-test	2	32	32		
	Sub-total (Professional module courses)					8	128	128		
Sub-total (Professional courses)						25	400	400		

11. Teaching Schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
Practical Training	Required	Engineering Training Center	b4090003	Basic Engineering Training C	Non-test	2	48		48	Summer semester 1
	Required	College of Engineering	b4020001	College chemistry experiment	Non-test	1	24		24	Summer semester 1
	Required	College of Engineering	b4013073	Cognition practice	Non-test	1	24		24	Summer semester 1
	Required	College of Engineering	b4013050	Participation of college students in scientific research practice	Non-test	1	24		24	Summer semester 2
	Required	College of Engineering	b4013036	Academic lecture	Non-test	1	24		24	Summer semester 2
	Required	College of Engineering	b4013068	Level 1 project I（Introduction to New Energy Materials and Devices）	Non-test	2	48		48	Summer semester 2
	Required	College of Engineering	b4000003	Innovation and Entrepreneurship in Materials Science and Engineering	Non-test	2	48		48	Spring semester 3
	Required	College of Engineering	b4013069	Material analysis experiment	Non-test	2	48		48	Spring semester 3
	Required	College of Engineering	b4013060	New energy material engineering practice	Non-test	2	48		48	Spring semester 3
	Required	College of Engineering	b4013086	Material thermal physical properties testing and analysis training	Non-test	3	72		72	Autumn semester 4
	Required	College of Engineering	b4013067	Level 1 project II（Advanced new energy materials and device design）	Non-test	2	48		48	Autumn semester 4
	Required	College of Engineering	b4013057	Material Science and Engineering Graduation Practice and Graduation Design (Thesis)	Non-test	6	288		288	Spring semester 4
	Sub-total (Required Practical Training)					25	744		744	
	★Selective by module 6 credits	Module A	b4013013	Level 2 project（Chemical battery system）	Non-test	3	72		72	Summer semester 3
			b4013012	Level 2 project（Super capacitor）	Non-test	3	72		72	Summer semester 3
			b4013061	Level 2 project（Electrochemical catalytic hydrogen evolution）	Non-test	3	72		72	Summer semester 3
		Module B	b4013070	Level 2 project（Energy-efficient devices）	Non-test	3	72		72	Summer semester 3
			b4013071	Level 2 project（Comprehensive utilization of energy）	Non-test	3	72		72	Summer semester 3
			b4013072	Level 2 project（Energy storage）	Non-test	3	72		72	Summer semester 3
		Module C	b4013064	Level 2 project（Dye-sensitized solar cell）	Non-test	3	72		72	Summer semester 3
			b4013065	Level 2 project（Perovskite solar cell）	Non-test	3	72		72	Summer semester 3
			b4013066	Level 2 project（Electrochromic device）	Non-test	3	72		72	Summer semester 3
	Sub-total (Practical Training Modules)					6	144		144	
Sub-total (Practical Training)						31	888		888	
Extracurricular Class	Required	Others	b5110001	Extracurricular Class	Non-test	1	-	-	-	Autumn, Spring, Summer
Total						150	2896	1920	976	

★ 1. Guidance for selecting professional module and practical module:

Professional courses are divided into modules according to different ability requirements. Students must select one of the modules and obtain the required credits for that module. Professional practice modules must be selected according to the corresponding professional course modules.

The modular professional course group A, course group B and course group C respectively correspond to the three directions including: new energy efficient storage materials and devices, new energy efficient materials and devices, and new energy efficient conversion materials and devices. When selecting a professional course corresponding to a professional course group, students can only choose one course group from professional course group A, course group B, and course group C, and complete the study of that course group's professional courses in the autumn semester 3 and spring semester 3. In the summer semester 3, the professional practice module elective course group A, course group B and course group C correspond to the professional course group A, course group B and course group C respectively. Students can only choose the professional practice module elective courses according to the corresponding relationship. (Refer to the eighteenth part of this training program: topology diagram).

2. Professional Certificates can be gained after learning following courses：

Students who have passed Photovoltaic power generation technology, New solar cell materials, Building energy-saving technology and energy-saving materials, Energy Engineering Management, New energy power generation technology courses can participate in the professional qualification certificate assessment related to this program or obtain the ability to obtain relevant professional qualification certificates: photovoltaic engineer, energy saving and emission reduction engineer, new energy engineer.

12. Schedule for Semesters（Suggested）

Autumn semester 1：

Type	Course Name	Assessment	Credit	Course Hour
Required	Outline of Chinese Modern History	Non-test	3	48
Required	First Foreign Language	Test	3	48
Required	Advanced Mathematics A1	Test	4	64
Required	Situation and Policy	Non-test	0.5	8
Required	Physical Education I	Non-test	0.5	32
Required	Military skills	Non-test	0.5	2W
Required	Introduction to Materials Science and Engineering	Non-test	1	16

Spring semester 1：

Type	Course Name	Assessment	Credit	Course Hour
Required	Basic principles of Marxism	Test	3	48
Required	Ideological and moral cultivation and legal foundation	Non-test	3	48
Required	First Foreign Language	Test	3	48
Required	Advanced Mathematics A2	Test	4	4
Required	College Physics A	Test	3	48
Required	College Chinese	Non-test	2	32
Required	Situation and Policy	Non-test	0.5	8
Required	Physical Education II	Non-test	0.5	32
Selective	General Course	Non-test	2	32
Required	Military theory	Non-test	0.5	32
Required	College chemistry	Test	4	64
Required	Fundamentals of College Computer	Non-test	2	32

Summer semester 1：

Type	Course Name	Assessment	Credit	Course Hour
Required	Basic Engineering Training C	Non-test	2	48
Required	College chemistry experiment	Non-test	1	24
Required	Visiting off-campus companies	Non-test	1	24

Autumn semester 2：

Type	Course Name	Assessment	Credit	Course Hour
Required	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics I	Test	3	48
Required	First Foreign Language	Test	2	32
Required	Linear algebra	Test	2	32
Required	Probability Theory and Mathematical Statistics	Test	2	32
Required	College Physics B	Test	2	32
Required	College Physics C	Non-test	1	32
Required	Situation and Policy	Non-test	0.5	8
Required	Physical Education III	Non-test	0.5	32
Selective	General Course	Non-test	2	32
Required	Physical Chemistry	Test	4	64
Required	Fundamentals of Materials Science	Test	4	64

Required	Introduction to Solid State Physics	Test	2	32

Spring semester 2：

Type	Course Name	Assessment	Credit	Course Hour
Required	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics II	Test	2	32
Required	First Foreign Language	Non-test	2	32
Required	Situation and Policy	Non-test	0.5	8
Required	Physical Education IV	Non-test	0.5	32
Selective	General Course	Non-test	2	32
Required	Fundamentals of Materials Science	Test	4	64
Required	Mechanical Drawing	Test	4	64
Required	Electrician and Electronics	Test	4	64
Required	Mechanics of Materials	Test	2	32
Required	Nano Material Technology	Test	2	32

Summer semester 2：

Type	Course Name	Assessment	Credit	Course Hour
Required	Participation of college students in scientific research practice	Non-test	1	24
Required	Academic lecture	Non-test	1	24
Required	Level 1 project I（Introduction to New Energy Materials and Devices）	Non-test	2	48

Autumn semester 3：

Type	Course Name	Assessment	Credit	Course Hour
Required	Physical Education V	Non-test	0.5	16
Required	Material Chemistry	Test	3	48
Required	Material Structure and Properties	Test	3	48
Required	Material analysis and testing	Test	2	32
Required	New energy technology and application	Test	3	48
Required	Fundamentals of Materials Engineering	Test	2	32
Required	Polymer Materials	Test	3	48
Module A	Energy electrochemistry	Non-test	2	32
Module B	Semiconductor Physics and Devices	Non-test	2	32
Module C	Photovoltaic power generation technology	Non-test	2	32

Spring semester 3：

Type	Course Name	Assessment	Credit	Course Hour
Required	Innovation and Entrepreneurship in Materials Science and Engineering	Non-test	2	48
Required	Material analysis experiment	Non-test	2	48
Required	New energy material engineering practice	Non-test	2	48
Required	Electrochemical Power Source	Test	3	48
Required	Thin film materials and device preparation technology	Test	2	32
Required	Energy Engineering Management	Non-test	2	32

Selective	Energy storage materials and technology	Non-test	2	32
Selective	Principles and key technologies of lithium-ion batteries	Non-test	2	32
Selective	Hydrogen energy and fuel cell technology	Non-test	2	32
Selective	Super capacitor materials and technology	Non-test	2	32
Selective	Power battery technology and application	Non-test	2	32
Selective	Heat Transfer Theory	Non-test	2	32
Selective	Energy-saving materials and technology	Non-test	2	32
Selective	Thermal energy conversion and utilization	Non-test	2	32
Selective	Semiconductor luminescent materials and devices	Non-test	2	32
Selective	Introduction to Computational Materials	Non-test	2	32
Selective	Energy conversion materials and devices	Non-test	2	32
Selective	Solar power generation system and application	Non-test	2	32
Selective	New solar cell materials	Non-test	2	32
Selective	CSP technology and application	Non-test	2	32
Selective	Solar cell process principle	Non-test	2	32

Summer semester 3：

Type	Course Name	Assessment	Credit	Course Hour
Selective	Level 2 project（Chemical battery system）	Non-test	3	72
Selective	Level 2 project（Super capacitor）	Non-test	3	72
Selective	Level 2 project（Electrochemical catalytic hydrogen evolution）	Non-test	3	72
Selective	Level 2 project（LED ENERGY SAVING LAMP）	Non-test	3	72
Selective	Level 2 project（Solar photovoltaic-thermoelectric power generation）	Non-test	3	72
Selective	Level 2 project（Waste heat conversion and utilization）	Non-test	3	72
Selective	Level 2 project（Dye-sensitized solar cell）	Non-test	3	72
Selective	Level 2 project（Perovskite solar cell）	Non-test	3	72
Selective	Level 2 project（Electrochromic device）	Non-test	3	72

Autumn semester 4：

Type	Course Name	Assessment	Credit	Course Hour
Required	Physical Education VI	Non-test	0.5	16
Required	Scientific paper writing and document retrieval	Non-test	2	32
Required	Material thermal physical properties testing and analysis training	Non-test	3	72
Required	Level 1 project II（Advanced new energy materials and device design）	Non-test	2	48

Spring semester 4：

Type	Course Name	Assessment	Credit	Course Hour
Required	Material Science and Engineering Graduation Practice and Graduation Design (Thesis)	Non-test	6	288

13. Prerequisite for Course Study

No.	Course Name	Prerequisite Course	No.	Course Name	Prerequisite Course
1	Physical Chemistry	College Physics	11	Introduction to New Energy	Introduction to Materials Science and Engineering
		College chemistry			Fundamentals of Materials Science
		Advanced Mathematics			Material Chemistry
2	Fundamentals of Materials Science	College Physics	12	Polymer Materials	Fundamentals of Materials Science
		College chemistry			Material Chemistry
3	Mechanics of Materials	College Physics	13	Nano Material Technology	Fundamentals of Materials Science
					Material Chemistry
4	Mechanical Drawing	Mechanics of Materials	14	Thin film materials and device preparation technology	Material Chemistry
					Fundamentals of Materials Science
5	Electrician and Electronics	College Physics	15	Energy Engineering Management	Introduction to Materials Science and Engineering
					Introduction to New Energy
6	Introduction to Solid State Physics	College Physics	16	Energy electrochemistry	Physical Chemistry
		Fundamentals of Materials Science			Electrochemical Power Source
7	Material Chemistry	College chemistry	17	Semiconductor Physics and Devices	Introduction to Solid State Physics
		Physical Chemistry			College Physics
		Fundamentals of Materials Science			Fundamentals of Materials Science
8	Material Structure and Properties	Fundamentals of Materials Science	18	Photovoltaic power generation technology	Introduction to Materials Science and Engineering
		Material Chemistry			Introduction to New Energy
		College chemistry			
		College chemistry			
9	Material analysis and testing	Fundamentals of Materials Science	19		
		Material Structure and Properties			
10	Electrochemical Power Source	Physical Chemistry	20		

14. Extracurricular Class

Through taking extracurricular classes, students are encouraged to take part in academic lectures, social practice activities, campus cultural and sports activities, innovative and entrepreneurial activities, voluntary activities, etc. to improve their social adaptability and enhance the competitiveness in the job market. Details are specified in Students' Manual.