Instructive Cultivation Plan for the Program of Materials Chemistry

(Grade 2021)

Course code: 080403

1. Orientation

The program of materials chemistry of the school is mainly oriented to electronic information materials and related industries, meets the needs of the country's strategic emerging industries to "enhance the supply of special electronic materials" and aims at cultivating composite application technical talents in the fields of electronic information chemicals and environmentally friendly materials.

2. Cultivation Objective

1. General Objective

This program trains engineering and technical talents with comprehensive development of morality, intelligence, physique, beauty and labor, and solid material science and chemistry knowledge, as well as advanced functional materials (especially green electronic materials) design and preparation technology. Graduates can engage in research and development of new products, new processes, and new technologies of environmentally friendly materials in related industries such as electronic components, printed circuit boards, electronic raw materials, electronic information chemicals, and also engage in production management, process control and quality management, etc. and have the potential for further studies.

2. Cultivation Value

Have green manufacturing awareness, sustainable development awareness, environmental protection awareness and safe production awareness, healthy personality and psychological quality, good scientific and cultural literacy, correct professional ethics, professional ethics and social responsibility, and can apply them to the design, development and implementation of the national electronic information materials industry in the process of materials.

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 theoretical knowledge of electrical engineering and electronics, engineering drawing, computers and other engineering and certain engineering management knowledge; be able to apply material chemistry expertise to improve actual material production process of enterprises, and analyze complex engineering problems such as the

development of new materials, material modification, and material performance testing, and can propose effective solutions.

(2) Career orientation: Be able to engage in technical or management works related to this program in advanced functional materials, especially electronic information materials related enterprises, and adapt to independent and team work.

(3) Basic Qualities: Familiar with important laws, regulations, guidelines and policies related to occupations and industries in the materials, chemical, and environmental fields; have good ideological and moral qualities and humanistic qualities, and have the awareness of sustainable development, environmental protection and safe production.

(4) Social competence: Have good psychological quality, interpersonal skills, organizational management and execution capabilities, and the team spirit; be able to integrate, drive or coordinate the organization and implementation of the project and can play an effective role.

(5) Self-development: Be able to adapt to career development through lifelong learning; be competitive in the workplace related to electronic information materials, and be able to actively adapt to changes and development in the career environment.

3. Requirement for Graduation

Graduation requirement 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 chemistry.

1-1 Master advanced mathematics knowledge, and can apply them to the basic methods of engineering problem expression, modeling and solving; have strong logical thinking ability and mathematical application ability.

1-2 Grasp the basic knowledge of physics, chemistry, mechanics and other natural sciences that can be used in the design, calculation and analysis of complex material 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 relevant basic theories and professional knowledge of materials chemistry, combine the knowledge of mathematics, natural sciences and engineering technology, and can use them to solve complex engineering problems in the field of materials chemistry.

Graduation requirement 2: Problem analysis: Be able to apply basic principles of mathematics, natural science and engineering science to identify, express, and analyze complex engineering

problems in the field of materials chemistry through literature research, and can obtain effective conclusions.

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

2-2 Be able to express complex engineering problems and seek solutions based on the basic principles of material chemistry and related basic knowledge.

2-3 Be able to analyze complex engineering issues in material preparation/processing and application by using the basic principles of relevant sciences and with the help of literature research, and can obtain effective conclusions.

Graduation requirements 3: Design/development of solutions: Be able to conceive and design solutions to complex engineering problems in the field of materials chemistry based on CDIO engineering concepts, be able to design systems, units (components) or process flows that meet specific needs, and be able to reflect the sense of innovation in the design link, 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, can meet 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 material chemistry.

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

Graduation requirement 4: Research: Be able to study complex engineering problems in the field of materials chemistry 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 engineering problems 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 chemistry to select research paths and design experimental programs based on actual engineering problems.

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

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 chemistry, including the prediction and simulation of complex engineering problems in the field of materials chemistry, and be able to understand its limitations.

5-1 Master the principles and methods of using modern information technology tools, modern instruments, engineering tools, etc., 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 chemistry, can effectively use modern engineering tools and information technology tools to predict and simulate complex engineering problems, and be able to analyze and understand the limitation.

Graduation requirements 6: Engineering and society: Be able to conduct reasonable analysis based on engineering-related background knowledge, evaluate engineering practices and complex engineering problems in the field of material chemistry, and propose solutions to social, health, safety, legal and cultural impacts, and understand the responsibility to be taken.

6-1 Understand the relevant technical standards, industrial policies, laws and regulations, and cultural knowledge in the professional field.

6-2 Be able to objectively analyze and evaluate engineering practices and complex engineering problems in the field of material chemistry, can propose solutions to social, health, safety, legal and cultural impacts, 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 practice on the environment and sustainable development of society for complex engineering problems in the field of materials chemistry.

7-1 Understand national strategy for environmental and social sustainable development and related policies, laws and regulations, be able to establish the concept of environmental protection and sustainable development and understand the connotation.

7-2 Be able to understand and evaluate the impact of engineering practices related to complex engineering issues in the material chemistry field on the environment and sustainable development of society.

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

8-1 Have a correct outlook on life and values, understand the relationship between individuals and society, understand national conditions and history, and have humanities and social sciences and a sense of social responsibility.

8-2 Be able to understand and abide by professional ethics and codes of conduct in engineering practice in the field of material chemistry, and consciously perform responsibilities.

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

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 chemistry, including writing reports and design manuscripts, making presentations, expressing their opinions clearly and answering questions; master a 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 expression skills of technical documents or scientific papers, have the ability to write reports, design manuscripts, statements and make clear expressions, and be able to effectively communicate and exchange with industry colleagues and the public on complex engineering issues in the material chemistry field.

10-2 Master at least a foreign language, understand the international development trends and research hotspots in the field of materials, 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 engineering management principles and economic decision-making methods, and be able to apply them in a multidisciplinary environment.

11-1 Master the relevant engineering management principles and economic decision-making methods involved in the practice of material chemistry.

11-2 Be able to correctly use engineering management and economic decision-making methods in the process of engineering design and technology development in the field of materials chemistry 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 Be able to recognize the importance of continuous exploration and learning in the context of social and technological development, and have the consciousness of independent learning and lifelong learning.

12-2 Have a healthy physique and the ability to continuously learn and can 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 152 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, Chemistry

8. Core Courses

1. Inorganic Chemistry

This course is a core chemistry basic course compulsory for students majoring in materials chemistry. It not only connects with the chemistry content of the middle school, but also lays the foundation for the follow-up course study, and plays a role in linking the past and the next. Inorganic chemistry is a discipline that studies the composition, structure, properties, reactions and applications of elemental elements and compounds (except hydrocarbons and base derivatives). Its purpose is to enable students to master the concept of material structure, the theory of chemical balance, and some chemical reactions of important elements and their compounds; gradually

cultivate students to establish dialectical materialist viewpoints and develop rigorous scientific attitudes and scientific thinking methods through teaching, thus laying the necessary chemical foundation for future practical work.

2. Organic Chemistry

Organic Chemistry is a discipline that studies the composition, structure, synthesis, physical properties, chemical properties and mutual transformation of organic compounds. It is an important basic course for materials chemistry programs, and is a course that emphasizes both theory and practices. Through the study of this course, students will understand the basic theories of modern organic chemistry, obtain the necessary basic knowledge and certain basic skills, and lay the necessary foundation for learning related follow-up courses and further mastering new scientific and technological achievements.

3. Analytical Chemistry

Analytical chemistry is a discipline that studies the composition, content, structure and other related information of substances, and is an important professional basic course required for this program. The purpose of this course is as follows: through the study of this course, students will master the basic theories, basic knowledge and basic analysis methods of analytical chemistry, and establish an accurate concept of "quantity". In the learning process, students will strengthen the training of experimental links, master basic operating skills, and obtain the ability to analyze and solve problems, thus laying a solid foundation for better learning of materials and chemistry courses and better solving of practical problems in future.

4. Physical Chemistry

Based on the previous "Inorganic Chemistry" course and from the study of the interrelationship between chemical phenomena and physical phenomena, this course 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.

5. Fundamentals of Materials Science

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.

6. Materials Chemistry

Materials Chemistry is a new subject formed by the intersection of materials and chemistry. It is an important professional basic course for this program, and mainly studies the principles of chemical synthesis and preparation of materials. The purpose of this course is to enable students to master the chemical preparation methods and principles of metal materials, inorganic non-metallic materials, polymer materials and composite materials after understanding the basic knowledge of materials science and physical chemistry, and to understand the position between the composition, chemical preparation and processing of new materials and performance of the material, so that new materials can be designed, synthesized, prepared and modified purposefully.

7. Material analysis and testing

Material analysis and testing is a professional course for materials chemistry program. Through learning, students will be familiar with the basic principles of material analysis and testing methods, understand the basic structure and working principles of various analytical instruments, and have a preliminary grasp of the application of various analytical instruments in material analysis research, so as to train students to use analytical testing methods to serve materials science research.

8. Polymer Chemistry and Physics

This course is one of the basic courses of this program. The course is divided into two parts, one is polymer chemistry and the other is polymer physics. Polymer Chemistry introduces the synthetic chemistry of polymers, including synthetic principles, synthetic methods, and synthetic engineering. Polymer physics introduces polymer structure, molecular motion, various properties and the relationship between structure and performance. The two parts are interrelated and constitute the core content of polymer science.

9. Material Physics

This course discusses the characteristics of materials starting from theory, including crystal structure, crystal vibration, solid energy band theory, semiconductor electronics theory, and solid magnetism. This course also reflects surface physics, amorphous physics, superconducting physics, low-dimensional systems and the theory of disordered systems. This course focuses on the crystal structure, crystal vibration and thermal properties of crystals, energy band theory, metal electron theory, etc., and also introduces new developments in solid state physics. Material physics includes basic knowledge of material mechanics and engineering mechanics.

10. Material Technology

The purpose of this course is to train students to obtain the ability of material industry production, quality control and technical management, the ability to design and prepare various materials, the ability to improve the performance of materials, the ability to analyze and solve practical problems in the material production process, as well as the innovative ability to carry out research and development of new materials and new processes.

9. Practical Training

1. Level 1 project (green electronic materials)

Through the green electronic materials project, the project will introduce the content of the syllabus based on the CDIO concept to the students who are about to start professional learning, so that students can understand the professional courses and various practical activities for future learning, understand the CDIO concept, and focus on cultivating their personal and collaborative skills, especially the idea of project organization, design, development, and implementation capabilities, as well as strong communication and coordination skills, so as to cultivate their sense of innovation, collaboration and the style of study by combining theory with practice.

Under the guidance of the instructor group, each student project team can selects a specific project or topic. Starting from market analysis and technical demand analysis, students first conduct the conceptual design and overall design of the project, and then doing system design, structural design, material design, etc., until the final material preparation, testing and characterization, thus experiencing the entire practical process of product development.

2. Level 1 project (graduation project)

Starting from the second semester of third grade, enter the completion link. At the same time, through the methods of inviting entrepreneurs for class exchanges and outing for internship visits, students are enabled to 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 studies purposefully and systematically.

3. Level 2 project (characterization of material structure)

The material structure characterization course group includes: analytical chemistry, material analysis and testing, material science foundation and nano materials. Based on the theoretical knowledge and skills of these courses and supplemented by high-precision analytical testing instrument testing, the composition and structure of materials are analyzed to lay a foundation for elaborating the mechanism of material performance. The characterization of material composition and structure belongs to the scope of materials science and plays an important role in the development of materials. This project intends to conduct a comprehensive analysis of the phase, composition and structure of photothermal carbon materials, smart sensor materials, and electronic thermal control materials. Through learning, students will be proficient in the mechanism and operation of X-ray diffractometers, infrared spectrometers, scanning electron microscopes, ultraviolet-visible spectrophotometers, etc. Comprehensive theoretical teaching and instrument operation practice are closely integrated and mutually supported by each other, thus training students' comprehensive ability to analyze and solve problems, and comprehensively improve students' comprehensive quality.

4. Level 2 project (comprehensive performance of materials)

The level 2 projects aims to deepen the understanding of the relationship between material performance and its chemical composition and organizational structure. Through the project, students will master material performance testing methods, understand the main factors affecting material performance, and improve their comprehensive ability to apply professional knowledge. Through practices, students can master the testing and evaluation methods of mechanical properties, optical properties, magnetic properties, electrical properties and thermal properties of materials, as well as comprehensive application practical capabilities, so as to achieve the effect of analogy.

5. Level 2 project (comprehensive innovation experiment)

The comprehensive innovative experimental project curriculum group includes: physical chemistry, analytical chemistry, material analysis and testing, material chemistry, applied electrochemistry, semiconductor materials and devices, interface chemistry, packaging materials and other main courses. The knowledge and skills of these courses are used to solve specific problems in engineering practice related to the course group, so that theoretical teaching and engineering practice are closely integrated and mutually supported, and students' professional ability, communication ability, team spirit and leadership ability are trained.

1) Comprehensive innovation experiment - electronic information materials

With the development of electronic technology, while the heat dissipation power and heat dissipation density of electronic devices are increasing, the requirements for thermal control are also getting higher and higher. Thermal control materials and thermal control technology for

electronic devices have become a top priority. This part is mainly to prepare high-performance and stable thermal control materials for electronic devices, as well as training in basic thermal control technology. The main contents include: (1) chemical methods of material surface modification, including oxidation, covalent bonding or non-covalent bonding, etc., application of surface-active substances, etc.; requirement: carry out in a laboratory, preparation in a fume hood; (2) Preparation of thermal control materials for electronic devices, using surface-modified materials to prepare stable and high-performance thermal control materials; requirements: conduct in the laboratory, prepare at room temperature; (3) thermal control material thermal conductivity and thermal contact resistance test; (4) improvement of thermal control technology, design the thermal control system of electronic equipment, adopt reliable heat conduction methods such as heat conduction chips and filled thermal control materials for heat dissipation.

2) Comprehensive innovation experiment - smart sensor materials

The design of smart sensing materials and devices requires a more detailed understanding of the special electrical, magnetic, mechanical, thermal, optical, chemical, and biological functional characteristics of the sensing material from the basic structure of the material, and needs to design and manufacture thermal, photosensitive, magnetic, gas, force, chemical and biological sensor devices based on the relevant characteristics. This part will train students on the technical foundation and basic skills of smart sensing materials and devices, and focus on gas-sensing, chemical and bio-sensing devices. The main contents include: (1) based on preparation and characterization of metal oxide semiconductor gas-sensitive materials, preparation of gas sensors and gas sensor performance testing; (2) Design and preparation of electrochemical sensor materials based on metal nanoparticle modified electrodes; using basic electrochemical methods for characterization and testing, and finally applying it to chemical sensing, including chemical detection of real samples; (3) Immobilization and processing methods based on biological sensitive elements (such as enzymes, etc.); the design, preparation, storage and characterization of biosensors, and finally applying in sample sensing and detection.

3) Comprehensive innovation experiment - environmentally friendly materials

The semiconductor photocatalytic oxidation technology represented by titanium dioxide has the advantages of energy saving, high efficiency, (photo)-chemical stability, low price, environmental friendliness, and recyclability. However, titanium dioxide is a wide band gap semiconductor material that requires ultraviolet light with a wavelength below 400nm to excite, and can only use less than 5% of the entire solar spectrum, so that the utilization rate is low. How to expand the spectral response scope of titanium dioxide so that it can be directly excited by visible light is still an interesting and extremely challenging research topic. In recent years, several ferrite semiconductor materials with smaller band gaps have attracted people’s attention in photoelectric conversion and photochemical preparation of hydrogen. These ferrite semiconductor materials are

sensitive to visible light and have good (photo)-chemical stability. If it is nano-composited with titanium dioxide, it is possible to significantly improve the photocatalytic and photoelectric conversion properties of titanium dioxide. The contents of this section include: (1) preparing titania-based photocatalyst by sol-gel method, hydrothermal method, etc.; (2) conducting a series of material characterization of the prepared photocatalytic material, and analysis of the microstructure of the prepared photocatalyst; (3) using the synthesized photocatalytic materials to simulate the degradation of organic pollutants (such as Rhodamine B, methyl orange, etc.), and screening out the best degradation conditions; (4) mixing titanium dioxide materials or conduct composite design with ferate according to performance, thus a new type of photocatalytic composite material can be prepared, and the performance difference between the composite photocatalyst and titanium dioxide will be compared.

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

Category	Total Credit	%	Total Course Hours	Theory Learning	Practical Training
General Education	50.5	33	960	896	64
Basic Course	35	23	560	528	32
Professional Course	24	16	384	384	0
Practical Training	31.5	21	760	0	760
General Course	10	7	160	160	0
Total	**151**	**100**	**2824**	**1968**	**856**
Theory : Practice（%）	70：30				

11. Teaching Schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
General Education	Required	School of Marxism	b1080001	Basic principles of Marxism	test	3	48	42	6	Autumn semester 1
	Required	School of Marxism	b1080003	Ideological and moral cultivation and legal foundation	non-test	3	48	42	6	Autumn semester 1
	Required	School of Marxism	b1080006	Outline of Chinese Modern History	non-test	3	48	42	6	Spring 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	School of Marxism	b1080008	Labor Education A	non-test	0.5	16	16		Spring semester 1
	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

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
	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
	★English (Selective, 1 Module 10 credits)	Module A	b1020003	General English III	test	3	48	48		Autumn semester 1
			b1020004	General English IV	test	3	48	48		Spring semester 1
			b1020005	General Academic English A	test	2	32	32		Autumn semester 2
			---	English development	non-test	2	32	32		Spring semester 2
		Module B	b1020002	General English II	test	3	48	48		Autumn semester 1
			b1020003	General English III	test	3	48	48		Spring semester 1
			b1020006	General Academic English B	test	2	32	32		Autumn semester 2
			---	English development	non-test	2	32	32		Spring semester 2
		Module C	b1020001	General English I	test	4	64	64		Autumn semester 1
			b1020002	General English II	test	3	48	48		Spring semester 1
			b1020003	General English III	test	3	48	48		Autumn semester 2
	★ German	College of Arts and Sciences	b1020040	German I	test	3	48	48		Autumn semester 1
		College of Arts and Sciences	b1020041	German II	test	3	48	48		Spring semester 1
		College of Arts and Sciences	b1020042	German III	test	4	64	64		Autumn semester 2
	★ Japanese	College of Arts and Sciences	b1020077	Japanese I	test	3	48	48		Autumn semester 1

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
		College of Arts and Sciences	b1020078	Japanese II	test	3	48	48		Spring semester 1
		College of Arts and Sciences	b1020079	Japanese III	test	4	64	64		Autumn semester 2
Sub-total (General Education)						**50.5**	**960**	**896**	**64**	
General Course	Required	Art Education Center	b0-----	Aesthetic Education	non-test	2	32	32		Autumn, Spring
	Selective	Each College	b0-----	Social Science and Humanities Literacy	non-test	4	64	64		Autumn, Spring
	Required	School of Energy and Materials	b2013175	Scientific paper writing and document retrieval	non-test	2	32	32		Spring semester 2
	Required	School of Energy and Materials	b1010005	Fundamentals of college computer	non-test	2	32	32		Spring semester 1
Sub-total (General Course)						**10**	**160**	**160**	**0**	

(★Note: The first foreign language has a total of 10 credits, including College English, German, and Japanese. Choose the appropriate language according to your needs; among them, if you choose College English, please choose the appropriate module in module ABC)

11. Teaching Schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
Basic Course	Required	School of Energy and Materials	b2013130	Inorganic Chemistry	Test	4	64	64		Autumn semester 1
	Required	School of Energy and Materials	b2013099	Introduction to Materials Chemistry	Non-test	1	16	16		Autumn semester 1
	Required	School of Energy and Materials	b2013093	Organic Chemistry	Test	3	48	48		Spring semester 1
	Required	School of Energy and Materials	b2013015	Fundamentals of Materials Science	Test	3	48	48		Autumn semester 2
	Required	School of Energy and Materials	b2013031	Analytical Chemistry	Test	3	48	48		Autumn semester 2
	Required	School of Energy and Materials	b2013081	Physical Chemistry (Bilingual)	Test	4	64	64		Spring semester 2
	Required	School of Energy and Materials	b2013007	Material analysis and testing	Test	3	48	48		Spring semester 2
	Required	School of Energy and Materials	b2013035	Polymer Chemistry and Physics	Test	3	48	48		Spring semester 2
	Required	School of Energy and Materials	b2013010	Materials Chemistry	Test	3	48	48		Autumn semester 3
	Required	Engineering Training Center	b2090009	Electrician and Electronics	Test	4	64	48	16	Autumn semester 3
	Required	School of Energy and Materials	b2013146	Mechanical Drawing	Test	4	64	48	16	Autumn semester 3
Sub-total (Basic Course)						**35**	**560**	**528**	**32**	
Professional Course	Required	School of Energy and Materials	b2013017	Material Physics	Test	2	32	32		Spring semester 2
	Required	School of Energy and Materials	b2013103	Material Technology	Test	2	32	32		Autumn semester 3
	Required	School of Energy and Materials	b2013033	Composite material	Test	2	32	32		Autumn semester 4
	Required	School of Energy and Materials	b2013176	Introduction to Environmental Engineering	Non-test	2	32	32		Autumn semester 4
Sub-total(required professional courses)						**8**	**128**	**128**		
	★Selective by module 16 credits	Module A	b2013002	Semiconductor materials, processes and devices	Test	3	48	48		Spring semester 3
			b2013032	Packaging materials and devices	Non-test	2	32	32		Autumn semester 4
			b2013112	Nanomaterials and Nanostructures	Non-test	3	48	48		Spring semester 3
			b2013006	Material table interface	Test	3	48	48		Spring semester 3
			b2013165	Electronic product quality inspection and standards	Test	3	48	48		Spring semester 3
			b2013163	Thermal management materials	Non-test	2	32	32		Autumn

										semester 4
		Module B	b2013092	Applied Electrochemistry (English)	Test	3	48	48		Spring semester 3
			b2013021	Sensing materials and devices	Non-test	2	32	32		Autumn semester 4
			b2013106	Nano Material Technology	Test	3	48	48		Spring semester 3
			b2013002	Semiconductor materials, processes and devices	Test	3	48	48		Spring semester 3
			b2013111	Optoelectronic materials and devices	Non-test	3	48	48		Spring semester 3
			b2013005	Thin film materials and preparation technology	Non-test	2	32	32		Autumn semester 4
		Module C	b2013006	Material table interface	Test	3	48	48		Spring semester 3
			b2013049	Environmental materials	Non-test	2	32	32		Autumn semester 4
			b2013165	Electronic product quality inspection and standards	Test	3	48	48		Spring semester 3
			b2013092	Applied Electrochemistry (English)	Test	3	48	48		Spring semester 3
			b2013106	Nano Material Technology	Test	3	48	48		Spring semester 3
			b2013164	Introduction to Green Energy Materials	Non-test	2	32	32		Autumn semester 4
	Sub-total(professional module courses)					**16**	**256**	**256**		
Sub-total(professional courses)						**24**	**384**	**384**		

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	Spring semester 1
	Required	School of Energy and Materials	b4013076	Cognition Practice	Non-test	1	24		24	Summer semester 1
	Required	School of Energy and Materials	b4013077	Level 1 project (green electronic materials)	Non-test	1	24		24	Summer semester 1
	Required	School of Energy and Materials	b4013052	Inorganic Chemistry experiment	Non-test	1	24		24	Autumn semester 1
	Required	School of Energy and Materials	b4013043	Organic Chemistry experiment	Non-test	1	24		24	Summer semester 1
	Required	School of Energy and Materials	b4013017	Polymer Chemistry and Physics experiment	Non-test	1	24		24	Summer semester 2
	Required	School of Energy and Materials	b4013035	Physical Chemistry Experiment	Non-test	1	24		24	Summer semester 2
	Required	School of Energy and Materials	b4013078	Level 2 project (characterization of material structure)	Non-test	3	72		72	Summer semester 2
	Required	School of Energy and Materials	b4013015	Analytical Chemistry experiment	Non-test	1	24		24	Autumn semester 2
	Required	School of Energy and Materials	b4000002	Materials Chemistry Professional Innovation and Entrepreneurship	Non-test	2	48		48	Spring semester 3
	Required	School of Energy and Materials	b4013018	Functional material process design	Non-test	2	48		48	Summer semester 3
	Required	School of Energy and Materials	b4013079	Professional internship	Non-test	1	24		24	Summer semester 3
	Required	School of Energy and Materials	b4013036	Academic lecture	Non-test	1	24		24	Summer semester 3
	Required	School of Energy and Materials	b4013080	Level 2 project (comprehensive performance of materials)	Non-test	3	72		72	Autumn semester 3
	Required	School of	b4013001	Materials Chemistry experiment	Non-test	1	24		24	Autumn

		Energy and Materials								semester 3
	Required	School of Energy and Materials	b4013087	Labor Education B	Non-test	0.5	16		16	Spring semester 3
	Required	School of Energy and Materials	b4013056	Materials Chemistry program graduation practice and graduation design	Non-test	6	288		288	Spring semester 4
	Sub-total(Required Practical Training)					**28.5**	**688**		**688**	
	★ Professional module Selective 3 credits	Module A	b4013081	Level 2 project (Comprehensive innovation experiment - electronic information materials)	Non-test	3	72		72	Spring semester 3
		Module B	b4013082	Level 2 project (Comprehensive innovation experiment - smart sensor materials)	Non-test	3	72		72	Spring semester 3
		Module C	b4013083	Level 2 project (Comprehensive innovation experiment - environmentally friendly materials)	Non-test	3	72		72	Spring semester 3
		Sub-total(Practical Training Modules)				**3**	**72**		**72**	
Sub-total(Professional practical)						**31.5**	**760**		**760**	
Extracurricular Class	Required	Others	b5110001	Extracurricular Class	Non-test	1	-	-	-	Autumn, Spring, Summer
Total						**152**	**2824**	**1968**	**856**	

★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.

1. Module A: Electronic Information Materials

2. Module B: Smart sensing materials

3. Module C: Environmentally Friendly Materials

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

Students who have passed Analytical Chemistry, Analytical Chemistry experiment, Material analysis and testing, and material structure characterization can participate in the professional qualification certificate assessment related to this program: chemical analysis, chemical inspection, and material composition inspection.

12. Prerequisite for Course Study

No.	Course Name	Prerequisite Course	No.	Course Name	Prerequisite Course
1	Materials Chemistry	Physical Chemistry	8	Packaging materials and devices	Fundamentals of Materials Science
		Fundamentals of Materials Science			Materials Chemistry
		Inorganic Chemistry			Material Physics
2	Material Physics	Fundamentals of Materials Science	9	Composite material	Fundamentals of Materials Science
		College Physics			Materials Chemistry
		Advanced Mathematics			Polymer Chemistry and Physics
3	Material analysis and testing	Organic Chemistry	10	Nano Material Technology	Inorganic Chemistry
		Inorganic Chemistry			Physical Chemistry
		Fundamentals of Materials Science			Materials Chemistry
		College Physics			Material Physics
4	Polymer Chemistry and Physics	Organic Chemistry	11	Environmental materials	Fundamentals of Materials Science
		Inorganic Chemistry			Materials Chemistry
		College Physics			Inorganic Chemistry
5	Material Technology	Fundamentals of Materials Science	12	Material table interface	Fundamentals of Materials Science
		Inorganic Chemistry			Inorganic Chemistry
		Organic Chemistry			Physical Chemistry
		Polymer Chemistry and Physics			Materials Chemistry
6	Applied Electrochemistry	Inorganic Chemistry	13	Semiconductor materials, processes and devices	College Physics
		Organic Chemistry			Fundamentals of Materials Science
		Physical Chemistry			Materials Chemistry
		Analytical Chemistry			Material Physics
7	Sensing materials and devices	Fundamentals of Materials Science	14		
		Materials Chemistry			
		Material Physics			

13. 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.