Instructive Cultivation Plan for the Program of Applied Chemistry

(Grade 2021)

Course code: 070302

1. Orientation

This program focuses on the physical and chemical analysis and testing of industrial products and the production of fine chemicals, covering chemical, food, medicine, customs, commodity inspection, environmental protection, textiles, cosmetics, building materials, petroleum and other industries.

2. Cultivation Objective

1 General Objective

This program is dedicated to cultivating chemistry talents with equal emphasis on theory and practice and the ability to solve practical problems. This program will cultivate graduates with solid theoretical knowledge of chemistry and experimental operation capabilities, who can be engaged in chemical, food, medicine, customs, commodity inspection, environmental protection, textiles, cosmetics, building materials, petroleum and related fields, or can also continue to pursue master's degree of chemistry, chemical engineering or other related programs.

Objective 1: Have the basic theories and strong experimental skills required in the fields of industrial analysis and fine chemicals, and be able to independently use subject knowledge to solve practical production problems encountered at work.

Objective 2: Familiar with the development trend of chemistry and chemical industry, and have the ability to engage in research, development and management works in the fields of industrial analysis and fine chemicals.

Objective 3: Be able to continuously learn and update knowledge systems and improve their own capabilities based on new technologies and new methods in chemistry, chemical engineering and other related fields.

2. Cultivation Value

This program takes the spirit of model workers and craftsmanship as the value orientation, cultivates ingenuity and educates craftsmen spirit. In the implementation of education and teaching, the engineering values and engineering ethics education are embedded in teaching through the spirit of craftsmanship, and students will be cultivated to develop a rigorous, meticulous, focused and responsible work attitude, and the work concept of meticulous craftsmanship and excellence. This program will cultivate students' love for the motherland, comprehensive development of moral, intellectual, physical, beauty and labor, allow them to obtain good scientific literacy, correct world outlook and values, and strong environmental awareness, and be able to adhere to the principle of good faith, quality standards and evaluation norms in analytical testing and chemical and chemical production positions.

3. Five-Year Goal after Graduation：

Have more exquisite professional skills, be able to play a leading role in the job, and have good management capabilities.

3. Requirement for Graduation

According to the OBE concept and the actual situation of our school, the core the core competencies and qualities of the 12 graduation requirements for engineering education certification for applied chemistry program are as follows:

Graduation requirement 1: Engineering knowledge. Be able to apply basic engineering knowledge such as mathematics and physics to complex engineering problems.

1-1: Master the mathematical knowledge and applications of advanced mathematics, linear algebra and probability theory required to solve complex analysis and detection or fine chemical problems.

1-2: Master the natural science knowledge and application of physics, biology, etc. required to solve complex analysis and detection or fine chemical problems.

1-3: Master the basic engineering knowledge and its application required to solve complex analysis and detection or fine chemical problems.

1-4: Master the professional basic knowledge and application required for intelligent analysis and detection systems or fine chemicals.

Graduation requirement 2: Problem analysis. Be able to apply the basic principles of mathematics, natural sciences and engineering sciences to identify, express, analyze and detect fine chemical problems through literature research, and obtain effective conclusions.

2-1: Be able to use relevant knowledge to reason, analyze, identify and judge the key links and parameters of complex analysis and detection or fine chemical problems.

2-2: Be able to seek solutions to complex analysis and testing or fine chemical problems through analysis of literature.

2-3: Be able to use basic principles to analyze the rationality of the solution.

Graduation requirement 3: Design of solutions. Be able to design solutions to complex analysis and testing problems, design testing methods and evaluation systems that meet specific needs, and be able to reflect the sense of innovation in the method design link, and can take into account social, health, safety, legal, cultural and environmental factors.

3-1: Master the basic methods of engineering design and be able to present design the results in the form of reports, drawings or objects.

3-2: Be able to formulate solutions based on the characteristics of complex analysis and detection or fine chemical problems, and can design systems, units or processes that meet specific needs.

3-3: Be able to comprehensively consider social, health, safety, legal, ethical, cultural and environmental factors in the design, and can reflect a certain sense of innovation.

Graduation requirement 4: Scientific research. Be able to study problems encountered in analysis and testing or fine chemicals based on scientific principles and using scientific methods,

including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.

4-1: Be able to design feasible experimental schemes for complex analysis and detection or fine chemical problems based on scientific principles and by using scientific methods.

4-2: Be able to correctly analyze and interpret data based on scientific principles and methods.

4-3: Be able to obtain reasonable and effective conclusions by integrating basic principles, literature synthesis, and analysis of experimental data, etc.

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 analysis and detection or fine chemical problems, including the prediction and simulation of complex analysis and detection or fine chemical problems, and be able to understand its limitations.

5-1: Be able to develop or select one or more modern technologies and engineering tools according to the needs of complex analysis and detection or fine chemical problems being studied.

5-2: Be able to use appropriate modern tools to simulate, analyze and predict complex analysis and detection or fine chemical problems, and understand the limitations of the tools used and the ways to improve.

Graduation requirement 6: Engineering and society. Be able to perform reasonable analysis based on relevant background knowledge of chemistry and chemical engineering, evaluate the impact of professional engineering practices and complex analysis and detection or solutions to fine chemical problems on society, health, safety, law and culture, and understand the responsibilities that should be undertaken.

6-1: Have experiences in analytical testing or fine chemical internship and social practices.

6-2: Familiar with technical standards, intellectual property rights, laws and regulations related to testing and certification or fine chemicals, and can use them to analyze and identify the potential impact of development and application of new technologies and new processes on society, health, safety, law and culture, etc.

6-3: Be able to objectively evaluate the impact of analysis and testing projects or fine chemical projects on society, health, safety, law and culture.

Graduation requirement 7: Sustainable development. Be able to assess the overall impact of the method on the environment and sustainable development of society.

7-1: Understand the connotation and significance of environmental protection and sustainable social development, and be able to practice the concept of environmental protection and sustainable development when solving complex analysis and testing problems or fine chemical problems.

7-2: Be able to evaluate the potential hazards to humans and the environment for actual engineering projects, and use professional knowledge to propose constructive scientific solutions.

Graduation requirement 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 norms in engineering practices, and can perform responsibilities.

8-1: Have a humanistic quality, understand and practice the core values of socialism, respect life, care for others, advocate justice and integrity codes, safeguard national interests, have a sense of responsibility and take the mission to promote social progress.

8-2: Understand the professional nature and responsibilities of the analytical inspection or fine chemical industry; have legal awareness and consciously abide by professional ethics and regulations in analytical inspection or fine chemical practices.

Graduation requirement 9: Individual and team. Be able to assume the roles of individuals, team members and leaders in a team with a multidisciplinary background.

9-1: Be competent in the roles and responsibilities of individuals and members of a team in a multidisciplinary background.

9-2: Be able to organize team members to carry out works in a multidisciplinary background.

Graduation requirement 10: Communication. Be able to effectively communicate and exchange with industrial peers and the public on issues such as complex physical and chemical analysis and detection technology development or fine chemical process optimization, including writing reports and design manuscripts, presentations, clear expressions or response instructions; have a certain international perspective and be able to communicate and exchange in a cross-cultural context.

10-1: Be able to express one's thoughts orally or in writing, and effectively communicate and exchange with colleagues in the industry and the public on complex engineering issues.

10-2: Master at least one foreign language, have a basic understanding of the international situation of applied chemistry and related fields, and be able to communicate and exchange in a cross-cultural context.

Graduation requirement 11: Project management. Be able to carry out technical and economic analysis on analysis and testing projects or fine chemical projects, can propose reasonable solutions, and have certain organizational, management and leadership capabilities.

11-1: Understand and master important engineering management principles and economic decision-making methods involved in analysis and testing activities or fine chemical process activities.

11-2: Be able to apply relevant engineering management principles and economic decision-making methods to a multidisciplinary environment.

Graduation requirement 12: Lifelong learning. Have the consciousness of independent learning and lifelong learning, and have the ability to continuously learn and adapt to development.

12-1: Be able to correctly understand the necessity of self-exploration and learning, have the awareness of autonomous learning and lifelong learning; master the methods of autonomous learning, understand the ways of knowledge expansion and ability improvement, and be able to maintain interest in new technologies.

12-2: Be able to take appropriate methods to learn independently, adapt to development, and demonstrate the effectiveness of independent learning and exploration in accordance with personal or professional development needs.

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

Main subject: Chemistry.

8. Core Courses

1. Basic chemistry (including inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry) 336 course hours

Basic chemistry includes four major chemistry courses. It is a basic course for applied chemistry program. It integrates and eliminates the repetitive parts, cuts branches and strengthens the trunk, and consolidates the foundation. This course focuses on resolving the difficulties of the theoretical part, reducing the abstraction of concepts, reflecting today's new technological achievements, and cultivating discipline pride. Through the study of this course, students will master basic theories, basic knowledge and certain basic skills, cultivate the ability to apply chemical principles to analyze and solve practical problems, and master the ability to conduct theoretical analysis and calculation of general chemical problems. The teaching of this series of courses emphasizes the cultivation of scientific thinking ability, learning methods and self-study ability. While laying the necessary foundation for follow-up course learning and mastering new science and technology, this series of courses is also important for cultivating students to have a correct world outlook, outlook on life, and values.

2. Basic Chemistry Experiment 264 course hours

Basic chemistry experiment includes inorganic chemistry experiments, analytical chemistry experiments, organic chemistry experiments, and physical chemistry experiments. It is the foundation of chemical theory and an important link in the integration of theory and practice. It mainly teaches students the basic knowledge of chemical experiments, trains the basic operation skills of experiments, teaches experimental methods, and cultivates observation ability and certain innovation ability. The main contents of the course include: general knowledge of chemical experiments, commonly used instruments, basic operations, substance preparation, qualitative and quantitative analysis, organic matter extraction and separation, determination of thermodynamic and electrochemical properties of substances, and determination of kinetic properties of chemical reactions.

3. Instrumental analysis 32 course hours

Instrumental analysis is a science about the theory and technology of material analysis. The main contents of this course include: spectral analysis, electrochemical analysis, chromatographic

analysis, mass spectrometry and nuclear magnetic resonance spectroscopy, etc. This course focuses on the introduction of spectral analysis (ultraviolet spectrophotometry, infrared spectroscopy, atomic emission spectroscopy and atomic absorption spectroscopy), electrochemical analysis (potentiometric analysis, polarographic analysis and coulometric analysis), chromatographic analysis (classical chromatography, gas chromatography, liquid chromatography) and nuclear magnetic resonance spectroscopy. Through the study of this course, students will master the basic structure and analysis methods of common analytical instruments such as spectrophotometer, atomic absorption, potentiometer, electrochemical analyzer, gas chromatography, and will be proficient in infrared spectroscopy, ultraviolet spectroscopy, nuclear magnetic resonance and other spectrum analysis.

4. Principles of Chemical Engineering 48 course hours

Principle of chemical engineering is based on the basic concepts of material balance, energy balance, material system balance, transfer rate, and economic accounting viewpoints, etc. This course mainly introduces the basic principles, calculation methods and typical equipment of the main chemical unit operations. The contents include: fluid flow, fluid transport machinery, sedimentation and filtration, heat transfer, absorption, distillation, drying, etc.

5. Chemical reaction engineering 32 course hours

Chemical reaction engineering is a course that studies the engineering problems that need to be solved in the chemical reaction process based on the principle of chemical reactors as the main clue. This course mainly involves chemical reaction kinetics, transfer characteristics in the reactor, reactor type structure, mathematical modeling methods, operation analysis and reactor design. This course will cultivate students' theoretical knowledge, allow them to master research methods, understand the frontiers of the subject of chemical reaction engineering, and obtain the initial ability to improve and strengthen the existing reaction technology and equipment, develop new reaction technology and equipment, solve the engineering amplification problem in the reaction process and realize optimization in the reaction process. The contents of this course include homogeneous single reaction kinetics; design of ideal reactors and combined ideal reactor design; non-ideal flow reactors; intrinsic kinetics of gas-solid phase catalytic reactions, etc.

6. Modern separation analysis technology 32 course hours

The modern separation technology course is a professional course in the direction of industrial analysis and detection of applied chemistry. This course is a specific application of analytical chemistry and instrumental analysis theory in industrial production for the analysis and determination of product quality, raw materials and intermediate products. The main contents include: sample collection and preparation, water quality analysis, gas analysis, silicate analysis, non-ferrous metal analysis, fertilizer analysis, polymer analysis, and rapid detection and analysis. The purpose of this course is to start with the analysis of industrial products and raw materials based on the students' basic mastery of systematic analytical chemistry theory and experimental technology, so that students can access to the whole process of physical analysis, and further broaden the depth and breadth of students' knowledge.

7. Modern synthesis technology 32 course hours

Modern synthesis technology mainly includes modern organic synthesis technology and modern inorganic synthesis technology, including the basics of organic synthesis, modern organic synthesis methods (organic transition metal compounds, application of element organic compounds in organic synthesis, asymmetric synthesis, organic synthesis control methods and

strategy and green synthesis), modern organic synthesis technology (organic electrochemical synthesis, organic photochemical synthesis, microwave irradiation organic synthesis, organic sonochemical synthesis, one-pot synthesis and phase transfer catalysis, etc.), metal-organic framework coordination polymers (MOF) synthesis, structure and application, preparation and application of inorganic-organic hybrid materials, etc. This course will train students to obtain the basic skills of organic synthesis and inorganic synthesis, master the methods and techniques of organic synthesis, and understand the basic methods and techniques of inorganic synthesis.

8. Quality management and certification and accreditation 32 course hours

The main contents of quality management and certification courses include quality assurance of analytical testing, measurement certification and laboratory accreditation, standardization and standard knowledge, measurement verification and legal measurement units, etc. This course mainly introduces the laboratory quality management knowledge of analytical testing quality assurance system, inspection quality control technology and assessment technology, measurement certification and laboratory accreditation, standardization and standards, standard methods and reference materials, etc., and also introduces laws and regulatory documents related to analysis and testing, so that students can clarify relevant industry norms, and can use reasonable standards for routine analysis and testing objects for effective treatment.

9. Comprehensive chemistry experiment 48 course hours

The contents of comprehensive chemical experiment involves the synthesis and testing of inorganic materials, the synthesis and characterization of organic drug molecules, the extraction and separation of natural products, the design and preparation of functional molecules, the analysis and testing of the resulting products, and the evaluation of conclusions, etc. Under the guidance of the instructor, students are required to conduct preliminary training in scientific research from literature review, designing experimental programs, experimental phenomenon records, data processing, and experimental reports. This course focuses on chemistry quality education, emphasizes the integration of theory with practice, and cultivates students' innovative spirit and practical ability.

9. Practical Training (Related courses)

The main practice links are composed of basic practice links, analysis and testing basic experiments and characteristic experiment links, and off-campus practices, with a total of 1104 course hours.

1. The basic practice links include college physics experiments, military training, ideological and political practices that engineering students need to carry out.

2. Basic experiments for applied chemistry program include inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry and other experiments required by chemistry programs.

3. Specialized experiments include analysis and detection experiments and fine chemical engineering experiments.

4. Off-campus internships include off-campus internships in enterprises such as environmental protection, chemical engineering, geology, agriculture, food, medicine, cosmetics and materials, or various testing institutions, quality supervision departments, central laboratories, customs, quarantine, judicial evidence and other institutions, and engaging in the analysis, testing,

inspection and quality analysis of raw materials, chemicals, industrial products and semi-finished products.

5. Strengthen the cultivation of innovative and entrepreneurial capabilities of engineering talents, improve the "creation-innovation-entrepreneurship" education system, and conduct engineering ethics education.

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

Category	Total Credit	%	Total Course Hours	Theory Learning	Practical Training
General Education	48.5	32	928	864	64
Basic Course	29	19	464	456	8
Professional Course	23	15	368	352	16
Practical Training	40.5	27	1120	0	1120
General Course	10	7	160	160	0
Total	**151**	**100**	**3040**	**1832**	**1208**
Theory : Practice(%)	60：40				

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	b1020063	College Physics A(Module 2)	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	0	32	Spring semester 1
	Required	College of Arts and Sciences	b1020018	College Chinese	Non-test	2	32	32		Autumn semester 1
	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	Department of Physical Education	-----	Physical Education I～VI	Non-test	3	160	160		Autumn semester 1～Autumn semester 4
★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
	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)					**48.5**	**928**	**864**	**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
				Natural Science and Technological Innovation	Non-test	4	64	64		Autumn, Spring
Sub-total (General Course)						**10**	**160**	**160**		

(★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 Resources and Environmental Engineering	b2022078	Inorganic chemistry (1)	Test	4	64	64		Autumn semester 1
	Required	School of Resources and Environmental Engineering	b2022079	Inorganic chemistry (2)	Test	2	32	32		Spring semester 1
	Required	School of Resources and Environmental Engineering	b2022080	Organic chemistry (1)	Test	4	64	64		Autumn semester 2
	Required	School of Resources and Environmental Engineering	b2022081	Organic chemistry (2)	Test	2	32	32		Spring semester 2
	Required	School of Resources and Environmental Engineering	b2022082	Analytical chemistry	Test	3	48	48		Spring semester 1
	Required	School of Resources and Environmental Engineering	b2022083	Physical Chemistry (1)	Test	4	64	64		Autumn semester 2
	Required	School of Resources and Environmental Engineering	b2022084	Physical Chemistry (2)	Test	2	32	32		Spring semester 2
	Required	School of Resources and Environmental Engineering	b2022085	Instrumental analysis	Test	2	32	32		Autumn semester 3
	Required	School of Resources and Environmental Engineering	b2022086	Principles of Chemical Engineering	Test	3	48	48		Autumn semester 3
	Required	School of Resources and Environmental Engineering	b2022087	Introduction to Applied Chemistry	Non-test	1	16	16		Autumn semester 1
	Required	School of Resources and Environmental Engineering	b2022088	Engineering drawing and chemical CAD	Non-test	2	32	24	8	Spring semester 2
Sub-total (Basic Course)						**29**	**464**	**456**	**8**	
Professional Course	Required	School of Resources and Environmental Engineering	b2022089	Fundamentals of Programming Design (Java)	Non-test	2	32	24	8	Spring semester 2

	Required	School of Resources and Environmental Engineering	b2022090	Modern synthesis technology	Test	2	32	32		Autumn semester 3
	Required	School of Resources and Environmental Engineering	b2022091	Biochemistry	Test	3	48	48		Spring semester 2
	Required	School of Resources and Environmental Engineering	b2022092	Modern separation analysis technology	Test	2	32	32		Spring semester 3
	Required	School of Resources and Environmental Engineering	b2022093	Chemical reaction engineering	Test	2	32	32		Spring semester 3
	Required	School of Resources and Environmental Engineering	b2022094	Foundation of Chemistry and Chemical Engineering Software	Non-test	2	32	24	8	Autumn semester 3
	Required	School of Resources and Environmental Engineering	b2022059	Quality management and certification and accreditation	Non-test	2	32	32		Autumn semester 4
	Sub-total (required professional courses)					**15**	**240**	**224**	**16**	
	Selective 6 credits	Professional characteristic A	b2022096	Fine Chemicals	Non-test	1.5	24	24		Autumn semester 3
			b2022097	Fine polymer synthesis and performance	Non-test	1.5	24	24		Autumn semester 3

			b2022098	Fine Chemical Technology	Non-test	1.5	24	24		Spring semester 3
			b2022099	Fine Chemical Analysis and Inspection	Non-test	1.5	24	24		Spring semester 3
			b2022100	Daily chemical regulations and safety evaluation	Non-test	1.5	24	24		Spring semester 3
		Professional characteristic B	b2022101	Sample pretreatment technology	Non-test	1.5	24	24		Autumn semester 3
			b2022102	Food and Drug Analysis and Testing	Non-test	1.5	24	24		Autumn semester 3
			b2022103	Analytical instrument maintenance	Non-test	1.5	24	24		Spring semester 3
			b2022104	Environmental Analysis	Non-test	1.5	24	24		Spring semester 3
			b2022105	Industrial analysis	Non-test	1.5	24	24		Spring semester 3
		Sub-total (professional featured courses)				**6**	**96**	**96**		
	Selective 2 credits	Professional extended	b2022106	Applied Electrochemistry	Non-test	2	32	32		Autumn semester 4
			b2022107	Solid waste treatment and disposal	Non-test	2	32	32		Autumn semester 4
			b2022108	Polymer Materials	Non-test	2	32	32		Autumn semester 4
			b2022109	Introduction to Environmental Protection and Sustainability	Non-test	2	32	32		Autumn semester 4
			b2022110	Introduction to Spectroscopy	Non-test	2	32	32		Autumn semester 4
		Sub-total (professional extended courses)				**2**	**32**	**32**		
	Sub-total (required professional courses)					**8**	**128**	**128**		
Sub-total (professional courses)						**23**	**368**	**352**	**16**	

11. Teaching Schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Semester
Practical Training	Required	School of Resources and Environmental Engineering	b4000037	Innovation and Entrepreneurship of Applied Chemistry	Non-test	2	48		48	Spring semester 3
	Required	Engineering Training Center	b4090003	Basic Engineering Training C	Non-test	2	48		48	Autumn semester 1
	Required	School of Resources and Environmental Engineering	b4022029	Comprehensive chemistry experiment	Non-test	2	48		48	Summer semester 2
	Required	School of Resources and Environmental Engineering	b4022030	Chemistry Innovative Experiment	Non-test	2	48		48	Summer semester 1
	Required	School of Resources and Environmental Engineering	b4022031	Chemical Engineering and Process Design Experiment	Non-test	2	48		48	Spring semester 3
	Required	School of Resources and Environmental Engineering	b4022032	Modern Instrumental Analysis	Non-test	2	48		48	Summer semester 2
	Required	School of Resources and Environmental Engineering	b4022033	Applied Chemistry Enterprise Cognition	Non-test	1	24		24	Summer semester 1
	Selective	School of Resources and Environmental Engineering	b4022034	Professional experiment in fine chemical industry	Non-test	2	48		48	Summer semester 1
	Selective	School of Resources and Environmental Engineering	b4022035	Analysis and detection direction professional experiment						
	Required	School of Resources and Environmental Engineering	b4022036	Analysis method selection and plan design	Non-test	2	48		48	Summer semester 3

	Required	School of Resources and Environmental Engineering	b4022037	Inorganic chemistry experiment (1)	Non-test	2	48		48	Autumn semester 1
	Required	School of Resources and Environmental Engineering	b4022038	Inorganic chemistry experiment (2)	Non-test	1	24		24	Spring semester 1
	Required	School of Resources and Environmental Engineering	b4022039	Analytical chemistry experiment	Non-test	2	48		48	Spring semester 1
	Required	School of Resources and Environmental Engineering	b4022040	Organic chemistry experiment (1)	Non-test	2	48		48	Autumn semester 2
	Required	School of Resources and Environmental Engineering	b4022041	Organic chemistry experiment (2)	Non-test	1	24		24	Spring semester 2
	Required	School of Resources and Environmental Engineering	b4022042	Physical Chemistry experiment (1)	Non-test	2	48		48	Autumn semester 2
	Required	School of Resources and Environmental Engineering	b4022043	Physical Chemistry experiment (2)	Non-test	1	24		24	Spring semester 2
	Required	School of Resources and Environmental Engineering	b4022044	Principles of Chemical Engineering experiment	Non-test	2	48		48	Autumn semester 3
	Required	School of Resources and Environmental Engineering	b4022045	Instrumental analysis experiment	Non-test	1	24		24	Autumn semester 3
	Required	School of Resources and Environmental Engineering	b4022046	Production Practice	Non-test	3	72		72	Autumn semester 4
	Required	School of Resources and Environmental Engineering	b4013088	Labor Education B	Non-test	0.5	16		16	Spring semester 3

	Required	School of Resources and Environmental Engineering	b4022027	Applied Chemistry Program Graduation Practice and Graduation Design (Thesis)	Non-test	6	288		288	Spring semester 4
	Sub-total (Practical Training)					**40.5**	**1120**		**1120**	
Extracurricular Class	Required	Others	b5110001	Extracurricular Class	Non-test	1	-	-	-	Autumn, Spring, Summer
Total						**152**	**3040**	**1832**	**1208**	

***Dual certificates integration**

To obtain a chemical analysis engineer professional qualification certificate, students need to be familiar with conventional chemical analysis methods, master relevant chemical analysis standards, be proficient in the use of various chemical analysis testing instruments, be able to perform data analysis and related graph analysis, and have a high sense of responsibility and good communication skills, and strong learning ability and hands-on ability. Therefore, in the course of teaching, it focuses on teaching important courses such as Inorganic chemistry (and experiment), Analytical chemistry (and experiment), Organic chemistry (and experiment), Physical Chemistry (and experiment), Instrumental analysis (and experiment), and Modern Instrumental Analysis, so as to lay a solid theoretical and practical foundation for students to obtain the junior chemical analysis engineer professional qualification certificate, and effectively improve the employment competitiveness and professional ability of graduates of this program.

12. 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.