# Applied Chemistry

**(Grade 2024)**

**Course code: 070302**

**I. Cultivation Objectives**

1. General cultivation objective

This program cultivates talents with comprehensive development of morality, intellect, physique, aesthetics and labor, who have the concept of sustainable development, master relevant basic theories, professional knowledge and engineering technologies of Applied Chemistry and Chemistry Engineering and other disciplines, and possess good professional ethics and strong engineering practice ability, capable of working in chemistry and chemistry engineering. They are technically proficient, responsible, international and innovative talents who can work in fields, such as engineering design, research and development, manufacturing, operation and maintenance management, especially in analysis and testing, safety and certification, fine chemicals, etc..

2. Objective of value guidance

This major takes moral education and talent cultivation as its fundamental principle, integrates the core values of socialism into the entire process of student education. It integrates craftsmanship, engineer values and Ethics in Engineering education into the implementation process of education and teaching. In the process of education will students be cultivated to love the motherland, develop morality, intellect, physique, aesthetics and labour comprehensively, in order to build students good scientific literacy, correct world perspective and values and a strong consciousness of environmental protection. Students will have the ability to adhere to the principles of integrity, quality standards and evaluation norms in their positions of applied chemistry and chemical production. This program actively cultivates students love for the Party and the country and strengthening the foundation of their values

3. Five years after graduation, students in this program should achieve the following objectives:

(1) Be able to integrate mathematics, natural sciences, engineering fundamentals and professional knowledge to analyze and solve complex Applied Chemistry problems, and be competent in engineering design, research and development, manufacturing, operation and maintenance management in fields related to the Program of Applied Chemistry.

(2) Have good humanities and scientific literacy, social responsibility and professional ethics, and the ability to consciously and effectively integrate social, health, safety, legal, cultural and sustainable development factors into solutions to complex engineering problems.

(3) Have the ability to communicate and articulate effectively, to work in multidisciplinary teams, and to organize and carry out project implementation.

(4) Possess a certain degree of engineering innovation, global awareness and international perspective, and have the awareness and ability of independent and lifelong learning.

**II. Graduation requirements**

According to the 12 basic requirements of the General Standard of China Engineering Education Accreditation Association (CEEAA), the graduation requirements of this program have been formulated in conjunction with the training objectives of the program, and the indicators of each graduation requirement are listed as follows:

1. Engineering knowledge: Have the ability to apply mathematical, physics and other natural science, as well as basic professional knowledge of engineering to solve complex problems in applied chemistry engineering.

1-1: Master the mathematical knowledge required for analyzing and solving complex applied chemical engineering problems;

1-2: Master the natural science knowledge such as physics and biology required for analyzing and solving complex applied chemical engineering problems;

1-3: Master basic engineering knowledge such as chemical engineering principles and chemical engineering drawing, and possess the ability to apply basic theories to analyze applied chemical engineering problems.

1-4: Be capable of establishing a mathematical model for a system or process in applied chemistry and solving it using reasonable boundary conditions;

1-5: Be capable of applying basic and professional knowledge to deduce and analyze complex applied chemical engineering problems, and compare and synthesize various solutions.

2. Analysis of the Problem: Have the ability to apply basic principles of mathematics, natural sciences, and engineering sciences to identify, represent, and analyze engineering problems in applied chemical engineering through literature research in order to reach valid conclusions.

2-1: Be capable of applying the fundamental principles of mathematics, natural science and engineering science to identify and judge the key links of complex applied chemical engineering problems;

2-2: Be capable of correctly expressing complex applied chemical engineering problems based on relevant scientific principles and mathematical model methods, and be able to provide multiple feasible solutions;

2-3: Be able to apply basic principles, conduct literature research, analyze the influencing factors of the process, and draw effective conclusions.

3. Design/develop of solutions: Have the ability to design solutions to complex engineering problems in applied chemical engineering to design chemical equipment or chemical process flows to meet specific needs of the chemistry and chemical engineering industries, and to demonstrate innovation in the design process, taking into account social, health, safety, legal, cultural and environmental considerations.

3-1: Master the basic methods of chemical equipment and chemical process flow design, and be able to present the design results in the form of reports, drawings or physical objects;

3-2: Understand the specific requirements that chemical equipment systems need to meet, be capable of formulating solutions based on the characteristics of complex application chemical engineering problems, design systems, units or process flows that meet specific needs, and demonstrate a certain degree of innovative consciousness;

3-3: In the design, factors such as society, health, safety, law, culture and environment can be comprehensively considered.

4. Research: Have the ability to apply scientific principles and methods to complex engineering problems in applied chemical engineering, including the design of experiments, analysis and interpretation of data, and the synthesis of information to reach sound and valid conclusions.

4-1: Be capable of investigating and analyzing solutions to complex applied chemical engineering problems based on scientific principles through literature research or relevant methods;

4-2: Be capable of selecting the research route based on the characteristics of the object, designing the experimental plan, constructing the experimental system, conducting experiments safely, and correctly collecting experimental data;

4-3: Be capable of accurately analyzing and interpreting the experimental results, and be able to draw reasonable and effective conclusions through information synthesis.

5. Use of modern tools: Have the ability to develop, select and use appropriate techniques, resources, modern engineering tools and information technology tools for the analysis of complex engineering problems in applied chemical engineering, including the prediction and simulation of complex engineering problems, and to understand their limitations.

5-1: Understand the usage principles and methods of modern instruments, information technology tools, engineering tools and simulation software commonly used in applied chemistry, and be able to understand their limitations;

Indicator Point 5-2: Be capable of selecting and using appropriate instruments, information resources, engineering tools and professional simulation software to analyze, calculate and design complex applied chemical engineering problems;

Indicator Point 5-3: Be capable of using appropriate modern engineering tools and information technology tools to simulate and predict complex applied chemical engineering problems, and be able to analyze their limitations.

6. Engineering and Society: Be able to undertake sound analysis based on background knowledge of applied chemical engineering and evaluate the social, health, safety, legal and cultural impacts of professional engineering practice and solutions to complex applied chemical engineering problems, and understand the responsibilities involved.

6-1: Understand the technical standards, intellectual property rights, laws and regulations, and industry policies related to applied chemical engineering, and comprehend the influence of different social cultures on engineering activities;

6-2: Be capable of analyzing and evaluating the impact of the development and application of applied chemical engineering on society, health, safety, law and culture, as well as the influence of these constraints on project implementation, and understand the responsibilities that should be assumed.

7. Environment and Sustainable Development: Be able to understand and evaluate the environmental and social sustainability impacts of engineering practice for complex engineering problems in applied chemical engineering .

7-1: Understand the concepts and connotations of environmental protection and sustainable social development, and be able to implement the concepts of environmental protection and sustainable development when solving complex applied chemical engineering problems;

7-2: Be capable of considering the sustainability of professional engineering practices from the perspective of environmental protection and sustainable development, evaluating the potential risks they may pose to humans and the environment, and applying professional knowledge to propose constructive and scientific solutions.

8. Professional Codes: Have good humanities and scientific literacy, social responsibility, and the ability to understand and comply with engineering ethics and codes of practice and responsibilities in the practice of engineering.

8-1: Possess good humanistic and social science literacy, have a scientific world outlook and outlook on life, and establish and practice the core socialist values;

8-2: Possess a sense of responsibility and social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities.

9. Individual and team: Demonstrate organizational, presentation, interpersonal and teamwork skills, with the ability to take on the role of individual, team member and leader in a multidisciplinary team context.

9-1: Possess a sense of teamwork and team spirit, and be able to understand the significance and responsibility of each role in the team in a multi-disciplinary context;

9-2: Possess certain organizational management and teamwork capabilities, be able to play a role in a multi-disciplinary team, and collaborate to complete team tasks.

10. Communication: Have the ability to communicate effectively with industry peers and the public on complex engineering issues in applied chemistry, including writing reports, briefs design, making presentations, and articulating or responding to instructions. Have an international perspective and the ability to communicate and interact in a cross-cultural context.

10-1: Be capable of accurately expressing one's viewpoints on professional issues through oral, written, and graphical means, responding to doubts, and understanding the differences in communication with industry peers and the general public.

10-2: Understand the international development trends and research hotspots in the professional field, and understand and respect the differences and diversity of different cultures around the world;

10-3: Possess the language and written expression skills for cross-cultural communication, and be capable of conducting basic communication and exchanges on professional issues in a cross-cultural context.

11. Project Management: Be able to understand and master the principles of engineering management and economic decision-making methods, and be able to apply them in a multi-disciplinary environment.

11-1: Understand and master the engineering management principles and economic decision-making methods involved in applied chemical engineering projects;
11-2: Be capable of applying engineering management and economic decision-making methods in the process of designing and developing solutions in a multi-disciplinary environment.
12. Spirit and ability of lifelong learning: Have a sense of independent and lifelong learning, with the ability to learn and adapt to development.
12-1: Be able to correctly recognize the necessity of self-exploration and learning, and have the awareness of autonomous learning and lifelong learning;
12-2: Possess the ability of self-study and be proactive in adapting to the constantly changing domestic and international situations and environments.
The supporting relationship between the graduation requirements of this major and the training objectives is shown in Table 1.

**III. Schooling System**

Four years.

**IV. Length of Study**

Flexible study period, generally four years, the minimum length of flexibility is not less than three years, the longest not more than six years.

**V. Requirements for Graduation and Degree Conferring**

In order to graduate, students must complete the minimum number of credits required by the Instructive Cultivation Plan and complete the corresponding extra-curricular arrangements, with a total of at least 167 credits, and will be awarded a Bachelor of Engineering degree if they meet the requirements for the award of a Bachelor's degree.

**VI. Discipline**

Discipline: chemistry.

**VII. Core Courses**

Inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, inorganic chemistry laboratory, analytical chemistry laboratory, organic chemistry laboratory, physical chemistry laboratory, instrumental analysis, principles of chemical engineering, experiment on principles of chemical engineering, modern separation and analytical techniques, modern synthetic techniques, integrated chemistry laboratory, food and drug analysis and testing, sample pretreatment technology

**VIII. Course Structure and Course Hours (excluding Extracurricular Class)**

| Category | Total Credit | % | Total Course Hours | Theory Learning | Practical Training |
|---|---|---|---|---|---|
| Public Fundamental Course | 54.5 | 33 | 1008 | 918 | 90 |
| General Education | 10 | 6 | 160 | 160 | 0 |
| Engineering Fundamental Course | 10 | 6 | 160 | 128 | 32 |
| Professional Fundamental Course | 25 | 15 | 400 | 400 | 0 |
| Professional Course | 26 | 16 | 416 | 416 | 0 |
| Professional Practice | 40.5 | 24 | 1120 | 0 | 1120 |
| Total | 166 | 100 | 3264 | 2022 | 1242 |
| **Theory**: **Practical** (%) | 62:38 | | | | |

## IX. Teaching schedule (1)

| Category | Type | Provided by | Course Code | Course Name | Assessment | Credit | Course Hours | Theory Learning | Practical Training | Recommended semester |
|---|---|---|---|---|---|---|---|---|---|---|
| Public Fundamental Course | required | School of Marxism | b1080001 | Basic Principles of Marxism | test | 3 | 48 | 42 | 6 | Autumn 1 |
| | required | School of Marxism | b1080009 | Ethics and the Rule of Law | non-test | 3 | 48 | 42 | 6 | Autumn 1 |
| | required | School of Marxism | b1080006 | Outline of Modern Chinese History | non-test | 3 | 48 | 42 | 6 | Spring 1 |
| | required | School of Marxism | b1080010 | Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics | test | 3 | 48 | 42 | 6 | Spring 2 |
| | required | School of Marxism | b1080011 | Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era | test | 2 | 32 | 28 | 4 | Autumn 2 |
| | required | School of Marxism | ----- | Situation and Policy (Modules 1 to 4) | non-test | 2 | 32 | 28 | 4 | Autumn 1 to Spring 2 |
| | required | School of Marxism | b1080008 | Labour Education A | non-test | 0.5 | 16 | 16 | | Spring 1 |
| | required | Others | b1110004 | Mental Health Education for University Students | non-test | 2 | 32 | 16 | 16 | Autumn 1 |
| | required | School of Mathematics, Physics and Statistics | b1020080 | Advanced Mathematics A1 | test | 4 | 64 | 64 | | Autumn 1 |
| | required | School of Mathematics, Physics and Statistics | b1020081 | Advanced Mathematics A2 | test | 4 | 64 | 64 | | Spring 1 |
| | required | School of Mathematics, Physics and Statistics | b1020012 | Linear Algebra | test | 2 | 32 | 32 | | Autumn 2 |
| | required | School of Mathematics, Physics and Statistics | b1020063 | Academic Physics A (Module 2) | test | 3 | 48 | 48 | | Spring 1 |
| | required | School of Mathematics, Physics and Statistics | b1020065 | Academic Physics B | test | 2 | 32 | 32 | | Autumn 2 |
| | required | School of Mathematics, Physics and Statistics | b1020111 | Academic Physics C | non-test | 2 | 32 | 0 | 32 | Autumn 2 |
| | required | School of Foreign Language and Cultural Communication | b1020018 | Academic Chinese | non-test | 2 | 32 | 32 | | Autumn 1 |
| | required | Others | b1110003 | Military skills | non-test | 0.5 | 2W | | | Autumn 1 |
| | required | Others | b1110002 | Military theory | non-test | 0.5 | 32 | 32 | | Spring 1 |
| | required | College of Physical Education | ----- | Physical Education I to VI | non-test | 3 | 160 | 160 | | Autumn 1 to Autumn 4 |
| | required | School of Computer and Information Engineering | b1012001 | Artificial Intelligence Application and Practice | non-test | 1 | 16 | 8 | 8 | Spring 1 |
| | required | School of Resources and Environment | b1012002 | Green, Low-carbon and Ecological Civilization | non-test | 1 | 16 | 16 | | Autumn 1 |
| | ★ Academic English(Select 1 Module for 10 Credits) | Module A | b1020003 | General English III | test | 3 | 48 | 48 | | Autumn 1 |
| | | | b1020004 | General English IV | test | 3 | 48 | 48 | | Spring 1 |
| | | | b1020005 | General Academic English A | test | 2 | 32 | 32 | | Autumn 2 |
| | | | --- | English Knowledge Expansion | non-test | 2 | 32 | 32 | | Spring 2 |
| | | Module B | b1020002 | General English II | test | 3 | 48 | 48 | | Autumn 1 |
| | | | b1020003 | General English III | test | 3 | 48 | 48 | | Spring 1 |
| | | | b1020006 | General Academic English B | test | 2 | 32 | 32 | | Autumn 2 |
| | | | --- | English Knowledge Expansion | non-test | 2 | 32 | 32 | | Spring 2 |
| | | Module C | b1020001 | General English I | test | 4 | 64 | 64 | | Autumn 1 |
| | | | b1020002 | General English II | test | 3 | 48 | 48 | | Spring 1 |
| | | | b1020003 | General English III | test | 3 | 48 | 48 | | Autumn 2 |
| | ★ Academic German | School of Foreign Language and Cultural Communication | b1020040 | Academic German I | test | 3 | 48 | 48 | | Autumn 1 |
| | | School of Foreign Language and Cultural Communication | b1020041 | Academic German II | test | 3 | 48 | 48 | | Spring 1 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | School of Foreign Language and Cultural Communication | b1020042 | Academic German III | test | 4 | 64 | 64 | | Autumn 2 |
| | ★ Academic Japanese | School of Foreign Language and Cultural Communication | b1020077 | Academic Japanese I | test | 3 | 48 | 48 | | Autumn 1 |
| | | School of Foreign Language and Cultural Communication | b1020078 | Academic Japanese II | test | 3 | 48 | 48 | | Spring 1 |
| | | School of Foreign Language and Cultural Communication | b1020079 | Academic Japanese III | test | 4 | 64 | 64 | | Autumn 2 |
| | **Subtotal (Public Fundamental Course)** | | | | | **54.5** | **1008** | **918** | **90** | |
| **General Education** | selective | Art Education Center | b0----- | Aesthetic Education | non-test | 2 | 32 | 32 | | Autumn, Spring |
| | selective | Each College | b0----- | Social Sciences and Humanistic Qualities | non-test | 4 | 64 | 64 | | Autumn, Spring |
| | | | | Natural Sciences and Technology Innovation | non-test | 4 | 64 | 64 | | Autumn, Spring |
| **Subtotal (General Education)** | | | | | | **10** | **160** | **160** | | |

(★Note: The first foreign language is 10 credits in total, including 3 languages: Academic English, Academic German and Academic Japanese, choose the appropriate language as required; when Academic English is chosen, please choose the appropriate module in Module A, B, C)

## IX. Teaching schedule (2)

| Category | Type | Provided by | Course Code | Course Name | Assessment | Credit | Course Hours | Theory Learning | Practical Training | Recommended semester |
|---|---|---|---|---|---|---|---|---|---|---|
| Engineering Fundamental Course | required | Engineering Training | b2090026 | Fundamentals of Programming Python | non-test | 2 | 32 | 16 | 16 | Autumn 1 |
| | required | School of Resources and Environment | b2013192 | Chemical Drawing | non-test | 2 | 32 | 24 | 8 | Spring 2 |
| | required | School of Resources and Environment | b2013238 | Principles of Chemical Engineering (1) | test | 2 | 32 | 32 | | Autumn 3 |
| | required | School of Resources and Environment | b2013194 | Principles of Chemical Engineering (2) | test | 2 | 32 | 32 | | Spring 3 |
| | required | School of Resources and Environment | b2013241 | Chemical Engineering Software and Artificial Intelligence | non-test | 2 | 32 | 24 | 8 | Autumn 3 |
| **Subtotal (Engineering Fundamental Course)** | | | | | | **10** | **160** | **128** | **32** | |
| Professional Fundamental Course | required | School of Resources and Environment | b2022078 | Inorganic Chemistry (1) | test | 4 | 64 | 64 | | Autumn 1 |
| | required | School of Resources and Environment | b2022079 | Inorganic Chemistry (2) | test | 2 | 32 | 32 | | Spring 1 |
| | required | School of Resources and Environment | b2022080 | Organic Chemistry (1) | test | 4 | 64 | 64 | | Autumn 2 |
| | required | School of Resources and Environment | b2022081 | Organic Chemistry (2) | test | 2 | 32 | 32 | | Spring 2 |
| | required | School of Resources and Environment | b2022082 | Analytical Chemistry | test | 3 | 48 | 48 | | Spring 1 |
| | required | School of Resources and Environment | b2022083 | Physical Chemistry (1) | test | 4 | 64 | 64 | | Autumn 2 |
| | required | School of Resources and Environment | b2022084 | Physical Chemistry (2) | test | 2 | 32 | 32 | | Spring 2 |
| | required | School of Resources and Environment | b2022085 | Instrumental analysis | test | 2 | 32 | 32 | | Autumn 3 |
| | required | School of Resources and Environment | b2022087 | Introduction to the Program of Applied Chemistry | non-test | 1 | 16 | 16 | | Autumn 1 |
| | required | School of Resources and Environment | b2013211 | Scientific and Technical Paper Writing and Literature Search | non-test | 1 | 16 | 16 | | Spring 2 |
| **Subtotal (Professional Fundamental Course)** | | | | | | **25** | **400** | **400** | | |
| Professional Course | required | School of Resources and Environment | b2022090 | Modern synthesis technology | test | 2 | 32 | 32 | | Autumn 3 |
| | required | School of Resources and Environment | b2022091 | Biochemistry | test | 3 | 48 | 48 | | Spring 2 |
| | required | School of Resources and Environment | b2022092 | Modern separation and analysis techniques | test | 2 | 32 | 32 | | Spring 3 |
| | required | School of Resources and Environment | b2013206 | Fine-goods chemistry | test | 2 | 32 | 32 | | Spring 2 |
| | required | School of Resources and Environment | b2013207 | Sample pre-treatment techniques | test | 2 | 32 | 32 | | Autumn 3 |
| | required | School of Resources and Environment | b2013191 | Laboratory Safety and Emergency Management | test | 1 | 16 | 16 | | Autumn 1 |
| **Subtotal(Required Professional Course)** | | | | | | **12** | **192** | **192** | | |
| | Selective 10 credits | Featured professional course A | b2013195 | Chemical regulation and safety evaluation | non-test | 2 | 32 | 32 | | Autumn 3 |
| | | | b2013196 | Laboratory Accreditation | non-test | 2 | 32 | 32 | | Autumn 3 |
| | | | b2013197 | Safe management of hazardous chemicals | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013198 | Environmental, Health & Safety Management Systems | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013199 | Chemical Process Safety Management | non-test | 2 | 32 | 32 | | Autumn 4 |
| | | Featured professional course B | b2013208 | Food and pharmaceutical analysis and testing | non-test | 2 | 32 | 32 | | Autumn 3 |
| | | | b2013209 | Analytical instrument maintenance | non-test | 2 | 32 | 32 | | Autumn 4 |
| | | | b2013200 | Environmental monitoring and analysis | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2022072 | Industrial Analysis | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013210 | Analysis and testing of fine chemicals | non-test | 2 | 32 | 32 | | Autumn 3 |
| | | **Subtotal (Featured Professional Course)** | | | | **10** | **160** | **160** | | |
| | Selective 4 credits | Expansion professional course | b2022109 | Introduction to Environmental Protection and Sustainability | non-test | 2 | 32 | 32 | | Autumn 3 |
| | | | b2013201 | Cleaner Production and Green Chemistry | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013202 | Solid waste treatment and disposal | non-test | 2 | 32 | 32 | | Autumn 4 |
| | | | b2013203 | Materials Chemistry | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013204 | New Energy Technology and Applications | non-test | 2 | 32 | 32 | | Autumn 4 |
| | | | b2013205 | Composite materials | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013234 | Fine Chemical Processing | non-test | 2 | 32 | 32 | | Spring 3 |
| | | | b2013062 | Fundamentals of Environmental Chemistry | non-test | 2 | 32 | 32 | | Autumn 3 |
| | | | b2013235 | Fundamentals of Materials Chemistry | non-test | 2 | 32 | 32 | | Autumn 3 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | b2013236 | Fermentation Technology | non-test | 2 | 32 | 32 | | Autumn 4 |
| | | **Subtotal (Expansion Professional Course)** | | | | **4** | **64** | **64** | | |
| | **Subtotal (Selective Professional Course)** | | | | | **14** | **224** | **224** | | |
| **Subtotal (Professional Course)** | | | | | | **26** | **416** | **416** | | |

## IX. Teaching schedule (3)

| Category | Type | Provided by | Course Code | Course Name | Assessment | Credit | Course Hours | Theory Learning | Practical Training | Recommended semester |
|---|---|---|---|---|---|---|---|---|---|---|
| Professional Practice | required | School of Resources and Environment | b4000037 | the Program of Applied Chemistry Innovation and Entrepreneurship | non-test | 2 | 48 | | 48 | Autumn 1, Spring 1 |
| | required | Engineering Training | b4090003 | Basic Engineering Training C | non-test | 2 | 48 | | 48 | Autumn 1 |
| | required | School of Resources and Environment | b4013095 | Integrated Chemistry Experiment (1) | non-test | 2 | 48 | | 48 | Summer 1 |
| | required | School of Resources and Environment | b4013096 | Integrated Chemistry Experiment (2) | non-test | 2 | 48 | | 48 | Summer 2 |
| | required | School of Resources and Environment | b4022031 | Chemical engineering and process design experiments | non-test | 2 | 48 | | 48 | Spring 3 |
| | required | School of Resources and Environment | b4013097 | Instrumental Analysis Experiment (1) | non-test | 2 | 48 | | 48 | Autumn 3 |
| | required | School of Resources and Environment | b4013098 | Instrumental analysis experiments (2) | non-test | 1 | 24 | | 24 | Summer 3 |
| | required | School of Resources and Environment | b4013044 | Professional Consciousnesses Placement | non-test | 1 | 24 | | 24 | Summer 1 |
| | required | School of Resources and Environment | b4022034 | Professional Experiment in Fine Chemical Engineering Direction | non-test | 2 | 48 | | 48 | Spring 3 |
| | | | b4022035 | Professional Practice for Testing and Certification | non-test | 2 | 48 | | 48 | Spring 3 |
| | required | School of Resources and Environment | b4022036 | Choice of analysis method and solution design | non-test | 2 | 48 | | 48 | Spring 3 |
| | required | School of Resources and Environment | b4022037 | Inorganic Chemistry Experiment (1) | non-test | 2 | 48 | | 48 | Autumn 1 |
| | required | School of Resources and Environment | b4022038 | Inorganic Chemistry Experiment (2) | non-test | 1 | 24 | | 24 | Spring 1 |
| | required | School of Resources and Environment | b4022039 | Analytical chemistry experiments | non-test | 2 | 48 | | 48 | Spring 1 |
| | required | School of Resources and Environment | b4022040 | Organic Chemistry Experiment (1) | non-test | 2 | 48 | | 48 | Autumn 2 |
| | required | School of Resources and Environment | b4022041 | Organic Chemistry Experiment (2) | non-test | 1 | 24 | | 24 | Spring 2 |
| | required | School of Resources and Environment | b4022042 | Physical Chemistry Experiment (1) | non-test | 2 | 48 | | 48 | Autumn 2 |
| | required | School of Resources and Environment | b4022043 | Physical Chemistry Experiment (2) | non-test | 1 | 24 | | 24 | Spring 2 |
| | required | School of Resources and Environment | b4022044 | Chemical Principles Experiment | non-test | 2 | 48 | | 48 | Autumn 3 |
| | required | School of Resources and Environment | b4022046 | Production internships | non-test | 3 | 72 | | 72 | Autumn 4 |
| | required | School of Resources and Environment | b4013088 | Labour Education B | non-test | 0.5 | 16 | | 16 | Spring 1 |
| | required | School of Resources and Environment | b4022027 | Applied Chemistry Graduation Internship and Final Design (Thesis) | non-test | 6 | 288 | | 288 | Spring 4 |
| | **Subtotal (Professional Practice)** | | | | | **40.5** | **1120** | | **1120** | |
| **Extracurricular Class** | required | Others | b5110001 | Extracurricular Class | non-test | **1** | - | - | - | Autumn, Spring, Summer |
| **Total** | | | | | | **167** | **3264** | **2022** | **1242** | |

*** Explanation of the relevance of professional certificates to the course:**

To obtain a professional qualification as a chemical analysis engineer, you 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 conduct data analysis and related graphical analysis; have a high degree of responsibility and good communication skills, and have strong learning ability and hands-on skills. Therefore, in the course of teaching, emphasis is placed on teaching key courses such as inorganic chemistry (and experiments), analytical chemistry (and experiments), organic chemistry (and experiments), physical chemistry (and experiments), instrumental analysis (and experiments) and modern instrumental analysis, which will provide students with a solid theoretical and practical foundation for obtaining the junior chemical analysis engineer vocational qualification and effectively improve the employability and vocational ability of graduates of this program.

**1. Description of Selective Professional Course:**

**Module A:** Safety and Certification, focusing on introducing relevant laws, regulations, and industry norms concerning laboratory certification and safety management, and cultivating the ability to manage the safety of applied chemistry

**Module B:** Analysis and Testing, focusing on introducing the relevant basic knowledge and industry standards of analysis and testing in fields such as food, medicine, chemical engineering, and the environment, and cultivating the ability to apply chemical analysis and testing

**2. Explanation of the relevance of professional certificates to the course:**

In the teaching key 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, most of the contents of professional qualification certificates (Chemical Analysis Engineer) are broken down and completed in the teaching, laying a solid theoretical foundation for professional qualification assessment, which helps improve students' professional quality and employment competitiveness.

## X. Credit of 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.

The weights of the corresponding indicators for the courses are shown in Table 4.