Contents

Course Number: 0000314

Course Title: Organic Chemistry Ⅱ

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Water Engineering

Prerequisites: Inorganic Chemistry

Evaluation Method: Written Examination

Course Description:

Organic Chemistry II is one of the required basic courses for the students majored in Water Engineering. The tasks of this course are to teach the fundamental knowledge of organic chemistry and introduce the produce and the prevention of the common organic pollutants. Through this course students should learn and grasp nomenclature, properties and structures of organic compounds, the basic reactions, and synthetic methods in organic chemistry, etc. The students should grasp the relations between molecular structure and reaction properties, and understand typical organic reaction mechanism and effects of different reaction conditions. This course was continued from inorganic chemistry, and will establish the basic for water chemistry and the water environmental microbiology. According to the current development of the discipline of water treatment engineering, new knowledge, new theories and new methods will be introduced. So that the students can adapt to water professional standards in modern social economy and modern metropolis.

Recommended Textbooks/References:

1. GAO Hongbin, "Organic Chemistry" (5^{th} Ed.), Higher Education Press, 2005
2. L. G. Wade Jr, "Organic Chemistry" (4^{th} Ed.), Higher Education Press, 2004

Course Number: 0000158

Course Title: Organic Chemistry Ⅲ

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Materials Science and Engineering; Undergraduate students Major in Resource Recycling Science and Engineering

Prerequisites: Inorganic Chemistry

Evaluation Method: Written Examination

Course Description:

Based on learning of inorganic chemistry, this course aims to present students with basic theory, basic knowledge and research methods of organic chemistry. Students should grasp nomenclature, properties, structures, synthetic methods and application of main organic compounds, and establish a strong organic chemistry foundation for learning professional courses, as well as engaging in research, teaching, production and development work in the future.

In the teaching process, the newest knowledge, theories and methods are added into the course, such as the organic nana-materials and functional polymer materials. The main contents of this course: organic chemistry and organic compounds, basic properties, reactions and theory of hydrocarbon(alkenes, alkenes, alkynes, cycloalkanes, alkyl halides, arenas), and Organic compound containing oxygen(alcohols, ethers, aldehydes and ketenes, carboxylic acids and their derivatives).

Recommended Textbooks/References:

1. GAO Hongbin. Organic Chemistry (4th Edition), Higher Education Press, 2005.

2. XING Qiyi. Basic Organic Chemistry, Higher Education Press, 2005.
3. GAO Hongbin. A Brief Course in Organic Chemistry, Tianjin University Press, 2001.

Course Number: 0000061

Course Title: General Chemistry IV

Credit: 4 **Total Credit Hours:** 64

Students: Undergraduate students Major in Material Science and Engineering

Prerequisites: High School Chemistry

Evaluation Method: Written Examination

Course Description:

General Chemistry briefly describes the basic chemical principle and knowledge. It is a bridge between chemical and engineering, and it also is one of the basic theory courses for the students majored in engineering technology. By studying basic knowledge, such as material structure, chemical thermodynamics, the basic principle of chemical reaction, important elements and compounds, new technology, new material, and chemistry experiments, students can understand the basic theory of modern chemistry, use chemistry methods to analysis the phenomenon and law of materials changing in engineering practice. It will build a good foundation for follow-up chemistry courses. The correct learning and research methods will be cultivated and dialectical materialism view of the world will be build. The students will possess the basic chemistry experimental operation skills and the preliminary analysis ability involving the actual chemical technology problems.

Recommended Textbooks/References:

1. Teaching and Research Group of General Chemistry in Zhejiang University, "General Chemistry" (5^{th} Ed.), Higher Education Press, 2002.
2. HUA Tongwen, "General Chemistry Principle" (3^{rd} Ed.), Peking University Press, 2005.
3. YAN Xuanshen, "Ordinary Inorganic Chemistry", Peking University Press, 1999.

Course Number: 0002609

Course Title: General Chemistry Ⅴ

Credit: 3.5 **Total Credit Hours:** 56

Students: Undergraduate students Major in Water Supply and Drainage Engineering

Prerequisites: Chemistry for Middle School

Evaluation Method: Written Examination

Course Description:

The basic concepts, theories and methods of chemistry are introduced in this course. The students are expected to master the chemical thermodynamics, water chemistry, basic electrochemistry and modern material structure. Then it is helpful to understand the basic element knowledge of the inorganic chemistry. The basic topics include: the concepts of thermo chemistry, measurement and calculation of reaction heat effect, the judgment of reaction direction, reaction degree and chemical equilibrium, ion equilibrium in solution, electrode potential and its application in electrochemistry, atomic structure, chemical bond and crystal structure, physical and chemical properties of elements and compounds. the abilities to analysis and solve the problems about

chemistry will be improved through the course study. Measurement and calculation of reaction heat effect. The basic theory and knowledge of Chemistry.

Recommended Textbooks/References:

1. Zhejiang University (Ed.), "General Chemistry" (5th Ed.), Higher Education Press, 2002.
2. Dalian University of Technology (Ed.), "Inorganic Chemistry" (4th Ed.), Higher Education Press, 2002.

Course Number: 0000064

Course Title: Physical Chemistry Ⅱ

Credit: 3.5 **Total Credit Hours:** 56

Students: Undergraduate students Major in Material Science and Engineering

Prerequisites: General Physics, General Chemistry and Calculus

Evaluation Method: Written Examination

Course Description:

Thermodynamic properties including the direction of chemical reactions, limits, and energy balance, etc. and kinetic properties such as chemical reaction rate and mechanism are introduced in this course. The students are expected to understand the basic concepts, theories, methods, and solving method to the related problems, through which their abstraction and modeling abilities will be improved. The basic topics include: the basic concepts of thermodynamics, thermodynamics first, second and third law, calculation of the equilibrium constant in the chemical equilibrium, Van't Hoff isotherm equation, Van't Hoff isobaric equation, Raoult's law and Henry's law in the mixture and the solution, the chemical potential of components in the mixture and the solution, the phase equilibrium of single-component systems and multi-component systems, the electromotive force and the polarization, interfacial phenomena, the basis of chemical kinetics, complex reaction kinetics and reaction rate theory.

Recommended Textbooks/References:

1. CHENG Lanzheng, ZHANG Yanhao, "Physical Chemistry" (3rd Ed.), Shanghai Science and Technology Press, 2007.
2. HU Ying, "Physical Chemistry" (4th Ed.), Higher Education Press, 2001.
3. FU Xiancai, "Physical Chemistry" (4th Ed.), Nanjing University Press, 1995.
4. P. W. Atkins, "Physical Chemistry" (6th Ed.), Oxford University Press, 1999.

Course Number: 0000312

Course Title: Physical Chemistry III

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in Water Supply and Drainage Engineering or Waterworks Engineering

Prerequisites: Calculus, General Chemistry, and General Physics

Evaluation Method: Written Examination

Course Description:

In physical chemistry, the theoretical and experimental methods of physics are applied to study the laws of chemical change and phase transition, the relationship between the laws and the

microstructure of materials. It is a fundamental discipline of the chemical science and engineering and the environmental science and engineering. After learning the course, students could comprehensively understand of chemical thermodynamics and chemical kinetics. The main content of this course includes the first and the second laws of thermodynamics, their application in the field of ideal gas, chemical balance, liquid mixtures, solutions, phase equilibrium, electrochemistry and interface system, and chemical kinetics. Furthermore, students should understand some physical-chemical calculation method and the application of these theories in the water supply and drainage.

Recommended Textbooks/References:

1. SHI Guole, "Physical Chemistry for Water Supply and Drainage Engineering", Machinery Industry Press, 2006.
2. YIN Yongjia, "A Simple Tutorial of Physical Chemistry", Higher Education Press, 2001.
3. FAN Kangnian, "Physical Chemistry" (2nd Ed.), Higher Education Press, 2005.

Course Number: 0001973

Course Title: Chemistry and Environment

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in mechanical Engineering and Applied Electronics Technology, Architecture and Civil Engineering, Energy Engineering, etc.

Prerequisites: Middle school Chemistry

Evaluation Method: Written Exam

Course Description:

This course aims to make students to understand the basic principles through learning the fundamental concept of chemistry. The environmental science about the chemical content will be introduced, including the air, water, soil, food pollution and the environmental sustainable development. The students shall study the following important contents: 1. the principles of chemical equilibrium; 2. the fundamentals of electrochemistry; 3. the structure of matter; 4. the air, water, soil, food pollution control; 5.the environmental sustainable development.

Recommended Textbooks/References:

1. REN Ren, YU Zhihui, CHEN Sha, ZHANG Dunxin, Chemistry and environment (3 edition), Chemistry Industry Press,2012. 6.
2. Chemistry (7 edition), Raymond Chang, McGraw-Hill Higher Education.

Course Number: 0003211

Course Title: Engineering Thermodynamics I

Credit: 4 **Total Credit Hours:** 64

Students: Architectural Environment and Equipment Engineering

Prerequisites: Advanced Mathematics

Evaluation Method: Written Examination

Course Description:

The course basically tells application for the rules and basic theory of the transformation and utilization of heat and mechanical energy. The course is divided into two parts: basic theory and

practical application. In the part of basic theory, we mainly introduce the first and the second law of thermodynamics, ideal gas, actual gas and thermodynamic process, summarizes the two circulations (positive circulation and reversal circulation). In the part of practical application, we apply the basic theory to the various thermal processes; discuss the factors of affecting the effect of energy conversion and the way and method of improving the conversion efficiency. The course describes the main flow of gas and steam power cycle, refrigeration cycle, taking the practical application into account, we also introduce water vapor and moist air.

Recommended Textbooks/References:

1. Kang Leming, Li Lican. Engineering thermodynamics. Beijing: China Architecture &Building Press(fifth edition). 2006.
2. He Yaling, Engineering Thermodynamics. Xian: Xi'an Jiaotong University Press, 1999.

Course Number: 0000955

Course Title: Fundamentals of Thermal Energy Engineering

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students

Prerequisites: Higher Mathematics, College Physics, Engineering Mechanics

Evaluation Method: Written Exam

Course Description:

This optional Subject is designed for undergraduate students in mechanical engineering and electrical engineering. Presentation of the course follows basic rules of the energy transfer such as heat and work, and the principles of heat transfer.

The subject is consisted of two parts: engineering thermodynamics and heat transfer. Basic concepts and definitions, Properties of substances, the first law of thermodynamics, the second law of thermodynamics, ideal gas, power cycles, and refrigeration cycles will be introduced in engineering thermodynamics. Basic concepts of heat transfer, steady-state conduction, convection, radiation heat transfer, heat exchangers will be introduced in heat transfer.

Recommended Textbooks/References:

1. ZHANG Xuexue, LI Guifu, SHI Ling. Fundamentals of Thermal Energy Engineering (the 2nd edition), higher education press, 2006
2. TONG Gengjun, WANG Pingyang, SHU Yongkang. Fundamentals of Thermal Energy Engineering (the 2nd edition), Shanghai Jiaotong University Press, 2008

Course Number: 0000302

Course Title: Heat Transfer III

Credit: 3.5 **Total Credit Hours:** 56

Students: Undergraduate students Major in Architectural Environment and Equipment Engineering

Prerequisites: Higher mathematics, College physics, Engineering Thermodynamics

Evaluation Method: Written Exam

Course Description:

This required Subjects is designed for undergraduate students in architectural environment and

equipment engineering. A society based on power technology teems with heat transfer problems. The aim is to learn the principles of heat transfer so we can solve these problems and design the equipment needed to transfer thermal energy from one substance to another.

The basic concepts, steady-state heat conduction, unsteady-state heat conduction, numerical model of heat conduction, analysis of convective heat transfer, one-phase convective heat transfer, boiling and condensation, basic law of thermal radiation, radiation heat transfer, heat exchanger will be introduced.

Recommended Textbooks/References:

1. ZHANG Ximing, Ren Zepei, Mei Feiming. Heat Transfer, 5th edition, China Architecture & Building Press, 2007
2. YANG Shiming, Tao Wenquan, Heat Transfer, 4th edition, Higher Education Press, 2006
3. DAI Guosheng, Heat Transfer, 2nd edition, Higher Education Press, 1999

Course Number: 0004759

Course Title: Inorganic Chemistry

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Science and Engineering

Prerequisites: High School Chemistry

Evaluation Method: Written Examination

Course Description:

Inorganic Chemistry is the first specialty basal course for the students in Environmental Science and Engineering, which serves as a link between past and future. The main content of this course is based on the grasped chemistry knowledge in high school and provides necessary theories and inorganic chemistry knowledge for the learning of subsequent chemistry courses. This course mainly includes the foundation of chemical thermodynamics, chemical equilibrium, oxidation and reduction, atomic structure, molecular structure, coordination chemistry, and element chemistry. Through the teaching of inorganic chemistry, the students are required to grasp the fundamentals of the periodic law of elements, modern material structure theory, chemical thermodynamics, chemical equilibrium, and oxidation and reduction, etc. In addition, the students are needed to grasp the main properties, structures, and applications of important elements. In the meanwhile, the students are required to establish the ability to analyze and calculate on the general inorganic problems, and be trained in science thinking.

Recommended Textbooks/References:

1. Teaching and Research Group of Inorganic Chemistry in Dalian University of Technology, “Inorganic Chemistry”, Higher Education Press, 2001.
2. HU Zhonggeng, “Modern Chemical Basis”, Higher Education Press, 2001.
3. ZHU Yuzhen, “Modern Basic Chemistry”, Chemical Industry Press, 1998.

Course Number: 0004997

Course Title: Analytical Chemistry Ⅲ

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Science and Environmental

Engineering

Prerequisites: Inorganic Chemistry, Calculus

Evaluation Method: Written Examination

Course Description:

Analytic chemistry covers substance composition, structure, analytic method and related theories. It is an important specialized foundation course for students whomajor in environmental science and environmental engineering. After this course study, students can learn the basic acknowledge, theories and calculation of routine chemical analysis methods. The main contents of this course include acid-base titration, complex metric titration, radix titration and precipitation titration based on the acid-base equilibrium, complex metric equilibrium, radix equilibrium and precipitation dissolution equilibrium, respectively, as well as spectrophotometer method based on the Lambert's and Bill's laws. Furthermore, theory of error and statistical data processing method will also be taught. The depth and breadth of this course are similar to other engineering universities.

Recommended Textbooks/References:

1. Wuhan University (Ed.), Analytic Chemistry (5th Ed.), Higher Education Press, 2006.
2. HE Xianli, ZHAO Shuzhen, WU Shaohua. "Analytic Chemistry", Beijing University of Technology Press, 2001.
3. Sichuan University, etc.(Ed.), Analytic Chemistry, Higher Education Press, 2004.
4. SUN Yuqing, HU Yuzhu, WU Yutian, LI Wanzhang, Analytic Chemistry (2nd Ed.), Science Press, 2006.

Course Number: 0005000

Course Title: Organic Chemistry V

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in Environmental Science and Engineering

Prerequisites: Inorganic Chemistry, Analytical Chemistry

Evaluation Method: Written Examination

Course Description:

Regular sets, the structure the property the mutual transformation relationship and the internal connection of all kinds of organic compounds. The students are expected to understand the basic knowledge theory and skill in organic chemistry, to use the basic knowledge to solve some problems in the organic reaction and the organic synthesis. At the same time our students need to know the latest result and development in this field and to improve their ability in analysis and solving problems. The basic topics include: organic chemistry and basic organic chemistry property reaction and theory of organic compounds, hydrocarbon (alkanet, olefin, alkynes, aliphatic hydrocarbon, halogenated hydrocarbon, aromatic hydrocarbon), organic compound containing oxygen (alcohol, ether, aldehydes and ketenes, carboxylic acid, carboxylic acid derivatives) organic compound containing nitrogen (nitro compounds, amine) heterocyclic compounds (heterocyclic compounds containing oxygen, heterocyclic compounds containing nitrogen and sulfur).

Recommended Textbooks/References:

1. GAO Hongbin. Organic Chemistry2nd ed. Higher Education Press, 2005
2. XING Qiyi. Basic Organic Chemistry. Higher Education Press, 2002

Course Number: 0004998

Course Title: Physical Chemistry Ⅴ

Credit: 4 **Total Credit Hours:** 64

Students: Undergraduate students Major in Environmental Science and Engineering

Prerequisites: General Physics, Inorganic Chemistry and Calculus

Evaluation Method: Written Examination

Course Description:

Thermodynamic properties including the direction, limits, and energy balance of chemical reactions and kinetic properties such as chemical reaction rate and mechanism are introduced in this course. The students are expected to understand the basic concepts, theories, methods, and solving method to the related problems, through which their abstraction and modeling abilities will be improved. The basic topics include: the basic concepts of thermodynamics, thermodynamics first, second and third law, calculation of the equilibrium constant in the chemical equilibrium, Van't Hoff isotherm equation, Van't Hoff isobaric equation, Raoult's law and Henry's law in the mixture and the solution, the chemical potential of components in the mixture and the solution, the phase equilibrium of single-component systems and multi-component systems, the electromotive force and the polarization, interfacial phenomena, colloid chemistry, the basis of chemical kinetics, complex reaction kinetics and reaction rate theory.

Recommended Textbooks/References:

1. LI Songlin, ZHOU Yaping, "Physical Chemistry" (5th Ed.), Higher Education Press, 2009.
2. HU Ying, "Physical Chemistry" (4th Ed.), Higher Education Press, 2001.
3. FU Xiancai, Physical Chemistry (4th Ed.), Nanjing University Press, 1995.
4. P. W. Atkins, "Physical Chemistry" (6th Ed.), Oxford University Press, 1999.

Course Number: 0005704

Course Title: Unit Operation IV

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Chemical Engineering, Light-Chemical Engineering, Material Engineering and Environmental Engineering

Prerequisites: Calculus, Physical Chemistry, etc.

Evaluation Method: Written Examination

Course Description:

This is a subsequent course of advanced mathematics, physics and physical chemistry, which mainly introduces the basic principles and typical equipment of the chemical engineering unit operation, the calculation of each unit operation and selection of typical equipment, the choice of the best operating conditions and process intensification and optimization. It involves such unit operations as fluid flow, fluid transport machine, heat transfer, absorption, drying and membrane separation. This course is a bridge of core curriculums and professional courses. Through the systematical learning of this course, students can master the process of each unit operation; understand the characteristics, performance and industrial applications of each unit operation. Calculations basing on the material balance and heat balance of equipment lay the foundations for the curriculum design, graduate design and professional courses.

Recommended Textbooks/References:

1. CHEN Minheng, et al., “Principles of Chemical Engineering” (3rd Ed.). Chemical Industry Press, 2006.
2. HUANG Shaolie, et al., “Principles of Chemical Engineering”, Higher Education Press, 2002.
3. Dalian University of Technology, “Principles of Chemical Engineering” (2nd Ed.), Higher Education Press, 2009.

Course Number: 0003014

Course Title: Water Quality Engineering -1

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduates of “Environmental Engineering”

Prerequisites: Fluid Mechanics, Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Principle of Chemical Engineering

Evaluation Method: Written Exam

Course Description:

This course is to teach the unit operations of water treatment. The objectives of the course includes: to have knowledge of wastewater characteristics and index, to gain an understanding of water quality standard, to learn some water pollution control methods, laying a solid foundation for design, construction, operation and scientific research of water treatment. The basic topics include: to understand the wastewater characteristic, water quality standard for drinking water and its relationship with human health; to master the water pollution index, wastewater characteristics, to know China’s sewage discharge standard and state of the art of wastewater treatment, et al., the target of wastewater treatment and the request of current regulations on sewage treatment; to master contamination law of water body (river, lake, sea and ground water, et al.), to know water quality assessment and measures of water pollution control; to deepen the understanding of the concepts of reactor used in water treatment technology; to master the basic concepts, theories and technologies of wastewater treatment methods, such as, physical operation units, chemical operation processes, physical-chemistry operation units.

Recommended Textbooks/References:

1. LI Guibai, ZHANG Jie, Water quality engineering (1st edition), China Architecture & Building Press, July 2005 (In Chinese)
2. ZHANG Zijie, Sewage engineering, second volume (4th edition), China Architecture & Building Press, July 2005 (In Chinese)
3. GAO Tingyao, GU Guowei, Water pollution control engineering, second volume (2nd edition), Higher Education Press, May 1999 (In Chinese)
4. Metcalf and Eddy,INC. Wastewater Engineering Treatment Disposal Reuse. 4th,March,2002,McGraw-Hill Science/Engineering/Math

Course Number: 0005725

Course Title: Air Pollution Control Engineering Ⅰ-1

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Principles of Chemical Engineering, Four Chemical Courses

Evaluation Method: Written Exam

Course Description:

Air Pollution Control Engineering is a required course of Environmental Science and Engineering majors, which focuses on gaseous pollutants and discusses the basic theory of air pollution control and particulate control,the basic principles of various control processes,the basic structure of typical control equipment and process design calculations. The course aims at training students' abilities of analyzing and solving problems about air pollution control and laying a necessary foundation of design, research and technology management. The basic topics include: Air Pollution and Global Climate, Combustion and Air pollution, Designing of a Typical Pollution Control System, General Ideas in Air Pollution Control, Control of Gaseous Pollutants (absorption, adsorption and catalysis), Control of Sulfur Oxides, Control of Nitrogen Oxides, Control of Volatile Organic Compounds (VOCs), The Motor Vehicle Problem.

Recommended Textbooks/References:

1. Hao Jiming, Air Pollution Control Engineering (Third Edition), Higher Education Press, in 2010
2. Noel de Nevers, Air Pollution Control Engineering (Second Edition), Tsinghua University Press, in 2001
3. Guojin, Air Pollution Control Engineering, Chemical Industry Press, in 2004

Course Number: 0003015

Course Title: Water Quality Engineering 2

Credit: 3 **Total Credit Hours:** 48

Students: Environmental Engineering Majors

Prerequisites: Water Quality Engineering1, Fluid Mechanics, Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Principles of Chemical Engineering, Environmental Engineering Monitoring

Evaluation Method: final examination

Course Description:

This course, which aims at providing students an overall and deep knowledge of theory on water biological treatment, as well as making students grasp preliminary the water treatment process system, is mainly about the theory and application of water biological treatment, sludge treatment and disposal, and also the water treatment systems. Undoubtedly, students are expected to fully understand and master relevant basic concepts, theories and methods. And, the specific requirements students need to meet are as follows: firstly, comprehensively and systematically grasp the theoretical basis of the activated sludge, the performance index, reaction kinetics, and its application; focus on mastering the basic principles and concepts of bio-film, and also understand the characteristics of bio-film processes and the application conditions. Secondly, master the basic principles of anaerobic biological treatment, coupled with the principles and core of up-flow anaerobic sludge bed reactor; grasp the basic principles of the stabilization pond sewage treatment process. Thirdly, have a good command of the basic principles and methods of sludge treatment and disposal. Last but not least, basically grasp the technology and methods of the urban water treatment and industrial enterprises water treatment engineering, and the related application conditions.

Recommended Textbooks/References:

Textbook:

Li Guibai, Zhang Jie. Water Quality Engineering, 1st Edition., China Architecture & building Press, July, 2005.

Reference Books:

1. Zhang zijie, Drainage Engineering, vol. 2, Higher Education Press, June, 2000.
2. Gao Tingyao, Gu Guowei. Water Pollution Control Engineering, vol.2, 2nd Edition. Higher Education Press, May, 1999.
3. (American) Metcalf and Eddy, INC, Wastewater Engineering Treatment Disposal Reuse, 4th, March, 2002, McGraw-Hill Science/Engineering/Math.

Course Number: 0000575

Course Title: Solid Wastes Management

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Engineering and/or Environmental Science

Prerequisites: Chemistry, Introduction to Environment Protection

Evaluation Method: Written Exam

Course Description:

This course will mainly discuss the integrated Municipal Solid Waste (MSW) management from waste generation to final disposal in order to content the requirement of Waste management policy: reduction, recycle and safe treatment. The objective of this course is to make the students learn the policies of MSW management, the principle and characteristics of the processing, transformation techniques and disposal methods on MSW. This course mainly introduce the collection, transfer and transport of MSW, the compaction, size reduction and separation techniques on MSW, the biological conversion technologies on MSW including composting and digestion, the thermal conversion technologies on MSW including combustion, paralyses and gasification, the MSW final disposal technology- sanitary landfill. The students are required to master the separation, composting, combustion and sanitary landfill techniques on MSW.

Recommended Textbooks/References:

1. George Tchobanoglous. Integrated Solid Waste Management,Beijing: Tsinghua University Press, 2000
2. J MI Zhenming, GAO zhongai,etal. Solid Waster treatment and disposal, Beijing: Higher Education Press, 1993
3. LI Jianguo. Solid Waste Treatment and Recycling Engineering. Beijing: Higher Education Press, 2001
4. ZHUANG Weiqiang. Solid Waste Treatment and Utilization. Beijing: Chemical Industry Press, 2001

Course Number: 0005726

Course Title: Air Pollution Control Engineering (Ⅰ-2)

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Physical Chemistry, Principle of Chemical Engineering, Environment Engineering Foundation

Evaluation Method: Written Exam

Course Description:

This course is an important professional degree course, which is designed for environmental engineering students. It plays an important role for students to master the professional knowledge of aerosol pollutants, gaseous pollutants removal. This course is to make the students master the basic concepts of atmospheric pollution, the combustion and air pollution, the physical properties of dust and the principle of gas and dust removal equipment. The aim is training the students to use the knowledge to cultivate their understanding, analytical and solving ability when faced with practical problems. The program is designed for teaching the relevant knowledge in the field of air pollution control. The main teaching content is as follows: introduction of atmospheric pollution, fuel and air pollution, air pollution control technology and pollutant removal system design. This course is to let students know and master the basic knowledge in the field of air pollution control, which lay the foundation for the relevant work in the future. The key of this course is air pollution control technology.

Recommended Textbooks/References:

1. Hao Jiming, Mang Guangda, Wang Shuxiao. Air Pollution Control Engineering, 3rd Edition. Higher Education Press, 2010.

Course Number: 0003012

Course Title: Environmental Management

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Naught

Evaluation Method: Written Exam

Course Description:

Environmental Management is the crossed outcome of the environment science, the environmental technology and the management science. Environmental Management is the one of the most impotent course of environmental science and environment engineering graduate student. Environmental Management is more important the station and effect. Request students to system hold the environmental basic theory knowledge, the administration rule of law, the environmental standard and the main pollution controlling technology.

Environmental Management main teaching, the basic concept, task, history and developing trend of the environment management science, to teacher the main theory of environment management, to teacher the environmental object, content and teaching method, to teaching environmental teaching sustain and safeguard, to teaching the different profession environment.

Recommended Textbooks/References:

1. YE Wenhu Environmental Management, Higher Education Press, 2000.6
2. ZHANG Chengzhong, The Principium and Methods of Environmental Management, China Environmental Science Press, 1997.5

Course Number: 0005721

Course Title: Pump and Fan

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate of Environment engineering

Prerequisites: Fluid mechanics, Chemical principle

Evaluation Method: Written examination

Course Description:

This course is the environment engineering discipline foundation course. The students are expected to master pump and fan's structure, working principle, characteristics, operation and adjusting method; have the ability of reasonable choice, correct application, maintenance, and technical innovation. Besides, training students have the ability to analyze and solve actual problems, and lay a foundation for learning other professional course of environment engineering. The basic content include: classification and working principle, basic performance parameters; speed triangle, energy equation; power, loss, efficiency and performance curve of pump and fan; The applications of similarity theory in pump and fan; cavitations phenomena and their influence on pump; Operation and adjustment of pump and fan; Selection of pump and fan; Pump station design.

Recommended Textbooks/References:

1. He chuan, Guo Lijun, Pump and Fan. (4th edition), China Electric Power Press, 2008.6
2. Zhang Jingcheng, Water Pump and Water Pump Station (3rd edition), Harbin Institute of Technology Press, 2010
3. Zhou Moren, Fluid mechanics Pump and Fan (2nd edition), China Building Industry Press

Course Number: 0005728

Course Title: An Introduction to Energy Science

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students

Prerequisites: no

Evaluation Method: Written Exam

Course Description:

This course introduces the general situation of energy science, the problem it's faced with, the solutions to these problem and the prospect of development, delivers the basic knowledge and theory of energy science to students. The aim of the course is to make students understand the energy history, new energy technology and its developing trend, improve and strengthen student's energy conservation and environmental protection consciousness, lay the foundation for the related energy scientific research and operation management. This seminar focuses on clarifying the energy concepts and energy classification in order to make the students establish energy evaluation foundation. The specific energy which will be analyzed and discussed in this course are fossil energy, nuclear energy, hydrogen, solar energy, wind energy, hydropower, biomass energy, geothermal energy.

Recommended Textbooks/References:

1. Huang Suyi, Gao Wei. Introduction to energy. Higher Education Press, 2004
2. Su Yaxin, Mao Yuru, Zhao Jinde, New energy and Renewable energy. Higher Education Press, 2006

3. J.R. Vankey, translated by Wang Naili, Energy: prospect of 21th century. Shanghai Jiaotong University Press,2008

Course Number: 0004353
Course Title: Drainage Ductwork Engineering
Credit: 3.5 **Total Credit Hours:** 56
Students: Environmental Engineering undergraduates
Prerequisites: Fluid Mechanics
Evaluation Method: Exam
Course Description:
This course is one of the environmental engineering professional electives, which consists of the theoretical teaching and practice teaching. The main content of the theoretical teaching embraces introduction to the drainage system、hydraulic calculation of drainage、design of sewer system、design of urban storm water drainage system、design of conflux drainage system、design of drainage pumping station、the basic concepts ,theories, methods and techniques of drainage construction and maintenance management. Practice teaching centers on the design calculations and drawings of sewer system and drainage system, supplemented by the social acknowledge internship and survey. Students will get a better and comprehensive understanding about the parts, basic principles, design principles and calculation methods of the drainage. Together with curriculum design and social practice, students can preliminary master the design methods of drainage project , which trains students' engineering design capability.
Recommended Textbooks/References:
1. GAO Tingyao, Guowei GU, Qi ZHOU. Water Pollution Control Engineering (PartI, 3rd edition) Beijing: Higher Education Press, 2007.3
2. ZHANG Qin, Junqi LI. Water Project Construction. Beijing: China Architecture & Building PRESS, 2005
3. XING Lizhen. Water Supply and Drainage Pipeline Design and Construction. Beijing: Chemical Industry Press, 2004
4. SUN Huixiu. Drainage Engineering (Part Ⅰ, 4th edition). Beijing: China Architecture & Building PRESS .2004

Course Number: 0005764
Course Title: Principle of Environmental Engineering
Credit: 2 **Total Credit Hours:** 32
Students: Environmental Engineering Majors
Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Principle of Chemical Engineering
Evaluation Method: Open-book examination
Course Description:
To provide students an overall and deep knowledge of theory on the common phenomena, basic process and principles of environmental pollution control (i.e. water pollution control engineering, air pollution control engineering and solid waste treatment and disposal engineering etc) and

ecological restoration project, this course lays a hard theoretical basis for later specialized courses. The basic content consists of three sections: PART 1 (Fundamentals of environmental engineering principle), PART 2 (separation process principle) and PART 3(reaction engineering principle). In PART 1, students are given information about the material and energy conservation principle and transfer process, etc; while in PART 2, students are given opportunity to have the knowledge of the principles of precipitation, filtration, absorption and adsorption. And the aim of PART 3 is to tell about chemical and biological response metrology, dynamics and process analysis of the various types of reactor, etc. And the key points are separation process principle and the reaction engineering principle, while the difficult point is reaction engineering principle.

Recommended Textbooks/References:

1. Hu Hongying, Principle of Environmental Engineering, Higher Education Press, 2005.
2. Jiang Zhanpeng, Environmental Engineering, 2nd Edition, Higher Education Press, 2005.

Course Number: 0005723

Course Title: Environmental Microbiology

Credit: 3.0 **Total Credit Hours:** 48

Students: Undergraduate students Major in environmental engineering

Prerequisites: Chemistry

Evaluation Method: Written Exam

Course Description:

This course is one of the required subject courses for the students majoring in environmental science and engineering. Environmental Microbiology is the study of microorganisms that inhabit the Earth and their roles in carrying out processes in both natural and human-made systems. The aim of this course is to provide wide-ranging training in environmental microbiology, applicable both to students with previous knowledge of a relevant subject and to those with little background in environmental microbiology. This course provides students with theoretical knowledge, practical skills and an appreciation of the application of the subject.

Studying this course enable the students to understand and grasp the diverse roles of microorganisms in natural and artificial environments. It will cover topics including: cellular architecture, energetic, and growth; evolution and gene flow; population and community dynamics; water and soil microbiology; biogeochemical cycling; and microorganisms in bio-deterioration and bioremediation.

Recommended Textbooks/References:

None

Course Number: 0005722

Course Title: Environmental Engineering Monitoring

Credit: 4.0 **Total Credit Hours:** 64

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Chemistry

Evaluation Method: Written Exam Experiment

Course Description:

This course is one of the required subject courses for the students majoring in environmental engineering. Its objectives are to enable students to understand the important roles of environmental monitoring in the field of environmental engineering. Enable students to grasp the principles, technical methods and the monitoring quality assurance, master the sampling, preservation and pretreatment methods of environmental samples. Enable students to make comprehensive use of the knowledge to preliminary design environmental monitoring program. It is designed to enable students to expand the knowledge vision, to improve the ability to analyze and solve practical engineering problems, and to lay the foundation for learning other professional courses in environmental engineering.

Recommended Textbooks/References:

1. Xi Danli. Environmental Monitoring (4th), Higher Education Press, 2010
2. Zhao Jianfu. Environmental Monitoring, Chemical Industry Press, 2004
3. Liu Desheng. Environmental Monitoring, Chemical Industry Press, 2001
4. Deng Guichun, Zang Shuliang. Environmental Analysis and Monitoring, Liaoning University Press 2001

Course Number: 0005724

Course Title: Physical Pollution Control Engineering

Credit: 3 **Total Credit Hours:** 40

Students: Undergraduate of Environment engineering

Prerequisites: University Physics

Evaluation Method: Written examination

Course Description:

This course is environment engineering discipline course. Students are expected to have a more comprehensive understanding of the nature, source, and control method of physical pollution, including noise, vibration, electromagnetic radiation, radioactive, heat, and light pollution and so on. The key of this course is to make the students master the basic concept of physical pollution; master the emergence, spread, harm, evaluation of noise and vibration, and the basic principles of control methods; understand the damage and control methods of electromagnetic radiation and radioactive pollution; understand the basic concept of thermal environment and light environment, and the control method of environmental heat pollution and light pollution.

Recommended Textbooks/References:

1 Chen Kang-li, Qian Xian-You, Xu Hao-Han, Physical Pollution and Prevention, Chemical Industry Press, 2006

2 Chen Jierong,Physical Pollution and Prevention, Higher Education Press, 2007

3 Pan Zhonlin, Zhai Guoqing, Noise Control, Chemical Industry Press, 2006

Course Number: 0005706

Course Title: Environmental Quality Assessment

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Science and Engineering

Prerequisites: Higher Mathematics

Evaluation Method: Written Exam

Course Description:

This course is included in the professional curriculums for the major of Environmental Science and Engineering, playing an important role on the personnel training. Purpose of this course is to enable students to understand the basic conception, theory, methods, relative laws and regulations of environmental quality assessment for water, noise and soil. Students should master atmospheric models and its application. Besides, students also need to try to solve actual problems based on the study of methods and theory. The content of the course are: summarize of environment assessment, basic knowledge of environment assessment, atmospheric environment assessment, water environment quality assessment, noise environment quality assessment, soil environment quality assessment, regional environment quality assessment and actual cases of environment quality assessment.

Recommended Textbooks/References:

1. CHENG Shuiyuan et al. Project and Strategic Environmental Impact Assessment, Beijing: China Environmental Science Press, 2008

2. CHENG Shuiyuan et al. Project and Regional Environmental Impact Assessment, Beijing: China Environmental Science Press, 2002

3. LU Shuyu et al., Environment Quality Assessment, Beijing, Higher Education Publishing House, 2001

4. SHI Baozhong et al., Project Environmental Impact Assessment, Beijing: China Environmental Science Press, 1999

Course Number: 0003892

Course Title: Environmental Engineering Design Basis

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in environmental engineering and environmental science

Prerequisites: Air Pollution Control Engineering, Water Pollution Control Engineering, Noise Control Engineering, Solid Waste Treatment and Disposal

Evaluation Method: Written Exam

Course Description:

The main topics of the course are listed as follows: process, principle, scope, content, characteristics of environmental engineering design, environmental protection law, regulations on the administration of construction project environmental protection, pollution sources investigation, engineering analysis, calculation of emission and source intensity, environmental protection request and process for location, principle and steps of treatment process choosing, structures and architectural form, the request of pipeline selection, environmental protection equipment , estimate and budget in economic analysis. The course aims to develop students' design ideas, consolidate \strengthen\deepen and extend the theoretical knowledge and primary professional skill, promote the ability of drawing, help students to solve the problems with basic theory and professional knowledge, lead students to have more creative and subjective ability to design independently.

Recommended Textbooks/References:

1. Jin Yuquan, Environmental Engineering Design Basis (second edition), Chemical Industry Press, July, 2008

Course Number: 0009001

Course Title: Instrument Analysis

Credit: 3 **Total Credit Hours:**48

Students: Bachelor students Major in Environmental Engineering

Prerequisites: Inorganic chemistry, Analytical chemistry, Organic chemistry, Physical chemistry

Evaluation Method: Written Exam

Course Description:

This course is for bachelor students who major in Environmental Engineering. The students are expected to understand the basic concepts, theories, analytical methods and application at the same time, to learn simple techniques during the experiments.

It is important to learn molecular spectroscopy and atomic spectrometry in keeping the electromagnetic spectrum as the main line and keeping the quantum chemistry as the theoretical foundation; to learn chromatographic analysis with chromatography theory; and to learn electrochemical analysis method by basic electrochemical theory.

After finishing this course, the students are expected to have a complete idea about analytical chemistry and the ability in basic instrument analysis.

The final examination is in the form of written examination. The final score consists of homework, experiment and the testing results.

Recommended Textbooks/References:

1. ZHU Minghua. Instrument analysis. Higher Education Press, 2009

2. LI Kean, Course of Analytical Chemistry. Beijing University Press,2005

3. XI Zhiwen, Instrument analysis. Tsinghua University Press,1992

Course Number: 0005727

Course Title: Construction and Management of Environmental Engineering

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Base of environmental Engineering, Water Quality Engineering, Air Pollution Control Engineering

Evaluation Method: Exams

Course Description:

This course is contented by the basic theory and technology of Construction and Management of Environmental Engineering. After finishing this course, undergraduates can resolve the problems happening in the real engineering and complete the engineering item. Following the construction procedure, construction framework can be laid out through using modern technology, economy and management methods, which can improve the construction efficiency. Besides, tender file can be compiled after grasping the program of tender procedure.

The task of this course is initiating the construction technology of environmental engineering. The ability of construction is the teaching emphasis.

Recommended Textbooks/References:

1. Guo Zheng, Environmental engineering construction and accounting, July, 2005.

Course Number: 0003986

Course Title: Determination and Purification for Indoor Air Pollution

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Science and Environmental Engineering

Prerequisites: Analytical Chemistry, Instrumental Analysis

Evaluation Method: Written Exam

Course Description:

Determination and Purification for Indoor Air Pollution is a selective course for environmental science and environmental engineering. The students are required to master the basic concepts, methods and technology of indoor air pollution. The course includes the introduction of indoor air pollution and relative standards, the sources of main pollutants in indoor air and the harm to health, the purification technology of indoor air pollution, and the methods for the determination of main pollutants. Students may know the hot issues and technical methods in the subject, and improve the recognition of indoor air pollution. The ability of solving problems is also trained.

Recommended Textbooks/References:

1. ZHOU Zhongping, ZHAO Shoutang, ZHU Li et al. Determination and Control of Indoor Pollution. Chemical Industry Press, 2002
2. ZHU Tianle. Control of Indoor Air Pollution. Chemical Industry Press, 2003
3. WANG Xiaoyi. Determination of Indoor Air—Method and Application. Chinese Environmental Science Press, 2006

Course Number: 0006378

Course Title: Environmental Planning

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students majored in Environmental Engineering

Prerequisites: Introduction to Environment Protection, Environment Monitoring, Environment Impact Assessment

Evaluation Method: Written Exam

Course Description:

This course mainly discussed three parts. In part one, the theory basis of Environmental Planning is introduced, including the basic overview of Environmental Planning, some theories about Environmental Planning (man-land system theory, sustainable development theory, complex ecosystem theory, spatial structure theory) and the content of Environmental Planning. In Part two, some technique methods in Environmental Planning are presents, including the common environment assessment methods, environment prediction methods and environment decision-making methods. In Part three, different types of environmental Planning are discussed. In this part, the planning content, program documentation and methods about atmospheric environmental planning, water environmental planning, land utilization planning, waste management planning and urban environmental planning are touched on. Through learning this course, students may know the important role of environmental planning in promoting the coordinated development of environment and economy and learn the theories and methods of Environmental Planning.

Recommended Textbooks/References:

1 GUO Huaicheng, SHANG Jincheng,etal. Environmental Planning. Beijing: Higher Education Press, 2001
2 ZHANG Huiqin, GUO Xiaomin. Environmental Economy System Analysis- Planning Method and Model. Beijing: Tsinghua University Press, 1993
3 LIU Tianqi, etal. Guide to Area Environmental Planning Method. Beijing: Chemical Industry Press, 2001
4 ZHANG Chengzhong. Environmental Planning and Management. Beijing: Higher Education Press, 2007
5 MA Xiaoming. Theories and Methods for Environmental Planning. Beijing: Chemical Industry Press, 2005

Course Number: 0004760
Course Title: Inorganic Chemistry Experiment
Credit: 0.5 **Total Credit Hours:** 12
Students: Undergraduates Major in Environmental Science and Engineering (Environmental Engineering)
Prerequisites: Nothing
Evaluation Method: Test
Course Description:
Inorganic chemistry experiment is the first fundamental chemistry experiment course for undergraduates major in Environmental Science and Engineering (Environmental Engineering). Through studying the course, the students are expected to obtain perceptual knowledge from experiments, to understand chemistry concept as well as theory in depth and utilize them flexibly, to master the elementary operation and fundamental skill of chemistry experiment, to get the ability to observe and analyze experimental phenomena, to form a good habit of recording experimental results honestly, to be capable of making logical deduction and drawing correct conclusion in the process of dealing with experimental results, to be able to express correctly using chemistry language and write experiment report on one's own, to have scientific attitude of seeking truth from facts as well as serious style of work, consequently, to lay a solid foundation for further study and following courses.
Recommended Textbooks/References:
1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011
2. CUI Aili. Fundamental Inorganic Chemistry Experiment. Higher Education Press, 2007
3. Group of Inorganic Chemistry, Dalian University of Technology. Inorganic Chemistry Experiment, Higher Education Press, 2004

Course Number: 0005716
Course Title: Experiments of Organic Chemistry
Credit: 0.5 **Total Credit Hours:** 12
Students: Undergraduate students Major in Environmental Science and Engineering,
Prerequisites: Experiments of Inorganic Chemistry

Evaluation Method: The experiment site evaluation and level of experiment reports

Course Description:

"Experiments of Organic Chemistry" is one of the most fundamental experimental courses and the practical key point for undergraduate students of major in Environmental Science and Engineering. The teaching aims are not only to verify and strengthen the basic theory of knowledge, but also reach the following requirements:

(l) To make the students master the basic theory of the organic chemistry experiment and basic knowledge, grasp the basic experimental skills of organic chemistry experiment;

(2 To make students with strong practical ability and the ability of doing experiment independently;

(3) To make students have strong abilities of self-study, observing, the comprehensive analysis and solving practical problems;

(4) To make students have serious, practical and realistic attitude and the rigorous work style, make the students get preliminary training in scientific method.

Recommended Textbooks/References:

1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011

Course Number: 0005717

Course Title: Experiment of Analytical Chemistry

Credit: 1 **Total Credit Hours:** 24

Students: Undergraduate students Major in Environmental Science and Environmental Engineering

Prerequisites: Analytical Chemistry

Evaluation Method: The mean score of all experiment (90%) + the course summary(10%)

Course Description:

Experiment of Analytical Chemistry is an important experiment course for environmental science and environmental engineering. The experiment course includes acid-base titration, coordination titration, oxidation-reduction titration, and spectrophotometer method. The students are required to master the basic operating still of the quantitative analysis, to establish the concept of quantity, to learn to process experimental data and to write experiment report. The students are expected to understand deeply the theoretical knowledge of analytical chemistry, to improve the ability of asking problems, analyzing problems, and solving problems, and to cultivate rigorous and realistic attitude and innovative consciousness.

Recommended Textbooks/References:

1 WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011

2 PENG Chonghui, FENG Jianzhang, ZHANG Xiyu, et al. Concise Course of Quantitative Chemical Analysis (second Edition). Peking University Press,1997

3 CHANG Wenbao, LI Ke'an. Concise Analytical Chemistry Manual. Peking University Press,1981

Course Number: 0005718

Course Title: Experimental Physical Chemistry

Credit: 0.5 **Total Credit Hours:** 12

Students: undergraduates Major in environmental engineering and environmental science

Prerequisites: Physical Chemistry V

Evaluation Method: Test

Course Description:

Students are encouraged to finish the experiments independently. On the basis of understanding of the fundamental theory in physical chemistry, the basic skills and abilities are emphasized, such as doing experiments, data processing, report writing by themselves, etc. Its main contents include four experiments. Measuring the pure liquid saturated steam pressure is done to master some simple vacuum technologies and to calculate the heat of phase change and the normal boiling point. Experiment of combustion heat determination is helped to learn the application of bomb calorimeter, use the oxygen bottle safely and to master Remolds graphic method. In the catholic polarization curve test, constant voltage/current is used to measure electrode potential, and the component and the function of the salt bridge as well as the impact of the addition on the catholic galvanization were grasped. Through the test of rate constant of ethyl acetate specification reaction, the component of thermostat water bath, temperature regulation, real-time solution conductivity measured by the conductivity gauge and rate constant calculated by the linear regression are acquainted.

Recommended Textbooks/References:

1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011
2. Physics and chemistry in Tianjin University. Physical Chemistry (Fifth Edition). Beijing: Higher Education Press, 2009

Course Number: 0005715

Course Title: Unit Operation Experiments Ⅱ

Credit: 0.5 **Total Credit Hours:** 12

Students: Environmental Science, Environmental Engineering

Prerequisites: Higher Mathematics, Engineering Mathematics, General Chemistry, Electrical and Electronic Technology, Principles of Chemical Engineering, etc**.**

Evaluation Method: Process assessment

Course Description:

The experiment of Unit Operation is the professional compulsory course of the environmental science and environmental engineering and is an important part of chemical engineering principle. The curriculum includes two parts: experimental theoretical teaching and the typical experimental teaching. The first part mainly expounds on the experimental methodology, data processing, testing techniques and the typical operation of chemical equipment. And the main project of the typical experiment includes: (1) Determination of fluid flow resistance; (2) the particular curve of the centrifugal pump; (3) determination of heat transfer coefficient; (4) absorber operations and determination of mass transfer coefficient;(5) distillation column operation and determination of the tower efficiency; (6) reverse osmosis membrane separation experiments; (7) gas membrane separation experiments; (8) electro dialysis experiments. With thoroughly learn the course, the

students will lay the foundation for engaging the works in the environmental chemistry, environmental chemical engineering, environmental testing enterprises and so on, such as technology development, process design, technological improvement, pollution controlling, etc.

Recommended Textbooks/References:

1. WU Hongte. Fundamental Chemical Engineering Experiment. Chemical Industry Press, 2010
2. MA Jiangquan. Experiment of Unit Operation. East China University of Science and Technology Press, 2008
3. ZHAO Yajuan, ZHANG Weilu, YU Weifang. Experiment of Unit Operation. China Science and Technology Press, 2009

Course Number: 0005375

Course Title: General Practice

Credit:1 **Total Credit Hours:** 30

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Without

Evaluation Method: Practice Report

Course Description:

In this course the new students can have a preliminary understanding about basic knowledge, application fields and development trends of the major though the study and visiting .The students can also realize the important function of the major in manufacture and life, thereby stimulating enthusiasm for learning and cultivating love for the major. At the same time, observation and reflection ability of the students can be cultivated; a good foundation for understanding major knowledge, building major thought and enhancing study of theory knowledge can be built.

Recommended Textbooks/References:

None

Course Number: 0005730

Course Title: Experiments of Water Quality Engineering Ⅱ-1

Credit: 1.0 **Total Credit Hours:** 24

Students: Undergraduate students Major in environmental engineering

Prerequisites: water quality engineering-2

Evaluation Method: Experimental reports

Course Description:

This course is a prerequisite course for undergraduates majored in environmental engineering. This course is contributed to help undergraduates know the biological treatment process well, cultivating the ability of independently thinking. Before experiments, students are required to pre-read the experimental illumination. During experiments, students are required to do the experiments and make observations. After experiments, experimental report is required. Aeration Experiment (integration, mastery)；Completely Mixed Activated Sludge Process (integration, mastery)；Measurement of SV% and SVI (integration, mastery)；Monitoring of Environmental Factor and Observation of Microorganism in Aeration Tank (integration, mastery)；Rotating Bio

Disc Experiment (operation, comprehension)；Computer Auto Control System of SBR (operation, comprehension), Experiment of Sequencing Batch Reactor (design, mastery)。

Recommended Textbooks/References:

Wang Shuying, Zeng Wei. experimental theory and technique of water quality engineering》, 2009

Course Number: 0005732

Course Title: Experiment of Air Pollution Control Engineering Ⅰ-1

Credit: 0.5 **Total Credit Hours:** 12

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Air Pollution Control Engineering

Evaluation Method: Experiment Report

Course Description:

This course includes the experiment of "removal of high concentration VOCs by absorption" and "purification of acid gas adsorption". The system is basically in same with the actual engineering system. Students should be able to deal with the system precisely in all aspects, e.g. adjust the butterfly valve, wind valve, muffler, air blower and its damping system, the size, connection and setting of the pipes, moreover, the setting of the sample point, and the type of the gas mask, etc. The requirements of the experiment: students should be able to master the basic principle of the instrument and the operation methods; conduct the whole process of the experiment, including install and adjust the instrument, observe the test phenomenon, analyze the experiment results and conclude a correct final report. Through the test, students should possess practical and scientific altitude, be faithful to the test phenomenon and develop a precise and serious working habit.

Recommended Textbooks/References:

Experiment instructor of Air Pollution Control Engineering (self-compiled textbooks).

Course Number: 0003615

Course Title: Solid Wastes Management Experiment

Credit: 0.5 **Total Credit Hours:** 12

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Solid Wastes Management

Evaluation Method: Experiment Report

Course Description:

This experiment is the required course for the students majored in environmental engineering, complying with the course of solid waste management. The objective of the experiment is to make the students integrate the theory learning with the experiment operating skill, through the observation and experimental, on one hand, students can understand deeply the knowledge in the course, on the other hand may exercise their research ability and problem solving ability.

This experiment course includes three experiments. (1) Leach ate Determination Experiment: Make the students learn to determine Chloride, Conductive, pH and Ammonia nitrogen in landfill leach ate; (2) Determination on Organic Compounds in Leach ate: Through determination of Chemical Oxygen Demand making the students understanding the concentration of organic compounds in landfill leach ate and the treatment effect of electrolysis of leach ate; (3) Compost

Mature Determination Experiment: Make the students earn to determine the mature Index of compost .

Recommended Textbooks/References:

1. Experiment guiding book edit by Beijing University of Technology

Course Number: 0007412

Course Title: Pump station design

Credit: 1 **Total Credit Hours:** 30

Students: Undergraduate of Environment engineering

Prerequisites: Fluid mechanics, Chemical principle, Pump and fan

Evaluation Method: Drafting and oral defense

Course Description:

This course is the environment engineering practice course. This course aims to cultivate students' independent ability to analyze and solve problems in practical projects, as well as the preliminary ability in project design based on theory knowledge. The task of this course is to carry out the real design of a pumping station based on the actual engineering situation, which include the choice of location, inflow and outflow style of water, the style of pump station, and drew the layout and cross-section of pump station. The whole process requires students to give full play the initiative and creativity, and completed design task independently.

Recommended Textbooks/References:

1. Zhang Jing-Cheng, Water Pump and Water Pump Station, (3rd edition), Harbin Institute of Technology Press, 2010
2. The Second Nuclear Industry Research and Design Institute, Water supply and drainage design manual (2nd edition), China Building Industry Press, 2001

Course Number: 0005733

Course Title: Experiment of Air Pollution Control Engineering Ⅰ-2

Credit: 0.5 **Total Credit Hours:** 12

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Air Pollution Control Engineering

Evaluation Method: Experiment Report

Course Description:

This course includes the experiment of "Performance measurement of sack-duster" and "Actual density measurement of dust". The course aims to master measuring method of performance of sack-duster and the effects of filtration rate on performance of sack-duster; to understand the principle of actual density measurement, random factors causing deviation and elimination method. The requirements of the experiment: students should be able to master the basic principle of the instrument and the operation methods; conduct the whole process of the experiment, including install and adjust the instrument, observe the test phenomenon, analyze the experiment results and conclude a correct final report. Through the test, students should possess practical and scientific altitude, be faithful to the test phenomenon and develop a precise and serious working habit.

Recommended Textbooks/References:

Experiment instructor of Air Pollution Control Engineering (self-compiled textbooks).

Course Number: 0005735
Course Title: Course Design of Water Quality Engineering
Credit: 1.0 **Total Credit Hours:** 24
Students: Undergraduate students Major in Environmental Engineering
Prerequisites: water quality engineering-1, drainage network engineering
Evaluation Method: Design drawings
Course Description:
This course objections are to (1) cultivating the right design idea, precise science attitude, and good work manner; (2) intensifying the ability of extending the theory knowledge, technique of design, and use of specialty drawing software; (3)cultivating the ability of using the basic knowledge to resolve the real engineering problems, leading students to complete the design task by themselves by initiative and creation and (4)request students in strict manner. The task is to design for a wastewater treatment plants by their understood knowledge. According to the accounting illustration, drawing and design performance, five levels was evaluated to make the final scores. Since this course need more extended knowledge, some necessary change can be altered according to the situation.
Recommended Textbooks/References:
Zhang Zijie, Theory and design of wastewater treatment, Feb, 2003

Course Number: 0005736
Course Title: The Course Design of Air Pollution Control Engineering
Credit: 1 **Total Credit Hours:** 30
Students: Undergraduate students Major in Environmental Engineering
Prerequisites: Physical Chemistry, Principle of Chemical Engineering, Air Pollution Control Engineering
Evaluation Method: Course Design
Course Description:
This course is an important professional degree course, which is designed for environmental engineering students. The aim of this course were: To foster students correct design thought, strict science attitude and good work style； To consolidate, strength, deepen and expend the theoretical knowledge and the basic professional skills as well as the drawing ability of using computer; To make the students use their basic theoretical and professional knowledge to deal with problems .Meanwhile to make the students accomplish the tasks by themselves. To be strict with the students, strengthen the sense of organizational discipline, and put the teaching thought into the whole course. The task of the course was to make engineering design of a factory air pollution control. Based on the knowledge of lessons such as Physical Chemistry, Principle of Chemical Engineering and Air Pollution Control Engineering, students can foster their engineering ability.
Recommended Textbooks/References:
1. Hao Jiming, Mang Guangda, Wang Shuxiao. Air Pollution Control Engineering, 3rd Edition. Higher Education Press, 2010.

Course Number: 0007409

Course Title: Professional Practice

Credit: 4.0 **Total Credit Hours:** 120

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: Water pollution control, Air pollution control, Management of Waste solid

Evaluation Method: Practice reports

Course Description:

This course provides students with theoretical knowledge, practical skills and an appreciation of the application of the subject. The aim of this course is to provide wide-ranging training in environmental engineering through involving in wastewater treatment plants, drinking water treatment plants, sanitary landfill, environmental companies, designing institutes and so on. This course enables the students to understand and grasp the theoretical knowledge in the fields of water pollution control, air pollution control and waste solid management as well as improve practical skills.

Recommended Textbooks/References:

None

Course Number: 0005731

Course Title: Experiments of Water Quality Engineering Ⅱ-2

Credit: 1.0 **Total Credit Hours:** 24

Students: Undergraduate students Major in Environmental Engineering

Prerequisites: water quality engineering-2

Evaluation Method: Experimental reports

Course Description:

This course is a prerequisite course for undergraduates majored in environmental engineering. This course is contributed to help undergraduates know the biological treatment process well, cultivating the ability of independently thinking. Before experiments, students are required to pre-read the experimental illumination. During experiments, students are required to do the experiments and make observations. After experiments, experimental report is required. Aeration Experiment (integration, mastery)； Completely Mixed Activated Sludge Process (integration, mastery)； Measurement of SV% and SVI (integration, mastery)； Monitoring of Environmental Factor and Observation of Microorganism in Aeration Tank (integration, mastery)； Rotating Bio Disc Experiment (operation, comprehension)； Computer Auto Control System of SBR (operation, comprehension), Experiment of Sequencing Batch Reactor (design, mastery)。

Recommended Textbooks/References:

1. Wang Shuying, Zeng Wei. Experimental theory and technique of water quality engineering, 2009

Course Number: 0005734

Course Title: Comprehensive Experiment of Air Pollution Control Engineering

Credit: 1.0 **Total Credit Hours:** 24

Students: Undergraduate students Major in Environmental Engineering
Prerequisites: Air Pollution Control Engineering
Evaluation Method: Experiment Report
Course Description:
This course includes the experiment of "Biological purification of VOCs", "Performance of electrostatic precipitator" and "Performance test of adsorbent". Comprehensive Experiment is designed according to the training target of this specialty and comprehensive application of the knowledge of air pollution control engineering. The comprehensive and designable experiments with engineering application type are of certain depth and difficulty. The requirements of the experiment: students should be able to master the basic principle of the instrument and the operation methods; conduct the whole process of the experiment, including install and adjust the instrument, observe the test phenomenon, analyze the experiment results and conclude a correct final report. Through the test, students should possess practical and scientific altitude, be faithful to the test phenomenon and develop a precise and serious working habit.
Recommended Textbooks/References:
1. Experiment instructor of Air Pollution Control Engineering (self-compiled textbooks).

Course Number: 0005234
Course Title: Senior Project
Credit: 16 **Total Credit Hours:** 480
Students: Undergraduate students Major in Environmental Engineering
Prerequisites: Water pollution control, Air pollution control, Management of Waste solid
Evaluation Method: Graduation Designing/Thesis
Course Description:
Senior Project is related to engineering designing about water pollution control, air pollution control and waste solid management. The aim is to improve the students' practical skills to solve the engineering problems. Graduation thesis involves the researches about novel theories, technologies and methods for pollutant removal and environmental protection. These researches enable the students to fully understand and grasp the theoretical knowledge as well as improve studying abilities.
Recommended Textbooks/References:
None

Course Number: 0007413
Course Title: Basics of Environmental Science
Credit: 2.0 **Total Credit Hours:** 32
Students: Undergraduate students Major in Environmental science
Prerequisites: "Inorganic Chemistry", "organic Chemistry ",
"Physical Chemistry", "Analytical Chemistry"
Evaluation Method: Written Exam
Course Description:
Basics of Environmental Science is a professional course of the Environmental Science. As a basis

of environmental education, the goal of this course is to improve environmental thought, ethics and awareness of students. Moreover, the environmental law, the concept and content of environmental science and environmental terminology are induced to grasp the main basic environmental knowledge and analyze the role of environmental laws, and find ways to solve environmental problems. This course also introduce the problems about the population and the environment, atmospheric environment, water environment, soil environment, physical environment, biological environment, human settlements environment, landscape, environment and sustainable development. This course elaborate the interaction between humans and the environment principle, not only to teach the major scientific achievements and environmental research in recent decades, but also about the latest research results of the basic theory in environmental science and talent training to adapt to social and economic development in the 21st century.

Recommended Textbooks/References:

1. Zuo YuHui, Edited , "Environmental Science" (2rd Edition), Higher Education Press, Publication Date: 2010
2. He Qiang, Edited, "Environmental Science Introduction" (3rd Edition), Tsinghua University Press, Publication Date: 2004

Course Number: 0005705

Course Title: Modern Instrument analysis

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Science

Prerequisites: Inorganic chemistry, analytical chemistry, organic chemistry

Evaluation Method: Written Exam

Course Description:

The instrumental analysis, as an analysis method, is used to analyze substances for obtaining the chemical composition and chemical structure information by measuring the parameters and their changes of physical or physical and chemical nature on some kind of complex and special equipment. It is generally used to analyzed the semi-micro (0.01-0.1g), trace (0.1-10mg), the ultra micro amounts (<0.1mg) with high sensitivity. The aim of this course is to make students have the ability to analyze the chemical material using the basis theory and knowledge of instrumental analysis.

Recommended Textbooks/References:

1. Liu Yuequan, Modern Instrument analysis, High Education Press, 2006.
2. Zhu Minghua and Hu ping, Instrument analysis, High Education Press, 2008.

Course Number: 0007414

Course Title: Environmental Chemistry

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Science

Prerequisites: Introduction to Environmental Science, Inorganic Chemistry, Organic Chemistry, Analysis Chemistry and Physical Chemistry

Evaluation Method: Written Exam (70%)+ Oral Presentation (15%)+ Assignment(10%) + paper (10%)

Course Description:

This course aims to make undergraduate students to grasp the basic Principles of environmental chemistry through learning the contemporary major environmental issues .The students should master the following important contents: 1.The major theories and methodology of environmental pollution chemistry.2.The causes, results, and control of various environmental pollution .3.The principles of migration and transformation of chemical pollutants and their distribution characteristics in ecological environment.

Recommended Textbooks/References:

1. Environmental Chemistry, Dai Shugui, Higher Education Press, 2001
2. Environmental Chemistry, 7th ed. Manahan S.E. Michigan: Lewis publishers,2004
3. Environmental Chemistry, Wang Xiaorong, Nanjing University Press, 2001
4. Environmental Science 6th ed, Daniel D, Chiras Jones and Bartlett Publishers
5. Environmental Chemistry, Zhao Meiping, Beijing University Press, 2005

Course Number: 0000577

Course Title: Environmental Monitoring

Credit: 4 **Total Credit Hours:** 64

Students: Undergraduate students Major in Environmental Science

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry,

Evaluation Method: Written Exam

Course Description:

This course is the basic compulsory course of undergraduate students of environmental science specialty, which is very important to the undergraduate students. It consists of classroom instruction of 32 credit hours and experimental contents of 32 credit hours. In the course the undergraduate students will study the knowledge about the monitoring methods of the content of pollutants in water body, air, soil, solid waste and the sound level of environmental noise so that they can master the basic concepts and principles, the location and sampling methods, the monitoring methods of pollutants and the monitoring data processing. Througth the study of experimental contents, the undergraduate students will be well-trained in technical ability of environmental monitoring.

Recommended Textbooks/References:

Textbook

1. XI Danli, SUN Yusheng. Environmental Monitoring (Fourth Edition). Higher Education Press, 2011.

References

1. CHEN Ling, ZHAO Jianfu. Environmental Monitoring. Press of Chemical Industry, 2004.
2. XI Danli, Handbook of Environmental Engineering — Environmental Monitoring Volume. Higher Education Press, 1998.

Course Number: 0002231
Course Title: Environmental Ecology
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Environmental Science
Prerequisites: Introduction to Environmental Science
Evaluation Method: Written Exam
Course Description:
Environmental Ecology, as a sub-subject of ecology, is of to study the mechanism, rule and effect of changing ecosystem because of human disturbance using ecology theory, to find the measures to recover and rebuild the degraded ecosystem. The objective of this course is to make students know about the formation and development of environmental ecology, understand most of classis ecology theory on population, community and ecosystem, familiar with the features of all kinds of degraded ecosystem and how to recovery them, learn about ecological assessment and planning, also have the ability to think and analyze the ecological environmental problems using the basis theory and knowledge of environmental ecology.
Recommended Textbooks/References:
1. Sheng Lianxi, Environmental Ecology(Second Version), High Education Press, 2003.
2. Lu Shenggao and Lv Jun, Environmental Ecology, Zhejiang University Press, 2004.

Course Number: 0005709
Course Title: Environmental Planning
Credit: 2.0 **Total Credit Hours:** 32
Students: Undergraduate students Major in Environmental Science
Prerequisites: Introduction to Environmental Science
Evaluation Method: Written Exam
Course Description:
Environmental planning is one of the important courses for the major of environmental science and engineering, which is mainly operated through theory teaching. It aims to help students to understand the significant roles of environmental planning on co-development of environment and economy, to recognize various types of the environmental planning, and to learn the contents, programming, methodologies of the typical environmental planning.
This course mainly includes the primary theories of the environmental planning (environmental capacity, sustainable development, complex ecosystem, spatial structure theory ,etc.), the dominant contents (objectives and assessment index system, environmental assessment and prediction, environmental function division, environmental decision scheme model, etc.), the basic methodologies (forecast methodology, assessment methodology, decision methodology, etc.), and the practical application of above contents and methodologies in water environment, atmospheric environment, soil environment.
Recommended Textbooks/References:
1. Guo Huaicheng, “Environmental Planning”, China Higher Education Press (CHEP), 2009.
2. Liu Wei, “Environmental Planning and Management”, Chinese Chemical Industry Press, 2006.

Course Number: 0005710

Course Title: Solid Wastes Management

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Engineering and/or Environmental Science

Prerequisites: Chemistry, Introduction to Environment Protection

Evaluation Method: Written Exam

Course Description:

This course will mainly discuss the integrated Municipal Solid Waste (MSW) management from waste generation to final disposal in order to content the requirement of Waste management policy: reduction, recycle and safe treatment. The objective of this course is to make the students learn the policies of MSW management, the principle and characteristics of the processing, transformation techniques and disposal methods on MSW. This course mainly introduce the collection, transfer and transport of MSW, the compaction, size reduction and separation techniques on MSW, the biological conversion technologies on MSW including composting and digestion, the thermal conversion technologies on MSW including combustion, paralysis and gasification, the MSW final disposal technology- sanitary landfill. The students are required to master the separation, composting, combustion and sanitary landfill techniques on MSW.

Recommended Textbooks/References:

1. George Tchobanoglous. Integrated Solid Waste Management, Beijing: Tsinghua University Press, 2000

2. J MI Zhenming, GAO zhongai,etal. Solid Waster treatment and disposal, Beijing: Higher Education Press, 1993

3. LI Jianguo. Solid Waste Treatment and Recycling Engineering. Beijing: Higher Education Press, 2001

4. ZHUANG Weiqiang. Solid Waste Treatment and Utilization, Beijing: Chemical Industry Press, 2001

Course Number: 0005707

Course Title: Air Pollution Control Engineering Ⅰ

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Science

Prerequisites: Four Chemical Courses

Evaluation Method: Written Exam

Course Description:

Air Pollution Control Engineering is a required course of Environmental Science and Engineering majors, which focuses on gaseous pollutants and discusses the basic theory of air pollution control and particulate control, the basic principles of various control processes, the basic structure of typical control equipment and process design calculations. The course aims at training students' abilities of analyzing and solving problems about air pollution control and laying a necessary foundation of design, research and technology management. The basic topics include: Air Pollution and Global Climate, General Ideas in Air Pollution Control, Particulate and Gaseous Pollutant Control Technologies, Control of Gaseous Pollutants, Control of Sulfur Oxides, Control of Nitrogen Oxides, Control of Volatile Organic Compounds (VOCs), The Motor

Vehicle Problem.

Recommended Textbooks/References:

1. Hao Jiming, Air Pollution Control Engineering (Third Edition), Higher Education Press, 2010
2. Noel de Nerves, Air Pollution Control Engineering (Second Edition), Tsinghua University Press, 2001
3. Guojin, Air Pollution Control Engineering, Chemical Industry Press, 2004

Course Number: 0005763

Course Title: Environmental Chemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Science

Prerequisites: Introduction to Environmental Science, Environmental Chemistry

Evaluation Method: Oral Presentation (30%)+ Notes(30%) + paper and report (40%)

Course Description:

This course arms to undergraduate student to grasp the theory of recycling economy and the relationship between recycling economy and cleaner production. The main contents and audit process of cleaner production are expounded from the angle of the combination of theory with case study. Eco- industry and industrial ecology theory and practice are also be introduced in this course. The students will learn about the implement recycling economy laws and regulations and macro-programmed in china

Recommended Textbooks/References:

1. Cleaner Production and recycling economy Xi Danli Chemical Industry Press 2005
2. Cleaner Production Zhao Yuming China Environmental Science Press 2005
3. The theory and ways for cleaner production Zhang Kai Cui Zhaojie Science Press 2005

Course Number: 0002256

Course Title: Environmental Management and Law

Credit: 2 **Total Credit Hours:** 32

Students: environmental science

Prerequisites: Inorganic chemistry, Analytical chemistry, Organic chemistry, Environment logy, Environmental Pollution Chemistry

Evaluation Method: Written Exam

Course Description:

This course aims to make graduate students to grasp the basic principles and methods of environmental management and law through learning the contemporary major environmental issues .The students should master the following important contents: 1.The major theories and methodology of environmental management. 2.The actual situation of China’s environmental management and the status of foreign environmental management. 3.The principles of environmental law. 4.The development, purpose and role of environmental law.

Recommended Textbooks/References:

1. Environmental Management, Ye Wenhu, Higher Education Press, 2006
2. Environment and Resources Law, Jin Reilin, Higher Education Press, 2006

Course Number: 0007419
Course Title: Environmental Toxicology
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Environmental Science
Prerequisites: Inorganic chemistry, analytical chemistry, organic chemistry
Evaluation Method: Written Exam
Course Description:
The aim of Environmental toxicology is to study the biological absorption, the distribution in vivo, metabolic conversion and excretion of environmental chemical pollutants. It includes the basic theory of general toxicity, specific toxicity of environmental chemical pollutants (carcinogenic change induced distortion and mutagenic effects). The evaluation methods, environmental chemicals on human health risk and safety evaluation theory and technology are also discussed.
Recommended Textbooks/References:
1. Meng Ziqiang, Environmental toxicology, High Education Press, 2006.

Course Number: 0004371
Course Title: Environmental Economics
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Environmental Science
Prerequisites: Introduction to Environmental Science
Evaluation Method: Written Exam
Course Description:
Environmental Economics is a new subject between economics and environmental science. It study the relationship between economic development and environmental protection using economics theory, and how to build a well-running environmental economic system and achieve the sustainable development. The contents include, the basic theory of environmental economics, such as externality theory, public goods, market failure; the cost-benefit analysis to environmental effect; valuation method of environmental resources; environmental economic policies; Green GDP, etc.
Recommended Textbooks/References:
1. Wang Jinnan, Environmental Economics-Theory, Method and Policy, Tsinghua University Press, Beijing. 1994.
2. Ma Zhong, Environmental and Resource Economics, High Education Press, Beijing, 1999.
3. Zuo Yuhui, Environmental Economics. High Education Press, Beijing, 2003.

Course Number: 0005712
Course Title: Air Pollution Meteorology I
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Environmental Science
Prerequisites: Advanced Mathematics
Evaluation Method: Written Exam
Course Description:

This course introduces the basic principles of air pollution meteorology, including the types and characteristics of air pollutants, meteorological factors affecting the spread of air pollution, air pollutant dispersion theory and modeling, the mechanism of atmospheric dispersion in urban areas and major air quality models and their applications, etc. It offers the migration and diffusion mechanisms of pollutants in the atmosphere. After learning the course, students will have a good academic background for the air pollution control. After learning this course, students can grasp the basic theory of atmospheric science knowledge, and get good academic background knowledge of air pollution control. This course covers: Overview of the atmosphere and air pollution, Measures of the Atmosphere, Atmospheric energy budgets, Forces influencing atmospheric motion, Atmospheric stability, Basic theory of atmospheric diffusion, Air quality models.

Recommended Textbooks/References:

1. JIANG Weimei, Air Pollution Meteorology Tutorials. Meteorological Press, 2004
2. LI Zongkai, Air Pollution Meteorology Theory and Application. Meteorological Press, 1985

Course Number: 0005713

Course Title: Analysis of Environmental System

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students Major in Environmental Science

Prerequisites: Introduction to Environmental Science

Evaluation Method: Written Exam

Course Description:

As one of the optional courses for the undergraduate students major in environmental science, this course mainly introduces the conception and analysis methodologies of environmental system. It would demand students to recognize the basic concepts and theories of system, to learn the relationship of environmental system analysis and environmental management, to grasp the basic methodologies of environmental forecast, pollution simulation, and environmental planning, which would be helpful for students to systematically recognize environmental pollutions and conduct environmental management measures in future.

Recommended Textbooks/References:

1. Cheng Shentong, Analysis of Environmental System, Chemical Industry Press, 2000.
2. Wei Heping, Environmental System Engineering, Tongji University Press, 2003.

Course Number: 0005735

Course Title: Cognitive Practice

Credit: 1 **Total Credit Hours:** 30

Students: Undergraduate students Major in Environmental Science and engineering .

Prerequisites: None

Evaluation Method: Report

Course Description:

The purpose of the practice is to allow students to effectively learn how to apply theoretical knowledge to actual production, so that students truly grasp and apply their expertise, and the

ability to integrate theory with practice. In the course, students will visit a large solid waste transfer station, garbage composting plant and a large urban sewage treatment plants and other environmental treatment facilities. Through independently inspecting the relevant literature, conducting research and writing cognition practice report and other sectors, students will be familiar with the solid waste and sewage treatment and environmental science expertise.

Recommended Textbooks/References:

Course Number: 5719

Course Title: Modern Instrument analysis Experiment Ⅰ

Credit: 1.5 **Total Credit Hours:** 36

Students: Undergraduate students Major in Environmental Science

Prerequisites: Inorganic Chemistry, Analytical Chemistry, Organic Chemistry

Course Description:

The instrumental analysis experiment is one of the professional basic courses of environmental science major. It is need to coordinate closely with instrumental analysis course. Moreover, it is an independent course because the exercise is important. It is involved in gas chromatography, liquid chromatography, UV-Vis, IR and electrochemistry. The aim is improving the ability to operate and deepening the theoretical knowledge.

Recommended Textbooks/References:

1. Wan Qijin, Yu Dezhong, Zan Guofang, Instrument Analysis Experiment, Chemical Industry Press, 2008.

Course Number: 0005720

Course Title: Curriculum Design of Environmental Quality Assessment

Credit: 1 **Total Credit Hours:** 30

Students: Undergraduate students Major in Environmental Science and Engineering

Prerequisites: Higher Mathematics

Evaluation Method: Curriculum Design Report

Course Description:

This course is included in the practice curriculums for the major of Environmental Science and Engineering, playing an important role on the personnel training. Purpose of this course is to enable students to (1)understand the application of atmospheric pollutants diffusion models in the actual cases of environment assessment; (2)understand the methods and course of meteorological data processing; (3)master several atmospheric models; (4)master the operation methods and data processing of LIDAR. The content of the course are: meteorological data processing and calculation of emissions diffusion; prediction of regional atmospheric pollutants concentration using EIAA, prediction of regional atmospheric pollutants concentration using multi-dimensional multi-box model, experiment of LIDAR, demonstration of atmospheric environmental numerical simulation.

Recommended Textbooks/References:

1. CHENG Shuiyuan et al. Project and Strategic Environmental Impact Assessment, Beijing: China Environmental Science Press, 2008.

2. CHENG Shuiyuan et al.. Project and Regional Environmental Impact Assessment, Beijing: China Environmental Science Press, 2002.
3. LU Shuyu et al., Environment Quality Assessment, Beijing, Higher Education Publishing House, 2001.
4. SHI Baozhong et al., Project Environmental Impact Assessment, Beijing: China Environmental Science Press, 1999.

Course Number: 0007415

Course Title: Laboratory Experiments of Environmental Chemistry

Credit: 0.5 **Total Credit Hours:** 12

Students: Undergraduate students Major in Environmental Science and Engineering

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry.

Evaluation Method: Experiment Report

Course Description:

This lab experiment course provides 3 extensively tested environmental chemistry experiments — with extensive introductory background material for each experiment. It covers a broad range of methods and provides detailed instructions on calculation of results. Experiments involve analysis of heavy metal Cr ion and its distribution in waste water; determination of chlorophyll A concentration in water; test of octane-water distribution coefficient of organic compounds. The course aims to help each student develop the ability to:

Plan out an experimental procedure and develop good lab techniques;

Conduct accurate chemical analyses on environmental samples;

Interpret chemical data on environmental samples;

Write both short and long reports describing your work and interpreting the significance of the results.

Recommended Textbooks/References:

1. Environmental Chemistry.7th ed. Manahan S.E. Michigan: Lewis publishers, 2004

Course Number: 0006360

Course Title: Comprehensive Experiments I in Environmental Monitoring I

Credit: 1 **Total Credit Hours:** 24

Students: Undergraduate students Major in environmental science

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Environmental Monitoring

Evaluation Method: Experiments

Course Description:

This course is the compulsory course of undergraduate students of environmental science specialty. After the students studied environmental monitoring course, they are assigned to investigate the environmental qualification of Beijing University of Technology campus by means of the knowledge they have studied. The purpose is that the students can further consolidate what has been learned by the practice course, understand the applications of environmental monitoring and submit the reliable data of the environmental qualification of Beijing University of Technology

campus. The experimental contents are including: the monitoring of NOX in air; the monitoring of SO2 in air; the monitoring of total suspended particulate in air; the monitoring of environmental noise. The students are assigned the comprehensive experiments in environmental monitoring according to the national standard methods of environmental monitoring. So that the students can be trained in more similar to real situation. Through the study of experimental contents, the students will be well-trained in technical ability of environmental monitoring.

Recommended Textbooks/References:

1. XI Danli, SUN Yusheng. Environmental Monitoring Experiment. Higher Education Press, 2011.

Course Number: 0007416

Course Title: Professional training of Environmental Science

Credit: 2 **Academic hours:** 48

Students: Environment and Energy Institute, Environmental Science Department

Prerequisites: Inorganic chemistry, Organic chemistry, Physical chemistry, Environmental chemistry, Introduction to Environmental Science

Evaluation Method: Report

Course Description:

Purpose of this course is to enable students to master the skill of experimental design and operation in analyzing and controlling environmental pollutants. After learning this course, students can grasp the basic theory of catalytic and analytic science knowledge, and get the good academic background knowledge of catalytic control and analysis in air pollution. After a series of experiments, the ability of students in analyzing and solving problem can be improved. This course requires students to master the high-pressure liquid chromatography analysis methods in environmental monitoring, the catalytic purification method and preparation methods of catalysts. The grasp of the evaluation methods for environmental catalysts and analysis are also required.

Recommended Textbooks/References:

1. He Hong, Li Junhua, He Hong et. al., Environmental Catalysis (First Edition), Beijing: Science Press, 2008.
2. Dong Deming, Hua Xiuyi, Kang Chunli. Experiment of Environmental Chemistry (First Edition), Beijing: Peking University Press, 2010

Course Number: 0007409

Course Title: Productive Technology Practice II for New Energy Science and Engineering

Credit: 4 **Total Credit Hours:** 120

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamic, Heat Transfer, Engineering Combustion, Fluid Mechanics

Evaluation Method: Written Report

Course Description:

This course is a important practice teaching link for the students Major in new energy science and engineering. The students are expected to understand the production process, equipments, to train the practical ability, safety production; to understand the management of modern company and to

establish the consciousness of cost, quality and management by objective, basic concepts, theories, methods. This course mainly includes: Invite company engineer to introduce the configuration, production process and equipments, performance test and safety production; Tour production workshop; worked together with worker; write reports.

This practice includes two aspects. One is mainly conducted in power plant. Another is practiced in new energy and renewable energy enterprises.

Recommended Textbooks/References:

1. Materials for Production Practice in Cogeneration Power Plant. Provisionally compiled.
2. Jianmin Liu. Solar Energy Utilization Principle, Technology and Engineering (in Chinese), Publishing House of Electronics Industry, 2010
3. Ruicheng Zheng. Technical Guidebook for Solar Water Heating System of Civil Building(second Edition, in Chinese).Chemical Industry Press, 2011
4. Yingzhou Jia. Design and Installation of Solar Heating System (in Chinese). Posts and Telecom Press, 2011
5. Hongxing Yang, Wei Zhou. Application of Solar Energy Technologies in Buildings (in Chinese). China Architecture and Building Press, 2008.

Course Number: 0007417

Course Title: Experiment of Municipal Solid Waste Recycling

Credit: 1 **Total Credit Hours:** 24

Students: Undergraduate students Major in Environmental Science

Prerequisites: Environmental Science

Evaluation Method: Examination based on the experimental reports

Course Description:

On the basis of understanding the basic conception and method of waste disposal and recycling, students should strengthen to understand their learned knowledge and reinforce on some respects. Students are required to master the basic experimental method, measure and practice technology. At the same time students are taught to master the correct using method of instruments and experimental equipment as well as data handling and data analysis. The experiment contents include the introducing of experimental method and principle, the installing the imitating landfill bioreactor, inspecting the biogas composition and concentration, the inspecting of main pollutant of leach ate, the testing of active sludge performance and the recycling plan designing of active sludge. The students are trained to have a serious scientific attitude and unite and cooperating spirit as well as careful and tidy experimental habit.

Recommended Textbooks/References:

1. HE Pinjing, Solid Waste Disposal and Recycling Technology. Beijing: High Education Press, 2011
2. CAO Weihua, SUN Xiaojie, ZHAO Youcai, the Application Example of Sludge Disposal and Recycling, Beijing: Metallurgical Industry Press, 2010

Course Number: 0002264
Course Title: Experimental Technique of Pollution Control Engineering
Credit: 1.0 **Total Credit Hours:** 24
Students: Undergraduate students Major in Environmental Science
Prerequisites: water quality engineering-2
Evaluation Method: Experimental reports
Course Description:
This course is a prerequisite course for undergraduates majored in environmental science. This course is contributed to help undergraduates know the biological treatment process well, cultivating the ability of independently thinking. Before experiments, students are required to pre-read the experimental illumination. During experiments, students are required to do the experiments and make observations. After experiments, experimental report is required. Aeration Experiment (integration, mastery)；Completely Mixed Activated Sludge Process (integration, mastery)；Measurement of SV% and SVI (integration, mastery)；Monitoring of Environmental Factor and Observation of Microorganism in Aeration Tank (integration, mastery)；Rotating Bio Disc Experiment (operation, comprehension)；Computer Auto Control System of SBR (operation, comprehension), Experiment of Sequencing Batch Reactor (design, mastery).
Recommended Textbooks/References:
1. Wang Shuying, Zeng Wei. experimental theory and technique of water quality engineering , 2009

Course Number: 0005234
Course Title: Senior Project
Credit: 16 **Total Credit Hours:**480
Students: Undergraduate students Major in Environmental Science and Engineering
Prerequisites: All basic courses and specialized courses
Evaluation Method: The mentor evaluation & Reviewers reviews & Thesis
Course Description:
Upon completion of the whole theory lessons and practice, students are required to complete the graduation project and thesis writing work under the guidance of teachers, who will help them to select a topic in the related fields of environmental science. This will effectively improve students' knowledge, skills, abilities and overall qualities.
Recommended Textbooks/References:
1. It will be determined by the instructor.

Course Number: 0007075
Course Title: Freshmen Seminar Course
Credit: 1 **Total Credit Hours:** 16
Students: Major in New Energy Science and Engineering
Prerequisites:
Evaluation Method: homework + final report

Course Description:

This course covers the introduction of new energy science and utilization technology. Upon completion, students should be able to know the scopes of their specialty and distinguishing features of refrigeration and air-conditioning industry.

Recommended Textbooks/References:

Course Number: 0007075

Course Title: Freshmen Seminar Course

Credit: 1 **Total Credit Hours:** 16

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: High School Chemistry

Evaluation Method: Open-book Examination

Course Description:

Freshmen Seminar Course is a Discipline Requirement course for the students of Applied Chemistry, and its aim is to require the students to understand the most recent research progresses on the catalytic technology for the control of atmosphere pollutions, bio-mimetic catalysis and green chemistry technology, automotive exhaust pollutions and their emission control technology, synthesis and applications of malodorous molecular sieves, microcontroller nano- and micrometer capillary chromatography and their applications in the separation of DNA and protein, chip HPLC system, microchip channel proton exchange membrane fuel cells, science and technologies, synthesis and applications of organic-metal framework materials, and fabrication and applications of nonporous materials.

Recommended Textbooks/References:

1. The main websites related to Chemistry and Chemical Engineering.

Course Number: 0000063

Course Title: Inorganic Chemistry II

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Environmental Science and Environmental Engineering

Prerequisites: High School Courses

Evaluation Method: Written Examination

Course Description:

Inorganic Chemistry is a compulsory professional basic course of environmental science and environmental engineering. This course plays an important role in the students' professional learning. The study of the course should be based on high school chemistry knowledge, and provide the necessary knowledge of theoretical and inorganic chemistry knowledge for all subsequent courses. The major content of this course include: chemical thermodynamics, chemical equilibrium, radix, atomic structure, molecular structure, coordination chemistry and elemental chemistry. Through the study of inorganic chemistry courses, students should master the basic knowledge of the periodic law of elements, the modern theory of structure of matter, chemical thermodynamics, chemical equilibrium and oxidation-reduction and master the main properties,

structures and applications of important elements and compounds. Through the teaching process, the abilities of students in theoretical analysis and calculation of general inorganic chemistry problem should be trained, and the scientific thinking ability of students also be trained.

Recommended Textbooks/References:

1 Department of Inorganic Chemistry, Dalian University of Technology, "Inorganic Chemistry", Higher Education Press, 2001.

2 HU Zhong, "Basis of Modern Chemistry", Higher Education Press, 2001.

3 ZHU Yuzhen. "Basis of Modern Chemistry", Chemical Industry Press, 1998.

Course Number: 0005739

Course Title: Organic Chemistry-1

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Analytical Chemistry

Evaluation Method: Written Examination

Course Description:

Organic Chemistry-1 is one of the required basic courses for the students majored in Applied Chemistry. On the basis of learning Inorganic Chemistry and Analytical Chemistry, the task of this course is to teach basic theoretical knowledge and research methods in organic chemistry. Through this course, students should master the structure, source, method of preparation, physical and chemical properties of various types of organic compounds. Meanwhile, students should proposed some design ideas in the analysis, separation and synthesis route of organic compounds, and analyze the relationship between the structure and properties of common organic compounds according to the theory of organic chemistry. This course is continued from inorganic chemistry and analytical chemistry, and will establish the theoretical basis for fine organic synthesis principle and technology I, fine chemicals chemistry I, and other professional courses. Therefore, attention should be paid to the connecting role of this course during teaching. According to the current development of Organic Chemistry, new knowledge, new theories and new methods will be introduced to enable students to adapt to the modern socio-economic and industrial requirements in Applied Chemistry.

Recommended Textbooks/References:

1. GAO Hongbin, "Organic Chemistry (4^{th} Ed.)", Higher Education Press, 2005.

2. XING Qiyi, "Basic Organic Chemistry", Higher Education Press, 2002.

3. YUAN Lubing, "Organic Chemistry", Higher Education Press, 2005.

4. DU Canping, "The Development Strategy of Organic Chemistry in the 21st Century", Chemical Industry Press, 2002.

Course Number: 0005740

Course Title: Organic Chemistry-2

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Analytical Chemistry

Evaluation Method: Written Examination

Course Description:

Organic Chemistry-2 is one of the required basic courses for the students majored in Applied Chemistry. On the basis of learning Inorganic Chemistry and Analytical Chemistry, the task of this course is to teach basic theoretical knowledge and research methods in organic chemistry. Through this course, students should master the structure, source, method of preparation, physical and chemical properties of various types of organic compounds. Meanwhile, students should proposed some design ideas in the analysis, separation and synthesis route of organic compounds, and analyze the relationship between the structure and properties of common organic compounds according to the theory of organic chemistry. This course is continued from inorganic chemistry and analytical chemistry, and will establish the theoretical basis for fine organic synthesis principle and technology I, fine chemicals chemistry I, and other professional courses. Therefore, attention should be paid to the connecting role of this course during teaching. According to the current development of Organic Chemistry, new knowledge, new theories and new methods will be introduced to enable students to adapt to the modern socio-economic and industrial requirements in Applied Chemistry.

Recommended Textbooks/References:

1. GAO Hongbin, "Organic Chemistry (4th Ed.)", Higher Education Press, 2005.
2. XING Qiyi, "Basic Organic Chemistry", Higher Education Press, 2002.
3. YUAN Lubing, "Organic Chemistry", Higher Education Press, 2005.
4. DU Canping, "The Development Strategy of Organic Chemistry in the 21st Century", Chemical Industry Press, 2002.

Course Number: 0005741

Course Title: Physical Chemistry-1

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physics, Calculus, etc.

Evaluation Method: Closed-book Examination

Course Description:

Physical Chemistry, which is the theoretical course for the undergraduate students major in Applied Chemistry, is one of the compulsory and key courses. The task of the course is to introduce physical chemistry principle and basic theory, and to explain the change and law of the physical chemistry processes. Through the study of physical chemistry, students should have a systematic understanding on physical chemistry, obtain the ability in apply the physical chemistry knowledge in the practical work, and have a systematic understanding on the important concepts and principle, knowing the significance and limitation of thermodynamics. The main contents consist of gas state equation; the concepts and calculation of state function U, H, A, G, S and path function Q, W ; the first law of thermodynamics and the second law of thermodynamics, chemical reaction isothermal equation and factors affecting reaction equilibrium, mono-component and bi-components phase equilibrium, surface phenomena and chemical kinetics.

Recommended Textbooks/References:

1. HU Ying, et al., "Physical Chemistry" (4th Ed.), Higher Education Press, 1999.
2. DENG Jingfa, FAN Kangnian, "Physical Chemistry", Higher Education Press, 1993.

3. YAO Yongbin, et al., “Physical Chemistry Tutorial” (Revised Ed.), Hunan Education Press, 1991.
4. ZHU Wentao, et al., “Physical Chemistry”, Tsinghua University Press, 1995.
5. FU Xiancai, et al., “Physical Chemistry” (4th Ed.), Higher Education Press, 1990.

Course Number: 0002226
Course Title: Unit Operation I
Credit: 4.5 **Total Credit Hours**: 72
Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Calculus, Physical Chemistry
Evaluation Method: Written Examination
Course Description:
Through the study of unit operation, such as fluid flow, basic equations of fluid flow, heat transfer, gas absorption, distillation and drying of solid to enable students to deeply understand basic principles and typical equipment in chemical industry. The abilities related to analyze and solve various problems and design requisite equipment in chemical industry will be improved. The students are expected to understand the basic concepts, theories, methods, and techniques of unit operation. The knowledge, including mass balance, heat balance and momentum balance, the calculation and selection of pump, heat transfer device, tower and dryers, is required.
Recommended Textbooks/References:
1. CHEN Meiheng, “Unit Operation” (3rd Ed.), Chemical Industry Press, 2006.
2. YAO Yuying, “Unit Operation”, Tientsin Since and Technology Press, 1995.
3. WANG Zhan, “800 Examples for Unit Operation”, National Defense Press, 2005.
4. William M. Deen, “Analysis of Transport Phenomena”, Oxford University Press, 2008.

Course Number: 0005742
Course Title: Physical Chemistry-2
Credit: 3 **Total Credit Hours:** 48
Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Calculus, Linear Algebra, Probability and Statistics, University Physics, Inorganic Chemistry and Physical Chemistry-1
Evaluation Method: Written Examination
Course Description:
It is main target that to obtain the knowledge of the fundamental principles of physical chemistry, and to greatly improve the ability to solve problems in the subject. This serial of courses introduces students to the physical concepts and methods used in explaining modern chemical knowledge. Electrochemistry; chemical kinetics, fundamentals of catalysis and optical chemistry; selections of colloid and interface chemistry were included in present course. Present course is based on the thermodynamic theory of physical chemistry-1, focus on the theory and practice of electrochemistry, rate theory of chemical kinetics, rate of complex reactions, homogenous and heterogeneous reactions, diffusion, absorption, colloidal and interfacial physical chemistry. Calculus, Linear Algebra, Probability and Statistics, University Physics, Inorganic Chemistry,

Physical Chemistry-1 are prerequisites.

Recommended Textbooks/References:

1. LI Songlin, ZHOU Yaping, LIU Junji, et al., "Physical Chemistry" (5th Ed.), Higher Education Press, 2010.
2. SHEN Wenxia, et al., "Physical Chemistry" (5th Ed.), Higher Education Press, 2006.
3. HU Ying, "Physical Chemistry" (4th Ed.), Higher Education Press, 1999.
4. ZHU Wentao, "Fundamental Physical Chemistry", Tsinghua University Press, 2011.
5. Ira N. Levine, "Physical Chemistry" (5th Ed.), McGraw-Hill, 2002.
6. Peter Atkins, et al., "Physical Chemistry" (7th Ed.), W.H. Freeman and Company, 2002.

Course Number: 0006167

Course Title: Principles and Technology of Fine Organic Synthesis I

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Structural Chemistry

Evaluation Method: Written Examination

Course Description:

Principles and Technology of Fine Organic Synthesis is an important Discipline Requirement course for the students of Applied Chemistry. Its aim is to introduce to the students the basic theories and technological theories of fine chemical synthesis, and the kinetics, thermodynamics, mechanisms, and applicable scopes of halogenations, suffocation, and sulfating, nitration and intonation, hydrogenation and reduction, diazotization and diazonium transformation, aminolysis and animation, alkylation's, acylation, oxidation, hydrolysis, and condensation. On the basis of lecture, experiments, discussion, exercises, and examination, the students are expected to grasp the basic theories and techniques of fine chemical synthesis, to design and select the optimal synthesis pathways for the synthesis of the desired products by using the related basic theories and principles and all kinds of unit reactions, so that it will lay a solid foundation for the learning of other Major courses and the solving of practice problems.

Recommended Textbooks/References:

1 TANG Peikun, "Chemistry and Technology of Fine Organic Synthesis", Tianjin University Press, 2001.
2 YAO Mengzheng, et al., "Synthesis Principles of Fine Chemicals", China Petrochemical Press, 1992.
3 YANG Jinzong, "Fundamentals of Industrial Organic Synthesis", China Petrochemical Press, 1998.
4 ZHANg Zhuyong, "Unit Reaction of Fine Organic Synthesis", East China University of Technology Press, 2003.
5 CHENG Lvbo, et al., "Synthesis and Applications of Fine Chemicals", Dalian University of Technology Press, 1992.
6 Imoto Minori (Translated by CHENG Nenglin, et al.), "Organic Electronic Theory—Fundamentals of Organic Chemistry", Chemical Industry Press, 1990.

Course Number: 0005744

Course Title: Chemical Engineering and Technology

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Physical Chemistry, Chemical Engineering Principles, Separation Engineering, Chemical Reaction Engineering and Catalysis

Evaluation Method: Written Examination

Course Description:

Chemical Engineering and Technology is a required discipline basic course. The generation of the bulk inorganic chemical products and basic organic chemical products is the basis of the sustainable development of the entire chemical industry. The production principle and process of these basic inorganic or organic chemical products is the major achievement of the present chemical engineering theory, and the foundation for a future development of the chemical engineering theory. Such principle and process play an irreplaceable role in developing other new chemical products and process Through the studying of this course, students will possess a solid foundation in chemical engineering and technology, have a deep understanding of the raw material and process route selection, the typical unit operations, and the chemical process accomplishment, and be able to analyze, improve, and develop the existing or novel chemical process and product. The major target of this course is to teach student how to develop a chemical process, and then to enhance their ability of independent thinking, analyzing and solving problems, which could lay a good foundation for students' employment and further development.

Recommended Textbooks/References:

1. TAN Shiyu, XUE Rongshu, "Chemical Engineering and Technology" (3rd Ed.), Chongqing University Press, 2009.
2. HUANG Zhongjiu, FAN Dingye, "Chemical Technology", Higher Education Press, 2001.
3. LIAO Qiaoli, MI Zhentao. "Chemical Technology", Chemical Industry Press, 2001.
4. WU Zhinan, "Basic Organic Chemical Technology", Chemical Industry Press, 1999.
5. CHEN Wuping, "Inorganic Chemical Technology" (3rd Ed.), Chemical Industry Press, 2002.
6. Jacob A. Moulijn, Michiel Makkee, Annelies Van Diepen, "Chemical Process Technology", Wiley, 2001.
7. Roel Prins, Gorge C.A. Schuit, "Chemistry and Chemical Engineering of Catalytic Process", Springer, 1980.

Course Number: 0005745

Course Title: Catalysis Chemistry

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Structural Chemistry

Evaluation Method: Written Examination

Course Description:

Through the studies on this course, the students are required to grasp the preparation methods of multiple typical catalysts, instrumental analysis methods for the characterization of catalytic materials and the techniques for spectral analysis, the deduction and confirmation of catalytic reaction mechanisms and catalytic reaction kinetic equations, the establishment of kinetic models;

to understand adsorption and description behaviors of various gases on the catalyst surfaces and catalytic deactivation and regeneration. With the training of scientific thinking and comprehensive analytical ability, the students should possess the ability to use the catalytic fundamental knowledge and modern instrumental analysis methods to solve practical problems. The main content of this course include: the basic concepts of catalysis, the physicochemical properties of catalysts, the adsorption behaviors of gases on catalyst surfaces, the preparation methods of common catalysts, the characterization methods of catalysts, the catalytic reaction mechanisms and catalytic reaction kinetic equations, and the structures and catalytic properties of zealots and malodorous materials. The important contents of this course are the adsorption in catalysis, catalyst preparation methods, and catalyst characterization methods; the difficult contents of this course are the adsorption in catalysis, the analysis of characterization spectra, and the establishment of the structure-performance relationship of the catalysts.

Recommended Textbooks/References:

1. GAO Zhengzhong, DAI Hongxing, "Practice Catalysis" (2nd Ed.), Chemical Industry Press, 2012.
2. HUANG Kaihui, WAN Huilin, "Fundamental of Catalysis", Science Press, 1980.
3. J.R. Anderson (Translated by YIN Yuangen et al.), "The Experimental Methods of Catalysis (Vol. 3: Surface and Characterization of Adsorbed Species)", Science Press, 1986.
4. WU Yue, "Catalysis Chemistry", Science Press, 1990 and 1995.
5. R. Hughes, "The Deactivation of Catalysts", Science Press, 1990.
6. C.N. Satterfield (Translated by PENG Li et al.), "Practical Heterogeneous Catalysis", Peking University Press, 1990.

Course Number: 0002225

Course Title: Analytical Chemistry II

Classification: Basic and Required Course

Credits: 4 **Total Credit Hours:** 64

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Calculus

Evaluation Method: Written Examination

Course Description:

The main contents include: the sampling and preparation of samples; the classification of errors, the causes of errors, the representation of errors and deviations, the concept of accuracy and precision and their mutual relationship, Significant figures and rules, t distribution, confidence and confidence interval, and the simple linear regression; quality assurance and quality control; concept of the standard substances, the preparation of standard solutions and calibration method, expression method of standard solution concentrations, and the calculation of titrimetric analysis; the pH value calculation of acid and alkali solutions, titration curves and choice of indicators for the systems of strong acids and strong bases, monobasic weak acids and bases, and multiphase weak acids and bases; side effects and side effects coefficient, conditional stable constants, the mechanism of action of metal indicators and the principle for selection; concept of conditional electrode potential and its influence factors, radix titration curve and the calculation of the electrode potential at the stoichiometric point, the selection of radix indicators; the influence of common-ion effect, salt effect, acid effect, and the coordination effect to precipitation solubility,

the concept of conditional solubility product; Bouguer–Lambert–Beer law, drawing standard curve. The main difficulties of this course: statistic treatment of the experiment data and the statistical law of random error, significant tests; the coefficient of side effects, the calculation of conditional stable constants; conditional electrode potential.

This course requests the students to obtain the basic theory and experimental techniques of chemical analysis, to be familiar with qualitative and quantitative analysis methods, to train themselves to have careful and strictly scientific attitudes and strong experimental techniques. It will give them a good theoretical background and solid experiment technology basis.

Recommended Textbooks/References:

1. Wuhan University (Ed.), "Analytical Chemistry" (5th Ed.), Higher Education Press, 2006.
2. PENG Chonghui, FENG Jianzhang, ZHANG Xiyi, "Analytical Chemistry" (3rd Ed.), Peking University Press, 2009.
3. SUN Yuqing, HU Yuzhu, "Analytical Chemistry" (2nd Ed.), Science Press, 2006.

Course Number: 0005746

Course Title: Modern Chemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry, Unit Operation, Catalysis Chemistry

Evaluation Method: Open-book Examination

Course Description:

This course is an elective course for undergraduate students of Applied Chemistry. Its aim is to let the students understand the research progresses and applied technologies of battery materials, environmental catalysis, bio-mimetic catalysis, separation strategies, membrane materials, calculation chemistry, inorganic and organic materials.

Through the study of this course, the students will understand the research progresses and applied technologies of battery materials, environmental catalysis, bio-mimetic catalysis, separation strategies, membrane materials, calculation chemistry, inorganic and organic materials, so that it will lay a good foundation for the students' employments and further developments.

Recommended Textbooks/References:

1 HE Hong, et al., "Environmental Catalysis", Science Press, 2008.
2. Wu Yue, "Catalysis Chemistry", Science Press, 1990 and 1995.
3. HU Changwei, et al., "Principles and Applications of Green Chemistry", China Petrochemical Press, 2002.
4. XU Ruren, et al., "Structures and Synthesis of Zeolitic Molecular Sieves", Jilin University Press, 1987.
5. WANG Zhan, "Fundamentals of Membrane Separation Technology" (2nd Ed.), Chemical Industry Press, 2006.
6. LI Jinghong, "Advanced Battery Materials", Chemical Industry Press, 2004.
7. Sun Xiaoqiang, "Introduction to Supramolecular Chemistry", China Petrochemical Press, 1997.

Course Number: 0005728

Course Title: An Introduction to Energy Science

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students

Prerequisites: no

Evaluation Method: Written Exam

Course Description:

This course introduces the general situation of energy science, the problem it's faced with, the solutions to these problem and the prospect of development, delivers the basic knowledge and theory of energy science to students. The aim of the course is to make students understand the energy history, new energy technology and its developing trend, improve and strengthen student's energy conservation and environmental protection consciousness, lay the foundation for the related energy scientific research and operation management. This seminar focuses on clarifying the energy concepts and energy classification in order to make the students establish energy evaluation foundation. The specific energy which will be analyzed and discussed in this course are fossil energy, nuclear energy, hydrogen, solar energy, wind energy, hydropower, biomass energy, geothermal energy.

Recommended Textbooks/References:

1. Huang Suyi, Gao Wei. Introduction to energy. Higher Education Press, 2004
2. Su Yaxin, Mao Yuru, Zhao Jinde, New energy and Renewable energy. Higher Education Press, 2006
3. J.R. Vankey, translated by Wang Naili, Energy: prospect of 21th century. Shanghai Jiaotong University Press,2008

Course Number: 0001680

Course Title: Modern Instrumental Analysis

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Analytical Chemistry

Evaluation Method: Written Examination

Course Description:

Instrumental analysis is one of fundamental courses of chemistry major, it's an important tool to characterize the chemical composition, structure of materials, which is important to scientific research and quality control. The purpose of course is to make student fully understand modern analysis field through the study of course, containing spectrum, electrochemistry, chromatography, mass spectrum and related field. The deep understanding of instrument's structure, functionality, and application is required, and the ability to use proper analytical method for analyzing different samples is also required. Besides, students are supposed to understand the trend of modern instrument analysis, increasing the innovation ability.

Recommended Textbooks/References:

1. Auja & Jespersen, "Modern Instrumental Analysis" (1st Ed.), Elsevier Science, 2006.
2. (2) Robert D. Braun, "Introduction to Instrumental Analysis", McGraw-Hill, 1987.

Course Number: 0005752

Course Title: Specialized English for Chemistry and Chemical Engineering

Credits: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: College English, Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry, Unit Operation, Chemical Engineering & Technology

Evaluation Method: Open-book Examination

Course Description:

This is an elective course in the Applied Chemistry major. Technical English is significantly different than everyday English in terms of grammar and composition. It requires that students have a good understanding of general English, have basic knowledge of the grammar and a decent vocabulary. Through the study of this course, students will be able to familiarize themselves with the characteristics of technical English, to master more specialized vocabularies, and to have the ability to read academic textbooks. It will give a solid foundation for future research work.

This course will cover the following contents: the characteristics of technical English for Chemistry and Chemical Engineering and learning methods; commonly used terminology for Chemistry-related word formation and ways to translate well; reading and translation of academic literature; and writing skills for scientific papers.

This course requires students to master learning methods, translation, and writing skills of technical English for Chemistry. Through quizzes and homework, students' reading abilities will improve. Students will be required to skillfully read and translate academic literature, and to correctly write abstracts and brief reviews in English.

Recommended Textbooks/References:

1. Yuhong, "Specialized English for Chemistry and Chemical Engineering", China Light Industry Press, 2006.
2. DONG Jian, "Specialized English for Chemistry and Chemical Engineering", Zhejiang University Press, 2010.
3. DING Hui, MA Xiaoyan, LI Chenglin, "Specialized English for Applied Chemistry and Chemical Engineering", Harbin Institute of Technology Press, 2007.

Course Number: 0002254

Course Title: Information Retrieval in Chemical Science and Engineering

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Fundamental Courses and Specialized English in Chemistry and Chemical Engineering

Evaluation Method: Open-book Examination

Course Description:

This course belongs to the elective course for the students of Applied Chemistry, and is a Major Requirement course for the students who have studied the fundamental and specialty courses and are going to do thesis. The contents of this course include the developments of American chemical abstracts (CA), structures, and contents, the basic method for the use of the CA, the resources of internets and our library, several worldwide famous chemistry websites and database, the most commonly used chemistry software, and the introduction to the fundamentals of calculation

chemistry.

The students are required to understand the use of computers and to have the ability to survey the literature via internets. This course introduces comprehensively the method to survey the literature, including the introduction on the CA, famous chemistry websites, database, our library resources, literature managements, the most commonly used chemistry software, and the introduction to the fundamentals of calculation chemistry.

Recommended Textbooks/References:

1. CHEN Mingdan, "Chemical Information", Chemical Industry Press, 2005.

Course Number: 0007410

Course Title: Applications of Computers in Chemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, etc.

Evaluation Method: Open-book Examination

Course Description:

Computer Chemistry, which mainly introduces the application of computer in chemistry field, is one optional course for students majored in applied chemistry. The students are expected to understand the basic concepts, theories, methods, and techniques. The basic topics include: the computer basic knowledge such as hardware, software and binary; molecular modeling, including the generation and representation of 2 dimensional & 3 dimensional molecular models, and generation of physicochemical parameters; auto deductive systems for reaction kinetics, including the principles of numeric auto deductive systems, the CRAMS system and designing an experiment; computer simulation of organic reactions, including the synthesis design systems and chemical reactivity. The structure and manipulation of the "CHEM OFFICE" is also introduced. Undergraduate students will be trained for using the software of the "CHEM OFFICE".

Recommended Textbooks/References:"“

1. Johann Gasteiger, Thomas Engel (Translated by LIANG Yizeng et al.), "Chemoinformations", Chemical Industry Press, 2005.

Course Number: 0002258

Course Title: Separation Technology in Chemical Engineering

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Principles of Chemical Engineering, Physical Chemistry, Analytical Chemistry, Instrumental Analysis

Evaluation Method: Written Examination

Course Description:

The course, which is concerned with chemical engineering separation process, is set up specifically for the engineering undergraduate curriculum in the College of Environmental and

Energy Engineering. The scope of chemical separation technology mainly focuses on the separation, extraction and purification the product of from the mixtures. This course covers the principles and applications of mass transfer and separation engineering. The research progress of the unit operations and chemical separation process was also included. In this course, the phase equilibrium, thermodynamics, kinetics, molecular and co-aggregation state of the microscopic mechanism of heat transfer, mass transfer and momentum transfer theory was used to study the separation and purification technology in the complex mixtures of chemical production. Through this course, students should master the basic theory of a variety of commonly used separation process, operating characteristics, calculation method and strengthen ways to improve operations. Moreover, some of the new separation technologies will be learned.

Recommended Textbooks/References:

1. CHEN Huanlin, "New Separation Technology", Chemical Industry Press, 2005.
2. LIU Jiaqi, "Separation Process", Chemical Industry Press, 2002.
3. CHEN Hongfang, LIU Jiaqi, "Separation Process in Chemical Engineering", Chemical Industry Press, 2006.

Course Number: 0005747

Course Title: Applied Electrochemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Physical Chemistry

Evaluation Method: Written Examination

Course Description:

Chemical power sources, electrolysis, electroplate, metal corrosion and protection and electrochemical sensors are introduced in this course. The students are expected to understand the basic concepts, theories, methods, and techniques of applied electrochemistry, through which their abilities to solve the related problems will be improved. The basic topics include: the basic concepts and property targets of the chemical power sources, composition, structure and the electrochemical characteristics of primary batteries and second batteries (such as Zn-Mn cell, lead-acid battery, Li-ion battery and fuel cell), the basic concepts and property targets of the electrolysis, the principle, technology and related calculation of chlorine alkali and aluminum electrolysis industry, electrochemical principle of metal corrosion and protection methods, structure and application of electrochemical sensors, electrochemical testing such as CV and EIS.

Recommended Textbooks/References:

1. YANG Qiqin, FANG Beilong "Applied Electrochemistry", Zhongshan University Press, 2001.
2. WU Huihuang, "Foundation of Applied Electrochemistry", Xiamen University Press, 2006.

Course Number: 0005749

Course Title: Introduction to Green Chemistry

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate in Applied Chemistry, Environmental Engineering, Environmental Science

Prerequisites: Inorganic Chemistry, Analytical Chemistry, Physical Chemistry, Organic Chemistry

Evaluation Method: Open-book Examination

Course Description:

This course is designed for Applied Chemistry, Environmental Engineering, Environmental Science undergraduates to take as a limitedly elective course. The main content of this course include that one eliminate or reduce the use and production of hazardous substances to jeopardize human health, community safety, the ecological environment, design and research the technically, economically viable chemicals and chemical processes having the loadings on environment as small as possible, though making use of green chemistry principles. Focuses are made on the basic principles and methods of green chemistry principles to understand and gasp. The difficulty lies in how to implement and realize these basic principles of green chemistry principles and methods in the production, research, and applications of chemistry and chemical engineering

Recommended Textbooks/References:

1. HU Changwei, "Principle and Application of Green Chemistry", China Petrochemical Press, 2002.
2. ZHONG Chongli, "Introduction to Green Chemistry", Chemical Industry Press, 2000.
3. JI Hongbing, SHE Yuanbin, "Green Oxidation and Reduction", China Petrochemical Press, 2005.
4. Paul T. Anastas, John C. Warner, "Green Chemistry—Theory and Practice", Oxford University Press, 1998.

Course Number: 0006149

Course Title: Assistants Chemistry and Applications

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry.

Prerequisites: Inorganic Chemistry, Organic Chemistry, Physical Chemistry and Synthesis of Fine Chemicals.

Evaluation Method: Open-book Written Examination

Course Description:

This course is a specialized direction courses for the undergraduate students major in applied chemistry. The main contents of "Assistants Chemistry and Application" include the characteristics and applications of plasticizer, antioxidant, heat stabilizer, light stabilizer, fire retardant, foaming agent, defoaming agent, surfactant, emulsifier, dispersant, rheological agent, thickener, and flow agent in coating industry, detergent industry, textile industry, food industry and paper-making industry. The students are expected to master how to choose a proper additive quickly and precisely from the vast and expansive industry additives database. The depth and breadth of this course are similar to other engineering universities.

Recommended Textbooks/References:

1. QIU Wenge, LI Songyue, "Industry Additives and Their Formulation Technology", Chemical Industry Press, 2009.
2. FENG Yaqing, WANG Lijun, et al., "Assistants Chemistry and Technology", Chemical Industry Press, 1997.
3. QIAN Fenglin, ZHU Yushu, "Coating Additives", Chemical Industry Press, 1990.

4. LI Yousen, “A Practical Manual of Light Chemical Industry”, Chemical Industry Press, 2005.
5. XIAO Weidong, “Chemical Assistants of Polymers”, Chemical Industry Press, 2003.
6. DONG Yongchun, “Textile Assistants Chemistry and Applications”, Chemical Industry Press, 2007.

Course Number: 0003223
Course Title: Fine Chemicals Chemistry
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Applied Chemistry.
Prerequisites: Inorganic Chemistry, Organic Chemistry, Physical Chemistry and Synthesis of Fine Chemicals
Evaluation Method: Open-book Written Examination
Course Description:
This course is a specialized direction courses for the undergraduate students major in applied chemistry. Fine chemicals have been a kind of very important materials in industry. Recently special coatings and adhesives, especially pro-environmental and harmonious coatings and adhesives have received increasing interest in chemical industry. The students are expected to understand the basic concepts, preparation methods and application of coatings and adhesives. The main contents include two parts, coatings and adhesives. The coating part includes introduction of coatings, coating resins, assistants and additives, preparation process of coatings, and some special coatings. The adhesives part includes introduction of adhesives, commonly used adhesives and some special adhesives.
Recommended Textbooks/References:
1. HONG Xiaoyin, et al., “Coating Chemistry”, Science Press, 2005.
2. QIAN Fenglin, ZHU Yushu, “Coating Additives”, Chemical Industry Press, 1990.
3. YANG Yukun, et al., “Synthetic Adhesive Series”, Science Press, 1996.
4. CHENG Lvbo, “Synthesis and Application of Fine Chemicals”, Dalian University of Technology Press, 2007.
5. WANG Mengzhong, “Adhesive Application Manual”, Chemical Industry Press, 1993.

Course Number: 0005750
Course Title: Environmental Catalysis
Credit: 2.0 **Total Credit Hours:** 32
Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Analytic Chemistry, Physical Chemistry
Evaluation Method: Written Examination
Course Description:
Environmental Catalysis opened by College of Environmental and Energy Engineering is a limited optional course in which theory and practice is closely bonded. The task of this course is to introduce systematically and comprehensively the development, applicative situation and the trend of the technique of environmental catalysis. This course proceeds from the relationship between environments and catalysis and the catalytic systems involve the main research objects in

environmental catalysis. The aim of this course is to systematically discuss the properties of environmental catalysis. According to the characteristics of environmental catalysis, the course explains in detail the preparation and characterization of the catalyst, the principle and process of catalytic reaction. It also summarizes the latest research development and application of the catalytic technique in dealing with different environment and explores the trend of the techniques of environmental catalysis.

Recommended Textbooks/References:

1. HE Hong, et al., "Environmental Catalysis", Science Press, 2008.
2. WU Zhongbiao, "Environmental Catalytic Principles and Applications", Chemical Industry Press, 2006.
3. Vicki H., "Environmental Catalysis", CRC Press, Taylor & Francis Group, 2005.

Course Number: 0005748

Course Title: Inorganic Preparation Chemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analysis Chemistry, Physics Chemistry

Evaluation Method: Written Examination

Course Description:

Inorganic Preparation Chemistry is a major elective course for the Applied Chemistry Majors and the foundation for the follow-up professional courses. This course is one of the most important parts for overall knowledge structure. Synthetic chemistry and material chemistry for molecular sieve and porous materials is main contents, which include synthetic law of molecular sieve and porous materials, structure characterized, and the basic theory and research method of synthesis chemistry. Molecular design and directional synthesis of inorganic porous materials, the synthesis and characterization of malodorous materials, research front and the development direction of advanced porous materials will be main parts. Through learning of this course, learners can grasp the preparation technology of nano porous materials, the basic theory of material structure, and the basic principle of chemical reaction, posses the abilities of solving inorganic preparation problems and self-study relative major knowledge, and build a good foundation for the future work.

Recommended Textbooks/References:

1. XU Ruren, PANG Wenqin, "Inorganic Porous Materials", Science Press, 2004.
2. WANG Shimin, XU Zhuxun, FU Jing, "Nonmaterial Processing Technology", Chemical Industry Press, 2003.
3. Zhang Lide, MU Jimei, "Nonmaterial and Nanostructures", Science Press, 1998.
4. PAN Furang. "Design and Preparation of Solid Catalysts", Nankai University Press, 2003.
5. ZHOU Zhukang, GU Tiren, Ma Jiming, "Colloid Chemistry Foundation", Peking University Press, 1999.

Course Number: 0005220

Course Title: Structural Chemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Calculus, Inorganic Chemistry, Organic Chemistry
Evaluation Method: Written Examination
Course Description:
Structural Chemistry is a specific discipline mainly to study the microscopic structures of atoms, molecules and crystals, the law of the atom's and molecule's motion, the relationship between the structure and the properties. Its mission is to enable students to understand the basic law of the microscopic motion of matter, the basic theory of the atomic, molecular and crystal structure, and the relationship between the materials' structures and properties, the basic principles of modern physical methods in the field of molecular and crystal structure. The content includes the basis of quantum mechanics, the orbital and energy levels of electrons in atom, the molecular orbital and its energy level, the nature of chemical bond, the spatial configuration and conformation of molecular, the symmetry theory (the preliminary group theory), the metal complexes and the knowledge about the crystal field and lagan field theory, the atom's arrangement in crystal and the crystal energy state.
Recommended Textbooks/References:
1. ZHOU Gongdu, DUAN Lianyun, "Fundamentals of Structural Chemistry" (4^{th} Ed.), Peking University Press, 2008.
2. WANG Rongshun, "Structural Chemistry", Higher Education Press, 2006.
3. Stepan S. Batsanov, Andrei S. Batsanov, "Introduction to Structural Chemistry", Springer, 2012.

Course Number: 0000818
Course Title: Membrane Separation Technology
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Principles of Chemical Engineering, Physical Chemistry, Analytical Chemistry, Instrumental Analysis
Evaluation Method: Written Examination
Course Description:
The course, which is concerned with membrane materials and membrane separation process, is set up specifically for the engineering undergraduate curriculum in the College of Environmental and Energy Engineering. The aim of this course is to enable students to understand the new chemical separation technology i.e. membrane separation technology, developed in recent 30 years. The students are expected to understand the basic concepts, theories, and methods related to membrane technology. In this course, membrane technologies e.g. reverse osmosis, nano filtration, ultra filtration, micro filtration, pervaporation, gas separation and electro dialysis are introduced. It introduces new developments like membrane based membrane bioreactor and transmembrane distillation too. The membrane techniques are presented based on physical principles as well as on scale up procedures. Industrial applications are presented and analyzed. The course teaches improvement in segmentation of available process solutions in respect to separation efficiency, yield and economics and process optimization in respect to process parameters and equipment. By learning this course, the creativity and practice abilities of the students will be improved.
Recommended Textbooks/References:

1. WANG Zhan, Basic Principles of Membrane Separation Technology (second Edition), Chemical Industry Press,2006
2. Jun Shi, Quan Yuan, Congjie Gao, Handbook of Membrane Technology, Chemical Industry Press,2006
3. Yiyuan Gao, Linbi Ye, Basic Principles of Membrane Separation Technology (second Edition), Science Press,2006

Course Number: 0000824
Course Title: Extraction and Application of Natural Products
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Organic Chemistry
Evaluation Method: Written Examination
Course Description:
Regular sets, the extraction of natural products and the application of the relevant theory, important natural physiological active components of molecular structure, physicochemical properties, extraction and separation, purification, and molecular structure determination methods to teach students knowledge and problem solving methods, culture and have engaged in the production of natural medicines and research. Specific knowledge including all kinds of natural medicine chemistry (primarily physiological active components or active ingredient) natural product separation method, sugar and glycoside extraction and physiological of coumarins, extraction and biological activity, extraction and separation of flavonoids, terpenoids and physiological activity of extraction and physiological activity of anthraquinone compounds, extraction and biological activity, extraction and separation of alkaloids from and its physiological activity and biosynthetic pathways.
Recommended Textbooks/References:
1. XU Rensheng. Natural Product Chemistry (Second Edition). Beijing: Science Press, 2004
2. YAO Xinsheng. Natural Pharmaceutical Chemistry (Third Edition). Beijing: People's Medical Press, 2001

Course Number: 0003224
Course Title: Biochemical Reaction Engineering
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in Applied Chemistry
Prerequisites: Basis of Chemical Engineering; Physical Chemistry; Microbiology
Evaluation Method: Written Examination
Course Description:
Biochemical reaction engineering is a combination of engineering knowledge of bio-engineering elective courses, the theoretical basis of biochemistry, microbiology, chemical engineering basis. The course is designed for undergraduate students major in Applied Chemistry. The basic content is divided into two aspects of the kinetics of biochemical reactions and biochemical reactions. The main task of the course is to enable students to master the basic theory and knowledge of the

dynamics of biochemical reactions, and understanding of the biochemical reactions in the biochemical processes in the core. Meanwhile, the course makes students have the capabilities of analysis and develop biochemical reaction engineering, as well as design, zoom in, operate and control of biochemical reactions to solve practical problems in the process of biochemical reactions practical ability.

Recommended Textbooks/References:

1. QI Yizheng, WANG Shuxiong, "Biochemical Reaction Kinetics and Reactor", Chemical Industry Press, 2005.
2. ZHU Bingchen, "Chemical Reaction Engineering", Chemical Industry Press, 2010.
3. LI Shaofen, "Chemical and Catalytic Reaction Engineering", Chemical Industry Press, 2008.

Course Number: 0003220

Course Title: Medicinal Chemistry

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analysis Chemistry, Physics Chemistry

Evaluation Method: Written Examination

Course Description:

Medicinal Chemistry is a course to study chemical structure of chemical medicines, preparation principle, physical and chemical properties, metabolism, structure-function relationship, biological activity, and new drug development using the modern scientific methods. It is a interdisciplinary of chemistry and life science. By learning this course, students can grasp the relevant basic knowledge of medicinal chemistry, preparation methods and their application, and build the foundation for the future work. In this course it will be introduced that the name of the drugs in both Chinese and English, physical and chemical properties of drugs, chemical structure characteristics of different drugs for the central nervous system, peripheral nervous system, circulation system, digestive system, thermal pain, ant tumor, antibiotics, chemical treatment, hormone and vitamins, basic efficacy structure and groups, acting targets and function way and method of preparation.

Recommended Textbooks/References:

1. ZHENG Hu, "Medicinal Chemistry", People's Medical Publishing House, 2003.

Course Number: 0004761

Course Title: Inorganic Chemistry Ⅱ Experiment

Credit: 1.5 **Total Credit Hours:** 36

Students: Undergraduates Major in Applied Chemistry

Prerequisites: Nothing

Evaluation Method: Test

Course Description:

Inorganic chemistry Ⅱ experiment is the first fundamental chemistry experiment course for undergraduates major in Applied Chemistry. The teaching content covers preparation of inorganic material, test of basic chemistry principles, constant determination, properties experiment of

elements and compound, and comprehensive experiment. Through studying the course, the students are expected to obtain perceptual knowledge from experiments, to understand chemistry concept as well as theory in depth and utilize them flexibly, to master the elementary operation and fundamental skill of chemistry experiment, to get the ability to observe and analyze experimental phenomena, to form a good habit of recording experimental results honestly, to be capable of making logical deduction and drawing correct conclusion in the process of dealing with experimental results, to be able to express correctly using chemistry language and write experiment report on one's own, consequently, to lay a solid foundation for further study and following courses.

Recommended Textbooks/References:

1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011
2. CUI Aili. Fundamental Inorganic Chemistry Experiment. Higher Education Press, 2007
3. Group of Inorganic Chemistry, Dalian University of Technology. Inorganic Chemistry Experiment, Higher Education Press, 2004

Course Number: 0005754

Course Title: Experiments of Organic Chemistry I

Credit: 1.5 **Total Credit Hours:** 36

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Experiments of Inorganic Chemistry

Evaluation Method: The experiment site evaluation and level of experiment reports

Course Description:

"Experiments of Organic Chemistry I" is one of the most fundamental experiment courses and the link of practice teaching for undergraduate students of major in applied chemistry. The teaching aims are not only to verify and strengthen the basic theory of knowledge, but also to reach the following requirements:

(l) To make the students master the basic theory of the organic chemistry experiment and basic knowledge, grasp the basic experimental skills of organic chemistry;

(2 To make students with strong practical ability and the ability to finish experiments independently;

(3) To make students have strong abilities of self-study, observing, the comprehensive analysis and solving practical problems;

(4) To make students have serious, practical and realistic attitude and the rigorous work style, make the students get preliminary training in scientific method.

This course combines the basic operation and synthetic experiments. Experimental contents are more compact reasonable, and to ensure the quality of experiment.

Recommended Textbooks/References:

1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011

Course Number: 0005757

Course Title: Chemistry Major Experiments II-1

Credit: 2 **Total Credit Hours:** 48

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Unit Operation, etc.

Evaluation Method: Report

Course Description:

Chemistry Major Experiments II-1 is an obligatory course of practice aspects. The purposes are to enhance students' ability to consult literature, integrate the competence of knowledge applications, analyze and solve the problems, and improve the experimental operation skills. The course covers a variety of typical synthetic reaction types, the basic operating techniques, qualitative and quantitative methods, and three key technologies in manufacturing functional fine chemicals — synthesis, separation, complex formulation and so on. The basic topics include: Checkout of tea, seniority detecting approach to understand the tea features, identification of caffeine and catechins in tea, to identify whether tea is genuine or not; checkout of sesame oil, to detect sesame oil mixed with peanut oil and soybean oil, active ingredient in sesame oil; preparation of orange blossom ether, the preparation method of orange blossom ether, recrystallization, melting point determination; Preparation of p-benzoquinone, learning oxidation of aniline to synthesize p-Grassian, understanding the chemical oxidation process of manganese dioxide; complex formulation of adhesive 107 (wallpaper glue), construction synthetic adhesives 107, understanding the method for removing free formaldehyde in 107 adhesive and its performance.

Recommended Textbooks/References:

None

Course Number: 0005375

Course Title: Cognitive Practice

Credit: 1 **Total Credit Hours:** 30

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Unit Operation, Principles and Technology of Fine Organic Synthesis

Evaluation Method: Open-book Examination

Course Description:

Cognitive Practice is a Discipline Requirement course for the students of Applied Chemistry, which begins after the study of the related basic theories and partial Major courses. Through Cognitive Practice, the students are expected to have an opportunity to contact practice production, to combine the theories with practice, to deepen the understanding of production, scientific research, overall determination, and environmental protection. By so doing, the students are expected to broaden their applied chemistry knowledge, to contact all kinds of production departments, and to understand the basic knowledge of modern enterprise managements, production equipment, production diagrams, and modern technology development. The students are trained to raise their ability to combine the related theories with practice and solve the practice problems, so that it will lay a foundation for the subsequent learning other Major courses.

Recommended Textbooks/References:

None

Course Number: 0003806

Course Title: Unit Operation Experiments I

Credit: 1.5 **Total Credit Hours:** 36

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Higher Mathematics, Engineering Mathematics, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Chemical Industry Automation and Instrument, Electrical and Electronic Technology, Principles of Unit Operation, etc.

Evaluation Method: Process assessment

Course Description:

The Experiment of Unit Operation is the basic course of applied chemistry and is an important part of chemical engineering principle. The curriculum includes two parts: experimental theoretical teaching and the typical experimental teaching. The first part mainly expounds on the experimental methodology, data processing, testing techniques and the typical operation of chemical equipment. In order to develop the students' ability to work independently and to meet the need of different levels, professional and interested students, some improved design experiments are available to students besides the basic experiments. The main project of the typical experiment includes: (1) Determination of fluid flow resistance; (2) the particular curve of the centrifugal pump; (3) determination of heat transfer coefficient; (4) absorber operations and determination of mass transfer coefficient; (5) distillation column operation and determination of the tower efficiency; (6) determination of drying operation and the drying rate curve; (7) constant pressure filtration experiments; (8) reverse osmosis membrane separation experiments; (9) gas membrane separation experiments; (10) electro dialysis experiments. With thoroughly learn the course,the students will lay the foundation for engaging the works in the chemical, fine chemical, petrochemical, and biochemical enterprises, such as new product research, technology development, process design, technological innovation, engineering application, etc.

Recommended Textbooks/References:

1. WU Hongte. Fundamental Chemical Engineering Experiment. Chemical Industry Press, 2010.
2. MA Jiangquan. Experiment of Unit Operation. East China University of Science and Technology Press, 2008.
3. ZHAO Yajuan, ZHANG Weilu, YU Weifang. Experiment of Unit Operation. China Science and Technology Press, 2009.

Course Number: 0005755

Course Title: Experimental Physical Chemistry

Credit: 1.5 **Total Credit Hours:** 36

Students: Undergraduates Major in Applied Chemistry

Prerequisites: Physical Chemistry Ⅱ

Evaluation Method: Exam

Course Description:

Students are encouraged to finish the experiments independently. This course mainly focuses on

the contents including chemical change, the phase change and the reaction rate, etc. On the basis of grasping principles of physical chemistry and scientific research methods, the ability of employing flexibly the theories in physical chemistry will be will be improved. The specific experiments showed as followed: The basic theories of measuring the saturated steam pressure and the application of vacuum technologies, the basic theories of combustion heat determination and the use of Reynolds graphic method, gas-liquid phase diagram obtained using the ebullionmeter, the solid-liquid phase diagram determined by the thermal analysis, the polarization curve achieved by Galvan static method, the ionization constant of the solution measured by using electronic bridge, the rate constant of ethyl acetate specification reaction reached by conductivity method, the surface tension of the liquid gained by using the maximum bubble pressure method, the micro-structure and micro section component of the samples observed by using scanning electron microscope (SEM), the component and usage of the X-ray diffraction (XRD) demonstrated intuitively, the explanation of some TG-DTA profiles , and the specific surface area (BET) of the catalyst characterized by nitrogen adsorption-description.

Recommended Textbooks/References:

1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011
2. Physics and chemistry in Tianjin University. Physical Chemistry (Fifth Edition). Beijing: Higher Education Press, 2009

Course Number: 0005756

Course Title: Course Design of Unit Operation II

Credit: 2.0 **Total Credit Hours:** 60

Students: Undergraduate students Major in Applied Chemistry and Environmental Science

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Unit Operation

Evaluation Method: Written Examination

Course Description:

The main task of the Course Design of Unit Operation is to let the students to grasp the basic programs and methods of unit operation design through the course design, and to obtain the training in the survey of literature, the selection of formulas and data, the description of results in terms of concise sentences and figures, and drawing. It is required for the students to establish right design ideas, to seek truth from facts, and cultivate the serious and responsible work style, so that the students can solve the practice problems by using the engineering viewpoints and strengthen the relation of theory and practice.

The main contents of this course include the introduction of design programs, the technological design and calculations of main equipment, the selection and calculations of typical equipment, diagrams of technology, technological schemes of main equipment, and the writing of design specifications.

Recommended Textbooks/References:

1. CHEN Yingnan, “Design of Commonly used Chemical Unit Equipments”, East China University of Technology Press, 1996.
2. MEI Ciyun, “Course Design of Unit Operation”, South China University of Technology Press, 1990.

3. CHEN Minheng, “Unit Operation”, Chemical Industry Press, 2000.
4. Editorial Commission of Chemical Engineering Handbook, “Handbook of Chemical Engineering”, Chemical Industry Press, 1982.
5. Shanghai Design Institute of Medicine, “Design Handbook of Chemical Technology”, Chemical Industry Press, 1986.

Course Number: 0007407

Course Title: Chemistry Major Experiments II-2

Credit: 2 **Total Credit Hours:** 48

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Unit Operation, Principles and Technology of Fine Organic Synthesis, etc.

Evaluation Method: Report

Course Description:

Chemistry Major Experiments II-2 is a required course of practice aspects. The purposes are to enhance students’ ability of consulting literatures, integrated competence of knowledge applications, the problem solving and analysis ability and to improve the experimental operations and equipment skills. The course covers a variety of typical synthetic reactions, the basic operation techniques, qualitative and quantitative methods, and three key technologies in manufacturing functional fine chemicals — synthesis, separation, complex formulation, and so on. The basic topics include: oxidation of cyclohexanol to prepare adipic acid, methods and characteristics of the oxidation reaction, operations of melting point detector, the water circulation pump; preparation of antioxidants biphenyl A, the principle in synthesizing antioxidants bisphenol A, preparation methods and performance determination; extraction of coloring matter from red hot chili peppers to, extracting the red pigment from the red hot chili peppers to, thin layer chromatography; the principle of the polycondensation reaction; preparation of alkyd resins, alkyd resins synthesis and performance measurement methods.

Recommended Textbooks/References:

None

Course Number: 0007408

Course Title: Chemistry Major Experiments II-3

Credit: 2.5 **Total Credit Hours:** 60

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, Physical Chemistry, Unit Operation, Principles and Technology of Fine Organic Synthetic, etc.

Evaluation Method: Report

Course Description:

Chemistry Major Experiments II-3 is an obligatory course for Applied Chemistry major students of practice aspects. Through the study of multi-step organic synthesis experiments, such as preparation of ω-caprolactam, preparation of fire-resistant coating, emulsion copolymerization of vinyl--acetate and acryl ate, and so on, the students grasp the basic skills and knowledge of

organic chemical reactions, validate and deepen the understanding of basic theories of organic chemistry, organic compounds and organic reactions. This experiment also trains the students to learn the appropriate choice for synthesis, isolation, and identification methods of organic compounds. In addition, the students can gain the capabilities about how to retrieve literature, record the experimental phenomenon, analyze test data and processes. Via the experiments, the students become better familiar in the operation of experimental and common equipment, developing the students' safety consciousness. Then the students are familiar with and master the filtration, extraction, recrystallization, decolonization and vacuum distillation, and the other basic operation techniques in organic synthesis, further understanding the organic unit reactions.

Recommended Textbooks/References:

None

Course Number: 0007409

Course Title: Professional Practice

Credit: 4 **Total Credit Hours:** 120

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Unit Operation, Principles and Technology of Fine Organic Synthesis

Evaluation Method: Open-book Examination

Course Description:

Professional Practice is an import practice link for the cultivation of talents and an effective way of combining the theories with practice. Through Professional Practice, the students are expected to contact workers, understand the factory, love their own specialty, widen their views, and provide an important opportunity to enrich the perceptual knowledge. The aim of Professional Practice is: The students can learn the excellent quality of workers via the contact of them with the workers, deepen the understanding on the role of the specialty in the national economy, cultivate the devotion to their work, the sense of mission, and the pragmatic spirit, so that they can make a better preparation for the student to worker; through the observation and analysis of chemical production processes, the students can learn the knowledge of production related to this Major, deepen the perceptual knowledge of chemical production and the understanding on the subsequent courses; On the basis of combining the theories with practice, the students are expected to analyze the practice production technologies by using the theoretical knowledge so that the theoretical knowledge can be consolidated, confirmed, and deepened, know the necessity of book knowledge and improve the ability to solve the practice problems; the students obtain a comprehensive training, give full play to their initiative and enthusiasm during the professional practice, the students can observe in situ production, think over modestly and positively, and learn all, so that they can have their capacity to be exercised during the limited professional practice time.

Recommended Textbooks/References:

None

Course Number: 0005234

Course Title: Senior Project

Credit: 16 **Total Credit Hours:** 480

Students: Major in New Energy Science and Engineering

Prerequisites: All fundamental and professional courses

Evaluation Method: tutor marking + reviewers evaluation + defense

Course Description:

After studying all theoretical and practical courses, a senior student can choose a task in renewable energy utilization, new energy utilization, thermal engineering and thermal physics etc. as his/her project, compose thesis.

Recommended Textbooks/References:

According to the tutor's recommendation.

Course Number: 0004968

Course Title: Engineering Thermodynamics II

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in new energy science and engineering , thermal energy and power engineering

Prerequisites: Advanced Mathematics, General Physics

Evaluation Method: Written Exam

Course Description:

The Engineering Thermodynamics is an essential course for undergraduate students in thermal energy and power engineering. The students may understand the transform processes and rules from thermal energy to mechanical energy through the study of the basic concepts, laws and calculation methods. The major knowledge include: the first law of thermodynamics, the second law of thermodynamics, process of ideal gases, gas and water vapor dynamic cycles, compressed air and vapor refrigeration cycles, actual gases and wet air, etc. Based on the mastery of elemental knowledge and theory of engineering thermodynamics, the students may acquire the abilities of thermodynamic analysis and calculations, make preparations for later special courses and increase their capacities of solving engineering problems with the training of essential skills.

Recommended Textbooks/References:

1. HUA Ziqiang, ZHANG Zhongjin, GAO Qing, Engineering Thermodynamics, Higher Education Press, 2009
2. SHEN Weidao, TONG Jungeng, Engineering Thermodynamics, Higher Education Press, 2010

Course Number: 0005753

Course Title: Experiment of Analytical Chemistry I

Credit: 1.5 **Total Credit Hours:** 36

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Analytical Chemistry

Evaluation Method: The mean score of all experiment (70%) + course summary(10%)+ operating skill examination(20%)

Course Description:

Experiment of Analytical Chemistry is an important experiment course for environmental science and environmental engineering. The experiment course includes acid-base titration, coordination titration, oxidation-reduction titration, and spectrophotometer method. The students are required to master the basic operating still of the quantitative analysis, to establish the concept of quantity, to learn to process experimental data and to write experiment report. The students are expected to understand deeply the theoretical knowledge of analytical chemistry, to improve the ability of asking problems, analyzing problems, and solving problems, and to cultivate rigorous and realistic attitude and innovative consciousness.

Recommended Textbooks/References:

1. WANG Xiaoyi, XIA Dingguo. Basic Technology and Method of Experimental Research in Chemistry. Chemical Industry Press, 2011
2. PENG Chonghui, FENG Jianzhang, ZHANG Xiyu, et al. Concise Course of Quantitative Chemical Analysis (second Edition). Peking University Press,1997
3. CHANG Wenbao, LI Ke'an. Concise Analytical Chemistry Manual. Peking University Press,1981

Course Number: 0007428

Course Title: Energy Saving and Emission Reduction

Credit: 2.0 **Total Credit Hours:** 32

Students: New Energy Science and Engineering, Thermal energy and power engineering

Prerequisites: Engineering Thermodynamics; Heat Transfer; Heat Engineering Progress and Equipment

Evaluation Method: investigate report

Course Description:

The objective of this course is to teach the basic concepts and theories of energy saving and pollutants emission reduction. Through the studying of this course, let the undergraduate students know that: the concept of energy saving and pollutants emission reduction, the purpose of energy saving and pollutants emission reduction, the important of energy saving and pollutants emission reduction for measurement and validation, the latest and most comprehensive international knowledge of energy conservation and emission reduction, laws and regulations, the international general measuring method of greenhouse gas emission reduction and carbon emissions transactions. And let them learn the general energy-saving technologies and these applications in power, electromechanical, electronic information, building, traffic and agricultural industry area. To equip the student knowledge and skills in mastering the technology of energy saving and emission reduction, including the method for measurement and verification of energy consumption and energy-saving, waste heat recovery and cogeneration technology in industrial applications in the field.

Recommended Textbooks/References:

1. Zhang Hui-li, Hao Ping. Energy Saving and Emission Reduction (knowledge reader). Posts and Telecommunications Press, August, 2009.
2. Yang Shen-zhong, Yang Wei, Zhu Tong-yu, Lu Yong-kai. Energy Saving Technology and Energy Consumption Evaluation in Industry. Machinery Industry Press, July, 2011.
3. China Energy Conservation Technology Policy. National Development and Reform Commission. December, 2006.

Course Number: 0004976

Course Title: Fuel Cell

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: College Physics, Chemical and Environment, Engineering Thermodynamics

Evaluation Method: Written Exam

Course Description:

This optional Subject is designed for undergraduate students in New Energy Science and Engineering. Fuel cells are electrochemical devices that convert the chemical energy of a reaction directly into electrical energy. This subject provides a foundation in fuel cells for students wanting a better understanding of the technology, its benefits, and the systems issues that influence its application.

The basic concepts, polymer electrolyte fuel cells, direct methanol fuel cells, solid oxide fuel cells, molten carbonate fuel cells, phosphoric acid fuel cells, alkaline fuel cells, fuel cell systems, and fuel cell application will be introduced.

Recommended Textbooks/References:

1**.** Fuel cell systems explained (2nd edition), James Larminie, Zhu Hong, Yi Baolian, Science Press, 2006

2. Fuel Cell, Mao Zhongqiang, Chemical Industry Press, 2005

Course Number: 0007426

Course Title: Technology of clean energy vehicles

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Vehicle

Prerequisites: Vehicle Engine, Chassis Construction of Vehicle, Vehicle Theory, Power Electronics Technology

Evaluation Method: Writing papers

Course Description:

Technology of clean energy vehicles is an elective course of vehicle engineering, it involving electrochemistry, automatic control, motor, computer and other multi-disciplinary course. Through this course, students should understand and master the basic principles, theory and design of the clean energy vehicles. Master the structure and electric drive system of hybrid electric vehicle, also the design method of the series, parallel and mild hybrid electric drive. Grasp the fuel cell, regenerative braking, energy storage system, and their application on the vehicle. Then, master the design method of the fuel cell hybrid electric drive system. Lay a good foundation for students to their future work of testing, service and scientific research on vehicles and new energy vehicles.

Recommended Textbooks/References:

1. CUI Shengmin. Technology of Clean Energy Vehicles. Peking University Press,2009
2. HU Hua. Electric Vehicles. Communications Press,2003.1

Course Number: 0000585

Course Title: Car Chassis Structures

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in science and engineering

Prerequisites: Engineering Graphics, Basis of Mechanical Designing, Engineering Mechanics

Evaluation Method: Written Exam

Course Description:

This course is a compulsory course for students major in automobile, is a required course to engage in industries such as vehicle engineering, vehicle body design, automobile manufacturing, automobile service engineering, automobile application and maintenance. It is also a prerequisite for related professional courses like Automotive. The main contents are learning constitute, function, structure and principle of automobile transmission system, automobile driving system, automobile steering system and automobile braking system respectively. Through learning and self-study, students should knowledge although structure of vehicle is complex and have many types, there is different systems and different parts behind the complex and a wide variety to establish a complete vehicle, and implements its functionality. After having a system understanding and master of vehicle chassis structure, the structure of each part and principles of joint work between the various components, then have more in-depth master of chassis structure under the general law, students should have learning ability of comprehend by analogy, and capability of practical and thinking.

Recommended Textbooks/References:

Chen Jiarui. Automotive Structure 2(third Edition). China Machine Press, 2009

Course Number: 0006148

Course Title: Refrigeration and Air Conditioning System

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Technology (Renewable Energy Source Direction), Undergraduate students Major in Energy and Power Engineering (Automobile Direction)

Prerequisites: Thermodynamics of Engineering, Heat Transfer, Fluid Dynamics of Engineering

Evaluation Method: Written Exam

Course Description:

The elective course aims at introducing basic refrigeration and air conditioning knowledge for students specialized in non-refrigeration direction. Through the course study, students could master fundamental theory of refrigeration and air conditioning; Also, students could know usual systems and equipments of refrigeration and air conditioning, and new technology and equipments. The course knowledge includes: relationship between refrigeration and air conditioning, refrigeration compression cycle, primary refrigerant, secondary refrigerant, absorption-type refrigerating system, equipments of compression-type refrigerating system, moist air properties, psychometric chart, cooling load calculation, air-conditioning equipments, air-conditioning systems. Through the course study, students could understand basic principles of refrigeration and air-conditioning systems, which contribute to extension of students' specialized knowledge and optimization of students' knowledge structure.

Recommended Textbooks/References:

1 WU Yezheng. Refrigeration Theory and Equipments (Third Edition). Xi'an: Xi'an Jiaotong University Press, 2010
2 ZHAO Rongyi, FAN Cunyang, XUE Dianhua, QIAN Yiming. Air Conditioning (Fourth Edition). Beijing: China Architecture Industry Press, 2009
3 Larsen M. E., Refrigeration: theory technology and applications, Nova Science Publishers Inc., 2010
4 Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler. Heating, Ventilating and Air Conditioning Analysis and Design (Sixth Edith). John Wiley & Sons, Inc, 2005

Course Number: 0000588

Course Title: Automotive Emission and Pollution Control

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduates Major in Power Engineering & Engineering Thermo Physics

Prerequisites: Structure of Engine; Introduction to Internal Combustion Engine.

Evaluation Method: Final examination

Course Description:

The aim of this course is to present knowledge of basic theory of automotive such as formation mechanism and influence factors of engine exhaust emissions, basic principle and methods of emission control technique, the emission measurement method, and the emission regulations of vehicle. This course also illustrates the development of automotive emission control technology in domestic and abroad, and discusses its trend. The objective of this course is to provide the students with the basic theoretical knowledge of automotive emission control to enable them to meet the requirement of further professional research on emission control technology.

Recommended Textbooks/References:

1. F. Schafer & R. van Basshuysen, Reduced Emissions and Fuel Consumption in Automobile Engines,Springer-Verlag,1995
2. Gong Jinke, Automobile Emissions and Control Technology, The People Traffic Press, 2007
3. Zhou Song, Xiao Youhong, Zhu Yuanqing, Internal Combustion Engine Emission and Pollution Control, Beihang University Press, 2010

Course Number: 0000586

Course Title: Construction of Automotive Engines

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in automotive engineering

Prerequisites: Mechanical design, Metal material, Thermodynamics

Evaluation Method: Written Exam

Course Description:

This course studies the fundamentals of how the internal combustion engines works, and the operation and construction of the constitutional parts and systems. Topics include the main moving parts, the valve train, the fuel delivery and injection system, the intake and exhaust systems, the turbo-charged system, the emission control system and petrol and diesel fuel properties as well. Students mainly focus the design features of two types of internal combustion engines:

spark-ignition and diesel engines. Class includes lab project in the Engine Laboratory

Recommended Textbooks/References:

1. Chen Jiarui. Construction of Automotive Engines (3rd Edition).Beijing: China Machine Press, 2007
2. Fu Baixue. Electronic Control of Automotive Engines. Beijing: Beijing Institute of Technology Press,2010
3. Halderman, James D. Automotive Engines: theory and servicing. US: Prentice Hall Press, 2001

Course Number: 0006150

Course Title: Application of Automotive Engineering Software(Self-learning)

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students Major in Automotive Engineering

Prerequisites: Engineering drawing, mechanical design

Evaluation Method: Comprehensive exam

Course Description:

This course is a self-learning professional course for automotive engineering students. Students can choose any one software from Catia, Matalb, AMESim according to their own interests to do some design, simulation, performance analysis works, which was commonly used in automotive engineering .

Recommended Textbooks/References:

1. Wang Moran, MATLAB and Scientific Computing, Publishing House of Electronics Industry, 2012
2. Zhu Xintao, CATIA V5 Mechanical Design from Entry to the Master, Mechanical Industry Press, 2011
3. Fu Yongling, AMESim System Modeling and Simulation Examples, Beihang University Press, 2011

Course Number: 0000587

Course Title: Automotive Theory

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Vehicle Engineering, Power Engineering

Prerequisites: Automotive Configuration, Principle of Internal-Combustion Engine

Evaluation Method: Written Exam

Course Description:

Basic performance of the vehicles related with vehicle dynamics, laws and dynamics of driving cars, as well as the influencing factors were analyzed based on the characteristics of the external force on the vehicles. Accordingly, these analyses provide the theory basis for rational design and rational use of cars. Students should be educated to acquire the evaluation criteria and methods of cars, the influence on the performance of cars from the structure form and structure parameters of cars, and the basic method of computation for Performance prediction of cars. On the basis above, students should master the ability to apply and integrate the main majors and theoretical

knowledge. The course associates the theory with the reality, tries to help students to form the custom of solving the actual problems with the knowledge what they have acquired, and dealing with the professional issues with existing tools. And the course also intents to help the students improve their ability of innovating.

Recommended Textbooks/References:

1 Yu Zhisheng, Automotive Theory (5th Edition), Beijing: China Machine Press, 2010
2 Thomas D. Gillespie, Fundamentals of Vehicle Dynamics, SAE, 2000
3 Manfred Mitschke, Henning Wallentowitz, Automotive Dynamics (4th Edition), Beijing: China Communications Press, 2009

Course Number: 0006352

Course Title: Automotive Electronic Control Technology

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students Major in Automotive Engineering

Prerequisites: Engineering mechanics, Automobile engine structure, Vehicle chassis structure, Principle of automatic control

Evaluation Method: Written Exam

Course Description:

This course studies the fundamentals of automobile power train electronic control technology and its development technology. Its specific content includes gasoline engine fuel injection electronic control, ignition electronic control, idle electronic control, AT, AMT, DCT automatic transmission electronic control. Through learning this course, students should understand the hardware structure of automotive electronic control system and its working principle, grasp the fundamental of open-loop control method, PID control method, self-learning control method, and grasp the automotive electronic control system design and development method .

Recommended Textbooks/References:

1. Zhuo Bin. Gasoline Engine Fuel Injection and Electronic Control, Mechanical Industry Press, 2001
2. Bosch. Gasoline Engine Management: Basics and Components, Wiley, 2006
3. Wu Sen. Gasoline Engine Management System, Beijing Institute of Technology Press, 2011

Course Number: 0000583

Course Title: Internal Combustion Engine Fundamentals

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Energy and Thermal Engineering (Automobile)

Prerequisites: Engineering Thermodynamics, Heat Transfer Theory, Engine Construction

Evaluation Method: Assignment **(**15%), Experiment (10%), Subjective Report (10%) and Written Exam (65%)

Course Description:

The basic working principle, analytical method and technical frontier of internal combustion engines are introduced in this course. Through the classroom instruction and experimental teaching, the students are expected to 1) obtain the calculation methods, influence factors and

internal relations of the engine dynamic and economic indexes, which benefit the theoretical foundation for designing the high performance engines; 2) understand the main parameters of internal combustion engines and analyze their influences on the engine performance through the basic theories; 3) capture the latest technical tendency of internal combustion engines. Through this course, the students could avail the improved ability of analyzing and solving problems, the basic knowledge of internal combustion engines, the promoted skill on experiments, and the interest in the specialized field. The basic topics of this course include: the history of internal combustion engines, the fuels for internal combustion engines, the engine operating parameters, the engine thermodynamic cycles, the engine intake and exhaust processes and the in-cylinder flow, the combustion in engines, and the engine testing technique.

Recommended Textbooks/References:

1. Allan Kirkpatrick. Internal Combustion Engine – Applied Thermal Sciences. John Wiley Sons, INC, 2001.

Course Number: 0007436

Course Title: Alternative Fuel for Internal Combustion Engine

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate of energy and power engineering power major

Prerequisites: Engineering thermodynamics, Internal combustion engine fundamental

Evaluation Method: Assignment (25%), Subjective Report (25%) and Written Exam (50%)

Course Description:

This course is combined with some pre-requisites such as engineering thermodynamics and internal combustion engine fundamental and its main content is consisted of combustion theory, application technology, emission performance, long-term service experience, and also the questions and solutions of alternative fuels. The purpose of the course is make students to systematically study and grasp the necessary engineering and technology knowledge after they have understand gasoline and diesel fuels. The basic requirement is that the students can realize and understand the status and prospects of ICE alternative fuels in-depth, and combine the basic theory with the realistic problems. Consequently innovation capability and research interests are enhanced. This is helpful to that students are engaged in such R&D work fields as vehicle power system, automobile new energy, power machinery and engineering and the power system of energy saving and emission reduction.

Recommended Textbooks/References:

1. Bian Yaozhang, New Energy Source for Automobiles, China Communications Press, 2003.
2. Jiang Deming, Combustion of Alternative Fuels for Internal Combustion engine, Xi'an Jiaotong University Press, 2007.

Course Number: 0007673

Course Title: Combustion Science in Internal Combustion Engine

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in Power Engineering and Engineering Thermo Physics

Prerequisites: Engineering Thermodynamics; Heat Transfer; Fluid Mechanics; Internal

Combustion Engine structure.

Evaluation Method: paper, presentation and Written Exam

Course Description:

The present course is an elective in subject of power engineering and engineering thermo physics and the basic topics include: introduction, combustion fundamental, ignition, premixed combustion, diffusion combustion, combustion in gasoline engines, combustion in diesel engines. By completing the course, students should have a basic view of phenomenon and theory of combustion, master the basic knowledge and concept of thermodynamics, chemical kinetics and combustion process, master the characteristics and basic laws of different fuels and different combustion patterns. Through learning and practicing, students could lay a good foundation for academic study and engineering work in fields of combustion and emission in internal combustion engines in the future.

Recommended Textbooks/References:

1. WEI Xiang Yi. Combustion Science in Internal Combustion Engine. Dalian: Dalian University of Technology Press, 1992.
2. JIANG De Ming. Combustion and Emission in Internal Combustion Engines. Xi'an: Xi'an Jiaotong University, 2001.
3. Stephen R.Turns (Author). YAO Yang, LI Shuiqing, WANG Yu(Translators). An introduction to combustion: concepts and applications (second edition). Beijing: Tsinghua University Press, 2009.

Course Number: 0004977

Course Title: An Introduction to Energy Science

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: no

Evaluation Method: Written Exam

Course Description:

This course introduces the general situation of energy science, the problem it's faced with, the solutions to these problem and the prospect of development, delivers the basic knowledge and theory of energy science to students. The aim of the course is to make students understand the energy history, new energy technology and its developing trend, improve and strengthen student's energy conservation and environmental protection consciousness, lay the foundation for the related energy scientific research and operation management. This seminar focuses on clarifying the energy concepts and energy classification in order to make the students establish energy evaluation foundation. The specific energy which will be analyzed and discussed in this course are fossil energy, nuclear energy, hydrogen, solar energy, wind energy, hydropower, biomass energy, geothermal energy.

Recommended Textbooks/References:

1. Huang Suyi, Gao Wei. Introduction to Energy. Higher Education Press, 2004
2. Su Yaxin, Mao Yuru, Zhao Jinde, New Energy and Renewable Energy. Higher Education Press, 2006
3. J.R. Vankey, translated by Wang Naili, Energy: Prospect of 21th Century. Shanghai Jiaotong University Press,2008

Course Number: 0005702

Course Title: Introduction to Environmental Engineering

Credit:2 **Total Credit Hours:** 32

Students: Undergraduate of Thermal energy and power engineering

Prerequisites: Chemistry and environment

Evaluation Method: Written examination

Course Description:

Environmental engineering introduction is set for thermal energy and power engineering discipline as the professional selective course. Through the study of this course, the students are expected affected by environmental protection and sustainable development view of the education, and set up the morality of environmental protection and sustainable development view of the world. Training students have the ability of processing environment quality evaluation and solving environmental problems. The basic content include: the basic professional knowledge of environment engineering, including water pollution prevention, air pollution prevention, solid waste pollution and its prevention, the basic principle and basic methods of physical pollution prevention and control. The key and difficult point of this course includes pollution basic principle and basic controlling methods of water, gas, solid waste and physical pollution.

Recommended Textbooks/References:

1. Jiang Zhanpeng, Environmental Engineering (2nd edition), Higher Education Press, 2005
2. Wang Shuying, Introduction to Environment, China Building Industry Press, 2004
3. Chen Jierong, Physical Pollution Control, Higher Education Press, 2007

Course Number: 0004970

Course Title: Engineering Combustion

Credit: 2 Total Credit Hours: 32

Students: Engineering Combustion

Prerequisites: Engineering Thermodynamics, Fluid Mechanics, Heat Transfer

Evaluation Method: Written examination

Course Description:

Engineering Science is a professional basic course for major of new energy science and engineering, also is one of the main subjects of thermal science theory. It is a scholarship to study how the chemical energy of the fuel changing into heat energy efficiently and cleaning.

Through the study of this course, the students can master the main characteristic all kinds of industrial fuel, and master the calculation method of fuel combustion in engineering and the diagnosis method of combustion, grasp basic concepts and basic laws of combustion theory such as the combustion reaction thermodynamics, kinetic theory, ignition, flame propagation theory, flame structure and stability principle. In the study of this course, the students are going to learn the theory and technology of atomization of liquid fuel, coal thermal decomposition and char particle combustion. From the study of this course, the students should also have certain understanding the properties of combustion device, formation mechanism of combustion pollutants and its prevention technology.

Recommended Textbooks/References:

1. WANG Jun, Qiliang MA etal, Engineering Combustion, China electric power Press, 2008.
2. ZHANG Songshou, Engineering Combustion, Shanghai Jiaotong University Press, 1987

3. HAN Zhaocang, Fuel and Combustion, Metallurgical industrial Press, 1984
4. YAN Chuanjun, Wei FAN, Combustion, Northwest Polytechnic University press, 2005

Course Number: 0004989
Course Title: Cognitive Practice
Credit: 1.0 **Total Credit Hours:** 30
Students: Undergraduate students Major in Automotive Engineering
Prerequisites: No
Evaluation Method: Comprehensive exam
Course Description:
Through visiting the enterprises, the freshmen can understand of automotive field, percept of automobile industry, understand the future direction of employment. The practice can promote freshman to plan the following four years of professional learning in the university, and the freshmen can build a clear learning goals.

Course Number: 0007409
Course Title: Professional Practice
Credit: 4.0 **Total Credit Hours:** 120
Students: Undergraduate students Major in Automotive Engineering
Prerequisites: Automobile engine structure, Vehicle chassis structure, Fundamental of internal combustion engine, Fundamental of vehicle, Automobile electronic control
Evaluation Method: Comprehensive exam
Course Description:
Through the professional practice course, students can select the engineering project according to their own interest, understand the basic process of automotive products in the design, performance test, calibration, and grasp the basic technology master of automotive products in the design, performance test, and calibration. Through the professional practice course, students can specify the major direction.

Course Number: 0004975
Course Title: Wind Energy Utilization
Credit:2 **Total Credit Hours:** 32
Students: Undergraduate students Major in New Energy Science and Engineering
Prerequisites: Higher Mathematics, Engineering Mechanics, Electrical Engineering Technology, Engineering Fluid Mechanics
Evaluation Method: Written Exam
Course Description:
This is a specialized optional course.The students can deeply understand wind energy utilization and development of wind power generation industry. The main contents of the course are wind power generation technology. The students are expected to understand theory of wind turbine, working principle of wind power generation, site selection of wind power field, economic analysis and construction of wind power field. In which, classification of wind turbine, structure and theory of horizontal axis wind turbine, stress analysis of wind wheel, engineering calculation of wind

turbine, working principle of wind power generation and site selection of wind power field should be mastered. In the course basic knowledge of wind power (formation of wind, measurement of wind and wind power calculation) and other form of wind power utilization (water supply and heating) are also introduced.

Recommended Textbooks/References:

1.Song Haihui. Wind Power Generation Technology and Engineering. China Water Conservancy and Hydropower Press, 2009

2.Guo Xinsheng. Wind Energy Utilization. Chemical Industry Press, 2007

3.Liao Mingfu. Wind Power Generation Technology. Northwestern Polytechnic University Press, 2008

Course Number: 0004980

Course Title: Technology and Equipment of Solid Wastes Combustion

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamics, Heat Transfer

Evaluation Method: Midterm and Final Exam

Course Description:

This course is the elective specialized course for undergraduate students who major in New Energy Science and Engineering. Through the study of this course, the students understand the properties of various solid wastes master the professional knowledge of method and equipment for waste incineration power and heat utilization.

The main contents of the course include: solid waste incineration process and its products, balance analysis of solid waste incineration processes, technology and equipment of solid waste incineration, waste incineration furnace and its heat utilization, flue gas treatment technology in waste incineration, residues treatment and resource utilization technology in waste incineration, waste incineration system and its equipment.

Recommended Textbooks/References:

1. Yi ZHANG,Youcai ZHAO, Garbage Incineration Technology, Chemical Industry Press,2000

2. Yanguo ZHANG, Clean Waste Incineration Power Generation Technology, Water Conservancy and Hydropower Press, 2004

3. Ministry of Construction Personnel and Education Division, City life waste incineration technology, China Building Industry Press, 2004

4. Weiqiang ZHUANG, Solid Waste Disposal and Utilization, Chemical Industry Press, 2001

Course Number: 0007433

Course Title: The Application of Nuclear Technology

Credit: 2.0 **Total Credit Hours:** 32

Students: New Energy Science and Engineering

Prerequisites: Engineering Thermodynamics; Heat Transfer; Heat Engineering Progress and Equipment

Evaluation Method: Investigate Report

Course Description:

The objective of this course is to teach the basic theories and application of nuclear energy. Through the studying of this course, let the undergraduate students know that: the discovery and development of this new type of energy and its great significance in the historical development, especially in the era of traditional fossil fuel resources are depleting and the deteriorating environment. And let them learn the development status of the nuclear power plants, the nuclear power plant accident prevention measures, the different types of safety radioactive waste disposal, as well as radiation protection measures. Let students understand the process of the pressurized water reactor nuclear power plant and the importance of radioactive waste disposal and its sources and master the safety and reliability of nuclear power plants and the impact on the environment.

By learning the knowledge of nuclear energy and technology, students can scientifically understand the nuclear science and technology. To broaden the students' knowledge, develop their interest in science, and improve the overall quality.

Recommended Textbooks/References:

1. Luo Shanggeng. Walking into the Nuclear Science and Technology. Atomic Energy Press, January, 2005.

2. Lian Peisheng. Nuclear Energy Industry. Atomic Energy Press, May, 2002.

Course Number: 0004978

Course Title: Instrument and Automatic Control in Thermal engineering

Credit: 2 **Total Credit Hours:** 30

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Principle of Automatic Control, Electronics

Evaluation Method: Written Exam

Course Description:

The mainly purposes of this course are made the students exactly select familiar instruments and rightly set up measurement system for thermal engineering application. The students are expected to understand the basic concepts, theories, methods of thermal engineering instrument and automatic control by this course study.

The primary contents of this course include the using of instruments, the principle of automatic control, the automatic control system for thermal engineering and the application of computer in instrument and automatic control. The using of instruments is important content which students are required on top of; The automatic control system for thermal engineering and the application of computer in instrument and automatic control are difficulties of this course and students need to understand combining in electro-ethnic and electronics.

Recommended Textbooks/References:

1. LIU ZiFang, LIU ChunLei. Thermal Measurement and Automatic Control. China Electric Power Press,2007

2. ZHANG ZiHui. Thermal Measurement and Automatic Control. China Building Industry Press, 2005

3. WU YongSheng, FANG KeRen. Thermal Measurement & Meter. Electronic Industry Press,1995

Course Number: 0004979

Course Title: Conversion and Use of Heat Energy

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamics, Heat Transfer

Evaluation Method: Midterm and Final Exam

Course Description:

This course is the elective specialized course for the major in New Energy Science and Engineering, which based on the first law and second law of thermodynamics to make student know the energy utilization and the basic knowledge of energy exchanger and heat transfer, make them to master the basic theory of heat exchange. The students can understand how to evaluate the performance of the thermodynamics process and the basic equipment by the method of energy balance and energy balance, energy efficient and energy efficient, energy loss and energy loss, and then they can give the improved method to enhance the performance of thermodynamics system and equipment. Based on the above introduction, the energy utilization of a typical industry will be analyzed and the enhanced method will be brought forward. Through the study of this course, the students can use the specialized knowledge of thermodynamics and heat transfer to solve the real problem in industry.

Recommended Textbooks/References:

1. Tang Xuezhong, Conversion and Use of Heat Energy, Metallurgical Industry Press,2004。

2. Lu Zhongwu, Energy utilization in metallurgical industry, Metallurgical Industry Press,1986；

3.Thermal Engineering guide on the Metallurgical industry. Northeastern University of Technology press, 1997.

Course Number: 0007432

Course Title: Geothermal Energy and Its Use of Technology

Credit: 2 **Total Credit Hours:** 32

Students: New Energy Science and Engineering

Prerequisites: Engineering thermodynamics, Fluid mechanics

Evaluation Method: Written Examination

Course Description:

This course begins with an explanation of geothermal energy concepts and classifications. The traditional geothermal energy is stored in underground in the form of steam or hot water above 25℃, divided into high, medium, low. As the science technology evolved, the traditional geothermal energy has been developed and shallow geothermal energy below 25℃ also can be used. Urban sewage and industrial sewage are contains heat energy, the atmosphere the earth's surface also contains heat energy. The energy below 25℃, including shallow geothermal energy, surface water, sewage resources and atmosphere, are all belong to a low-grade energy. What's more, introduces the use technology of traditional geothermal energy, including power generation technology, indirect using technology and cascade utilization technology of geothermal energy. Finally, it will introduce the air source heat pump use of technology, shallow underground water heat pump use of technology, underground soil heat pump use of technology, surface water heat pump use of technology and sewage source heat pumps use of technology.

Recommended Textbooks/References:

1.Yihan Cai. Geothermal Energy and Its Utilization. Tianjin: Tianjin Polytechnic Press,2004.
2.Zuiliang Ma, Yang Tao, Yiqiang Jiang. HVAC Heat Pump Technology. Beijing: China Building Industry Press, 2008

Course Number: 0006157
Course Title: Energy Technical Economics
Credit: 2 **Total Credit Hours:** 32
Students: Undergraduate students Major in New Energy Science and Engineering
Prerequisites: Foundation Courses related Economics
Evaluation Method: Examination
Course Description:
The course contents were mainly included the basic concepts and analysis method of technical economic in the flied of energy engineering. By learning this course, students can develop the thinking of technical and economics for engineering project. The basic concepts included time value of money, investment, costs, depreciation, taxes, profits, interest rates etc, students should master the calculating method of funds equivalents and the interest rate. The methods of economic evaluation mainly divided into static and dynamic, the basic concepts included Discount rate, net present value, internal rate of return, static investment recovery period, and dynamic payback period etc, and students can use those indexes to preliminary technical and economic analyze of specific project case. The basic concepts of investment uncertainty analysis included breakeven analysis, sensitivity analysis, probabilistic analysis; risk decision-making etc, students should understand those concepts. Students should know the technical economic characteristics of public utility projects, and the energy saving about basic concept, evaluation indexes and measurement.
Recommended Textbooks/References:
1. FU Jiaji, TONG Yunheng. Engineering Economics. Tsinghua University Press, 1996
2. HONG Yue. Engineering Economics. Chemical Industry Press, 2008
3. HUA Zepeng. Energy economics. China University of Petroleum Press, 1991

Course Number: 0004973
Course Title: Heat Pump Principle and Equipment
Credit:2 **Total Credit Hours:** 32
Students: Undergraduate students Major in New Energy Science and Engineering
Prerequisites: Engineering Thermodynamics, Hydrodynamics, Heat Transfer
Evaluation Method: Written Exam
Course Description:
This is a specialized direction course. The course is consist of six chapters, Respectively preface,basic technology of heat pump, vapor compression heat pump, absorption heat pump, adsorption heat pump and applications of heat pump. The students can understand definition of heat pump,work principle and characteristic of different forms of heat pump, driving energy of heat pump,types of low temperature heat source and performance evaluation of heat pump.The keys of the course are work principle and structure of vapor compression heat pump, absorption heat pump and adsorption heat pump.The students should master thermal calculation methods of cyclic process of vapor compression heat pump and absorption heat pump, draw cyclic process

curves in p-h graph or t-s graph,and explain every work process in graph.

Recommended Textbooks/References:

1.Chen Dong, Xie Jihong. Heat Pump Technology and Applications. Chemical Industry Press, 2006

2.Zhang Zaoxiao. Refrigeration and Heat Pump. Chemical Industry Press, 2000

3.Yu Yongzhang. Heat Pump Principle and Applications. China Machine Press, 1993

Course Number: 0004971

Course Title: Thermal Process and Equipment

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamic, Heat Transfer, Engineering Fluid Mechanics, Engineering Combustion

Evaluation Method: Written Examination

Course Description:

This course is a distributional electives course for undergraduate students major in new energy science and engineering.

Through the studying of this course, students is required to master the knowledge of the principle and structural characteristics about boiler, steam turbine, heat exchanger and other thermal equipments, and to understand the operation characteristics of their thermal processes. During the study of this course, the students are trained to learn how to use the knowledge and the theory they have learnt for actual engineering problems analysis.

Recommended Textbooks/References:

1. DING Chonggong, Industrial boiler equipment, Mechanical Industry Press, 2009, first edition
2. QING Dingbin, Industrial furnace heat exchange device, Metallurgical Industry Press, 1986
3. JIN Anding, Industrial boiler principle , Xi'an Jiao Tong University Press, 1995
4. HUANG Shuhong, Principles of steam turbine, China Electric Power Press, 2009, Second Edition
5. YAN Junjie, Thermal system and equipment of power plant, Xi'an Jiao Tong University Press, 2003
6. SHI Meizhong, Zhongzheng WANG, Principle and design of heat exchanger, Southeast University Press, 2009, Fourth Edition

Course Number: 0004972

Course Title: Solar Energy Technology

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamic, Heat Transfer, Electro technical, Engineering Fluid Mechanics

Evaluation Method: Written Exam

Course Description:

This course is a distributional electives course for upper grade students major in new energy

science and engineering. Main topic of this course include: change rule and calculate method of solar radiation, principle and method of collect, conversion and storage of solar energy, principle and method of design and assessment on solar energy utilization technology, such as solar water heater, solar refrigeration and air conditioning, solar thermal power, solar photovoltaic power, and so on. The students are expected to understand the basic concepts, theories, methods, and techniques of solar energy technology, have the ability to solve the practical problems and design the system of solar energy.

Recommended Textbooks/References:

1. Liu Jianmin. Solar Energy Utilization Principle, Technology and Engineering (in Chinese), Publishing House of Electronics Industry,2010
2. Zheng Ruicheng. Technical Guidebook for Solar Water Heating System of CivilBuilding(second Edition, in Chinese).Chemical Industry Press,2011
3. Jia Yingzhou. Design and Installation of Solar Heating System (in Chinese). Posts and Telecom Pres,2011
4. Wang Dong. Technology and System Integration of Solar Photovoltaic Power (in Chinese). Chemical Industry Press,2011
5. Yang Hongxing, Wei Zhou. Application of Solar Energy Technologies in Buildings (in Chinese). China Architecture and Building Press,2008.
6. Soteris A. Kalogirou. Solar Energy Engineering: Processes and Systems. Academic Press, 2009

Course Number: 0003211

Course Title: Engineering Thermodynamics II

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in New Energy Science and Engineering, Thermal Energy and Power Engineering

Prerequisites: Advanced Mathematics, General Physics

Evaluation Method: Written Exam

Course Description:

The Engineering Thermodynamics is an essential course for undergraduate students in thermal energy and power engineering. The students may understand the transform processes and rules from thermal energy to mechanical energy through the study of the basic concepts, laws and calculation methods. The major knowledge include: the first law of thermodynamics, the second law of thermodynamics, process of ideal gases, gas and water vapor dynamic cycles, compressed air and vapor refrigeration cycles, actual gases and wet air, etc. Based on the mastery of elemental knowledge and theory of engineering thermodynamics, the students may acquire the abilities of thermodynamic analysis and calculations, make preparations for later special courses and increase their capacities of solving engineering problems with the training of essential skills.

Recommended Textbooks/References:

1. HUA Ziqiang, ZHANG Zhongjin, GAO Qing, Engineering Thermodynamics, Higher Education Press, 2009
2. SHEN Weidao, TONG Jungeng, Engineering Thermodynamics, Higher Education Press, 2010

Course Number: 0006148

Course Title: Refrigeration and Air Conditioning System

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Technology (Renewable Energy Source Direction), Undergraduate students Major in Energy and Power Engineering (Automobile Direction)

Prerequisites: Thermodynamics of Engineering, Heat Transfer, Fluid Dynamics of Engineering

Evaluation Method: Written Exam

Course Description:

The elective course aims at introducing basic refrigeration and air conditioning knowledge for students specialized in non-refrigeration direction. Through the course study, students could master fundamental theory of refrigeration and air conditioning; Also, students could know usual systems and equipments of refrigeration and air conditioning, and new technology and equipments. The course knowledge includes: relationship between refrigeration and air conditioning, refrigeration compression cycle, primary refrigerant, secondary refrigerant, absorption-type refrigerating system, equipments of compression-type refrigerating system, moist air properties, psychometric chart, cooling load calculation, air-conditioning equipments, air-conditioning systems. Through the course study, students could understand basic principles of refrigeration and air-conditioning systems, which contribute to extension of students' specialized knowledge and optimization of students' knowledge structure.

Recommended Textbooks/References:

1. WU Yezheng. Refrigeration Theory and Equipments (Third Edition). Xi'an: Xi'an Jiaotong University Press, 2010
2. ZHAO Rongyi, FAN Cunyang, XUE Dianhua, QIAN Yiming. Air Conditioning (Fourth Edition). Beijing: China Architecture Industry Press, 2009
3. Larsen M. E., Refrigeration: theory technology and applications, Nova Science Publishers Inc., 2010
4. Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler. Heating, Ventilating and Air Conditioning Analysis and Design (Sixth Edith). John Wiley & Sons, Inc, 2005

Course Number: 0005234

Course Title: Senior Project

Credit: 16 **Total Credit Hours:** 480

Students: Major in New Energy Science and Engineering

Prerequisites: All fundamental and professional courses

Evaluation Method: tutor marking + reviewers evaluation + defense

Course Description:

After studying all theoretical and practical courses, a senior student can choose a task in renewable energy utilization, new energy utilization, thermal engineering and thermal physics etc. as his/her project, compose thesis.

Recommended Textbooks/References:

According to the tutor's recommendation.

Course Number: 0004968

Course Title: Engineering Thermodynamics II

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in New Energy Science and Engineering, Thermal Energy and Power Engineering

Prerequisites: Advanced Mathematics, General Physics

Evaluation Method: Written Exam

Course Description:

The Engineering Thermodynamics is an essential course for undergraduate students in thermal energy and power engineering. The students may understand the transform processes and rules from thermal energy to mechanical energy through the study of the basic concepts, laws and calculation methods. The major knowledge include: the first law of thermodynamics, the second law of thermodynamics, process of ideal gases, gas and water vapor dynamic cycles, compressed air and vapor refrigeration cycles, actual gases and wet air, etc. Based on the mastery of elemental knowledge and theory of engineering thermodynamics, the students may acquire the abilities of thermodynamic analysis and calculations, make preparations for later special courses and increase their capacities of solving engineering problems with the training of essential skills.

Recommended Textbooks/References:

1. HUA Ziqiang, ZHANG Zhongjin, GAO Qing, Engineering Thermodynamics, Higher Education Press, 2009
2. SHEN Weidao, TONG Jungeng, Engineering Thermodynamics, Higher Education Press, 2010

Course Number: 0005375

Course Title: Cognitive Practice

Credit: 1 **Total Credit Hours:** 30

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Unit Operation, Principles and Technology of Fine Organic Synthesis

Evaluation Method: Open-book Examination

Course Description:

Cognitive Practice is a Discipline Requirement course for the students of Applied Chemistry, which begins after the study of the related basic theories and partial Major courses. Through Cognitive Practice, the students are expected to have an opportunity to contact practice production, to combine the theories with practice, to deepen the understanding of production, scientific research, overall determination, and environmental protection. By so doing, the students are expected to broaden their applied chemistry knowledge, to contact all kinds of production departments, and to understand the basic knowledge of modern enterprise managements, production equipment, production diagrams, and modern technology development. The students are trained to raise their ability to combine the related theories with practice and solve the practice problems, so that it will lay a foundation for the subsequent learning other Major courses.

Recommended Textbooks/References:

None

Course Number: 0007409

Course Title: Professional Practice

Credit: 4 **Total Credit Hours:** 120

Students: Undergraduate students Major in Applied Chemistry

Prerequisites: Inorganic Chemistry, Physical Chemistry, Analytical Chemistry, Organic Chemistry, Unit Operation, Principles and Technology of Fine Organic Synthesis

Evaluation Method: Open-book Examination

Course Description:

Professional Practice is an import practice link for the cultivation of talents and an effective way of combining the theories with practice. Through Professional Practice, the students are expected to contact workers, understand the factory, love their own specialty, widen their views, and provide an important opportunity to enrich the perceptual knowledge. The aim of Professional Practice is: The students can learn the excellent quality of workers via the contact of them with the workers, deepen the understanding on the role of the specialty in the national economy, cultivate the devotion to their work, the sense of mission, and the pragmatic spirit, so that they can make a better preparation for the student to worker; through the observation and analysis of chemical production processes, the students can learn the knowledge of production related to this Major, deepen the perceptual knowledge of chemical production and the understanding on the subsequent courses; On the basis of combining the theories with practice, the students are expected to analyze the practice production technologies by using the theoretical knowledge so that the theoretical knowledge can be consolidated, confirmed, and deepened, know the necessity of book knowledge and improve the ability to solve the practice problems; the students obtain a comprehensive training, give full play to their initiative and enthusiasm during the professional practice, the students can observe in situ production, think over modestly and positively, and learn all, so that they can have their capacity to be exercised during the limited professional practice time.

Recommended Textbooks/References:

None

Course Number: 0007423

Course Title: Experimental and Measurement Technology in Thermal Energy Engineering

Credit: 1 **Total Credit Hours:** 24

Students: Undergraduate students majoring in New Energy Science and Engineering, and Thermal Energy Engineering

Prerequisites: Engineering Thermodynamics, Heat Transfer

Evaluation Method: Experimental Reports

Course Description:

Under the background of systematic study of Engineering Thermodynamics and Heat Transfer, students can begin their practical training in operating experiments and writing experimental reports. The students are expected to master the basic experimental & measurement technology in Thermal Energy Engineering, to be familiar with data processing methods, and to make progress in innovative thinking which can be embodied in subsequent practice such as graduation design. The basic aspects include: (1) the operation of experimental systems related to fundamental knowledge points such as conduction, convection, radioactive heat transfer, adiabatic index of air, temperature-pressure relationship of saturated steam, etc. (2) data record and investigation, (3)

data processing, (4) plotting experimental data and analyses. This course will provide an opportunity in innovative skills in experimental work, report writing, data analyses and resultant conclusions.

Recommended Textbooks/References:

1. ZHAO Qingguo, CHEN Yongchang, XIA Guodong. Measurement Technology in Thermal and Power Engineering. Chemical Industry Press,2006.6.

Course Number: 0007430

Course Title: Geothermal Energy and Its Use of Technology Curriculum Design

Credit: 2 **Total Credit Hours:** 32

Students: New Energy Science and Engineering

Prerequisites: Geothermal energy and its use of technology, Engineering thermodynamics, Fluid mechanics

Evaluation Method: Written Examination

Course Description:

According traditional geothermal energy utilization technology, concluding Power generation technology, indirect utilization technology, geothermal energy cascade utilization technology, air source heat pump utilization technology, the shallow underground water heat pumps utilization technology, underground soil heat pump technology, surface water heat pump utilization technology as well as sewage source heat pump utilization technology, we can arrange students to the course design. This course require students to master the system processes, to carry out the thermodynamic calculation, to select equipment and piping and to be able to using modern computing draw system flow chart. Through the course design students can exercise their professional application ability, which consist of consulting and summarizing literature, computational design, using engineering manuals, engineering drawing, writing papers and so on.

Recommended Textbooks/References:

1.Yihan Cai. Geothermal energy and its utilization Tianjin: Tianjin Polytechnic Press, 2004.

2.Zuiliang Ma, Yang Tao, Yiqiang Jiang. HVAC heat pump technology. Beijing: China Building Industry Press, 2008

Course Number: 0004986

Course Title: Solar Energy Technology－Curriculum Design

Credit: 2 **Total Credit Hours:** 60

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamic, Heat Transfer, Electro technical, Engineering Fluid Mechanics

Evaluation Method: Written Report

Course Description:

This course is a practice teaching link of “solar energy technology” course and the aim is to train students to make a project design by the integrated application of the knowledge of the course and related courses. This course mainly includes two parts, one parts is the design of solar water heating system and another parts is the design of solar photovoltaic power generation system. In

the design of solar water heating system, Students are asked to calculate the heat load, overall solar collector area, pipeline pressure loss, heat loss, auxiliary heat source, etc. Then to determine the size, number and layout of solar collector, water pump, water tank, water pump, heat insulation layer. In the design of solar photovoltaic system, Students are asked to collect the basic resources and load data, to determine the size, number and layout of solar cell array, battery, etc.

Recommended Textbooks/References:

1 Jian-Min Liu. Solar Energy Utilization Principle, Technology and Engineering (in Chinese), Publishing House of Electronics Industry, 2010

2 Rui-Cheng Zheng. Technical Guidebook for Solar Water Heating System of CivilBuilding(second Edition, in Chinese).Chemical Industry Press,2011

3 Ying-Zhou Jia. Design and Installation of Solar Heating System (in Chinese). Posts and Telecom Pres, 2011

4 Dong Wang. Technology and System Integration of Solar Photovoltaic Power (in Chinese). Chemical Industry Press, 2011

5 Hong-Xing Yang, Wei Zhou. Application of Solar Energy Technologies in Buildings (in Chinese). China Architecture and Building Press, 2008.

Course Number: 0006376

Course Title: Computer Application in Refrigeration and Air Conditioning System

Credit: 2 **Total Credit Hours:** 32

Students: Major of New Power Source Science and Engineering

Prerequisites: Refrigeration Theory & Equipment, Air Conditioning Theory & Equipment, Refrigeration Compressor I

Evaluation Method: Course work

Course Description:

This course belongs to a Professional Elective, and its pre-requisites include Refrigeration Theory & Equipment, Air Conditioning Theory & Equipment, Refrigeration Compressor I. In the training process of the professionals, students will learn the principle of refrigeration and air conditioning with computer software technology and master the general principle and basic methods of the computer aided design and simulation in refrigeration and air conditioning equipment through this course.

Recommended Textbooks/References:

1. Zhongbao Liu, Sujun Dong, Zhiyuan Wang. Installation & System Simulation in Air Conditioning & Refrigeration , Machinery & Industry Press, 2011

2. Guoling Ding, Chunlu Zhang. Installation Simulation & optimizing in Refrigeration & Air Conditioning, Science Press, 2001

Course Number: 0007431

Course Title: New Energy Science and Engineering Experiment

Credit: 1 **Total Credit Hours:** 24

Students: Renewable energy specialized

Prerequisites: Heat Transfer Science; Engineering Thermodynamics, Fluid Mechanics; New Energy Technology

Evaluation Method: Experiment Report

Course Description:

New Energy Science and Engineering Experiment composed by eight characteristics experiments: Test of phase change heat transfer at low temperature, The heat exchanging experiment in underground soil and rocks, Performance measurement of Air cleaner, Synthetic Utilization of Solar Energy and Ground Heat, Illumination Measure Experiment of Light pipe, Test of Small Differential Temperature Air-Air Heat Exchange, Measurement of COP and EER in Heating and Cooling and The Combine using of ground source heat pump and air source heat pump. These experiments requires students to master the principle of each experiment, the basic experimental methods and able to complete the experiment by themselves. The Engineering Experiment aim to exercise the ability to observe and the ability to use basic measuring instruments of the students, students also could have a better understanding of the textbook knowledge.

Recommended Textbooks/References:

1. Yang Shiming. Heat Transfer (fourth edition). Beijing: Higher Education Press,2010
2. Kang Yueming, Li Li. Engineering Thermodynamics(fifth edition). Beijing: China Building Industry Press, 2006
3. Lu Huiqing. Practical Heating and Air Conditioning Design Manual (second edition). Beijing: China Building Industry Press, 2008

Course Number: 0004969

Course Title: Heat transfer

Credit: 3 **Total Credit Hours:** 48

Students: New Energy Science and Engineering, Thermal Engineering

Prerequisites: Advanced mathematics, Physics, Fluid Dynamics, Thermodynamics

Evaluation Method: Written Examination

Course Description:

Heat Transfer is a required course for Energy & Power Engineering and New Energy Science & Engineering students. It is a science that studies the energy transfer between two bodies due to temperature difference. There are three modes of heat transfer: Conduction, Convection and Radiation. The course consists of nine parts: ① Introduction to conduction; ② one dimensional steady-state and unsteady-state Conduction; ③ Fundamentals of numerical methods of conduction; ④ Introduction to Convection; ⑤ Single-phase flow and convection correlations; ⑥ Condensation and Boiling; ⑦ Fundamental Laws for radiation; ⑧ Radiation exchange between surfaces; ⑨ Heat transfer process and heat exchangers. Methods for solving multi-mode heat transfer are also presented in the course.

Recommended Textbooks/References:

1. Dai G S. Heat Transfer (second edition). Beijing: High Education Press, 1999. (in Chinese)

Course Number: 0004970

Course Title: Engineering Combustion

Credit: 2 Total Credit Hours: 32

Students: Engineering Combustion

Prerequisites: Engineering Thermodynamics, Fluid Mechanics, Heat Transfer

Evaluation Method: Written Examination

Course Description:

Engineering Science is a professional basic course for major of new energy science and engineering, also is one of the main subjects of thermal science theory. It is a scholarship to study how the chemical energy of the fuel changing into heat energy efficiently and cleaning.

Through the study of this course, the students can master the main characteristic all kinds of industrial fuel, and master the calculation method of fuel combustion in engineering and the diagnosis method of combustion, grasp basic concepts and basic laws of combustion theory such as the combustion reaction thermodynamics, kinetic theory, ignition, flame propagation theory, flame structure and stability principle. In the study of this course, the students are going to learn the theory and technology of atomization of liquid fuel, coal thermal decomposition and char particle combustion. From the study of this course, the students should also have certain understanding the properties of combustion device, formation mechanism of combustion pollutants and its prevention technology.

Recommended Textbooks/References:

1. WANG Jun, Qiliang MA etal, Engineering Combustion, China electric power Press,2008.
2. ZHANG Songshou, Engineering Combustion, Shanghai Jiao tong University Press,1987
3. HAN Zhaocang, Fuel and combustion, Metallurgical industrial Press,1984
4. YAN Chuanjun, Wei FAN, Combustion, Northwest Polytechnic University press,2005

Course Number: 0004977

Course Title: An Introduction to Energy Science

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: none

Evaluation Method: Written Exam

Course Description:

This course introduces the general situation of energy science, the problem it's faced with, the solutions to these problem and the prospect of development, delivers the basic knowledge and theory of energy science to students. The aim of the course is to make students understand the energy history, new energy technology and its developing trend, improve and strengthen student's energy conservation and environmental protection consciousness, lay the foundation for the related energy scientific research and operation management. This seminar focuses on clarifying the energy concepts and energy classification in order to make the students establish energy evaluation foundation. The specific energy which will be analyzed and discussed in this course are fossil energy, nuclear energy, hydrogen, solar energy, wind energy, hydropower, biomass energy, geothermal energy.

Recommended Textbooks/References:

1. Huang Suyi, Gao Wei. Introduction to Energy. Higher Education Press, 2004

2. Su Yaxin, Mao Yuru, Zhao Jinde, New Energy and Renewable Energy. Higher Education Press, 2006
3. J.R. Vankey, translated by Wang Naili, Energy: Prospect of 21th Century. Shanghai Jiaotong University Press, 2008

Course Number: 0000580

Course Title: Principles and Equipments of Air-conditioning

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students Major in New Energy Science and Technology (Refrigeration and Air condition Direction)

Prerequisites: Thermodynamics of Engineering, Heat Transfer, Fluid Dynamics of Engineering

Evaluation Method: Written Exam

Course Description:

The course is a major requirement and a prerequisite of curse design and graduation project. Through the course study, students could master fundamental theory of air conditioning, and design and analysis methods of usual air-conditioning systems, and selection methods of usual air-conditioning equipments; Also, students could know measurement and adjusting methods of air-conditioning systems, and new technology and equipments. The course knowledge includes: moist air properties, psychometric chart, cooling load calculation, air-conditioning equipments, air-conditioning systems, off-design conditions adjustment, space air diffusion, air flow in ducts design, indoor air quality, noise abatement and shock absorption, fire protection and smoke exhaust, measurement and adjusting methods. Through the course study, students could understand fundamental principles and equipments of air-conditioning theoretically, which is a solid foundation for the future application.

Recommended Textbooks/References:

1. ZHAO Rongyi, FAN Cunyang, XUE Dianhua, QIAN Yiming. Air Conditioning (Fourth Edition). Beijing: China Architecture Industry Press, 2009
2. HUANG Xiang. Air Conditioning Engineering, Beijing: China Machine Press, 2007
3. Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler. Heating, Ventilating and Air Conditioning Analysis and Design (Sixth Edith). John Wiley & Sons, Inc, 2005

Course Number: 0000595

Course Title: Refrigeration & Air-conditioning Compressors I

Credit: 3 **Total Credit Hours:** 48

Students: Students Major in refrigeration and Air-conditioning

Prerequisites: Engineering Thermodynamics II, Engineering Fluid Mechanics, Basis of Mechanical Designing V

Evaluation Method: Written Exam

Course Description:

“Refrigeration & Air-conditioning Compressors I” involves some special knowledge for the students who are studying refrigeration and Air-conditioning. Compressors, as the “heart” of vapor compression refrigeration systems, are very important for those who will engage the R&D, design,

manufacturing of refrigeration & Air-conditioning systems. There are many kinds of compressors with different working principles and structures. This course will make students master working principles, specialties, key technologies and application knowledge of different kinds of compressors. This course includes three parts, reciprocating compressors, rotary compressors, and compressor applications. In the first part, students can master the working principles, thermodynamic analysis, dynamics analysis and typical structure of reciprocating compressors and their key parts. In the second part, they can master the working principles, structures, characteristics and some key or new technologies of each kind of rotary compressors, screw compressors, rolling piston compressors and scroll compressors. In the third part, they can master the assistant systems such as lubrication system, safety and protection, control and adjustment, and cooling system as well.

Recommended Textbooks/References:

1. WU Yezheng, LI Hongqi, ZHANG Hua. Refrigeration Compressor. China Machine Press, 2010
2. MA Guoyuan, LI Hongqi. Rotary Compressor. China Machine Press,2001

Course Number: 0000598

Course Title: Principles and Equipments of Refrigeration

Credit: 4 **Total Credit Hours:** 64

Students: Major in Energy and Power Engineering, New Energy Science and Engineering, Architectural Environment & Equipment Engineering

Prerequisites: Engineering Thermodynamics, Heat Transfer, Engineering Fluid Mechanics

Evaluation Method: Homework + Final Examination

Course Description:

This course covers the principles of refrigeration and heat pump, refrigeration cycles, alternative refrigerants, primary and accessorial equipments in domestic, commercial refrigeration / heat pump system. Upon completion, students should be able to identify refrigeration systems and components, explain the refrigeration process and analyze performance of refrigeration and heat pump system.

Recommended Textbooks/References:

1. Larsen M. E., Refrigeration: theory technology and applications, Nova Science Publishers Inc., 2010.
2. Hua Z. Z., Refrigeration technology, Science Press, 2009.
3. Hundy, G. F. Refrigeration and air-conditioning, Butterworth – Heinemann / Elsevier, 2008.
4. Langley, C., Refrigeration principles, practices, and performance, Thomson/Delmar Learning, 2008.
5. ASHRAE, 2006 ASHEAE handbook: refrigeration: inch-pound edition, 2006.
6. Whitman, W. C., Refrigeration & air conditioning technology, Thomson Delmar Learning, 2005.

Course Number: 0003218

Course Title: Freezing and Cold Store

Credit: 2 **Total Credit Hours:** 32

Students: Major in New Energy Science and Engineering (Refrigeration and Air Conditioning Module)

Prerequisites: Heat Transfer, Refrigeration Principle and Equipment, Refrigerating Installation

Evaluation Method: Written Exam

Course Description:

Freezing and cold store is a main required elective course, it is also the advanced placement of the students, who major in new energy science and engineering (refrigeration and air conditioning module), to finish the following course design, engineering practice, and graduation design. The characteristic is that it discusses the new theory and new equipment of freezing and cold store based on the refrigeration courses. In this course, the fundamentals of foods chilling and freezing techniques will be lectured , mainly including the preserving principles, refrigerating technologies, chilling and freezing technique and their plants of foods, and vacuum drying of freezing foods, cold chain and store. After studying this course, students can master the elementary knowledge about the food chemical composition and the change during cold store, the principles of freezing and cold store, freezing process design. At the same time, students can design the common food freezing process.

Recommended Textbooks/References:

1. Guan Zhiqiang, Food Freezing and Cold Store Principles and Technology, Chemical Industry Press, 2010
2. Hua Zezhao, Food Freezing and Cold Store Principles and equipment, mechanical Industry Press, 2002

Course Number: 0007435

Course Title: Heating, Ventilating, Fluid Transmission and Distribution

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students for the Major in New Energy Science and Engineering

Prerequisites: Fluid Dynamics, Engineering Thermodynamics, Heat Transfer

Evaluation Method: A Big Assignment

Course Description:

This is a self-study type specialized course for the undergraduate students for the major in new energy science and engineering (refrigeration). Specialized courses include only principles and equipments in refrigeration and air conditioning systems are not enough for students who may work in the areas of heating, ventilating and air conditioning system designs or maintenance and operation of the building equipments. To let the students' knowledge structures more systematic and comprehensive, the design calculation of heating, ventilating, fluid transmission and distribution need to be compensated. The students are expected to grasp the working principles and design methods of heating and ventilation systems. Basic topics also include load calculation method, common ventilation methods, and hydraulic calculation of wind ducts and water pipes. It supplies a base for students to learn air conditioning system design later.

Recommended Textbooks/References:

1. WANG Yizhao, LIU Xiong, Heating Engineering, China Machine Press, 2007

2. WANG Hanqing, Ventilation Engineering, China Machine Press, 2007
3. FU Xiangzhao, XIAO Yimin, Fluid Transmission and Distribution, China Architecture and Building Press,2010
4. YU Hui, LI Xiangcheng, Architectural Drawing, China Electric Power Press,2010
5. ASHRAE handbooks: Heating, Ventilating and Air-conditioning Systems and Equipment, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 2008
6. McQuiston, Parker and Spitler, Heating, Ventilating, and Air Conditioning, John Wiley &Sons, Inc., 2005
7. Standard for architectural drawing GB/T50104-2001
8. Standards for HVAC Drawing, GB/T50114-2001

Course Number: 0007436

Course Title: Alternative Fuel for Internal Combustion Engine

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate of energy and power engineering power major

Prerequisites: Engineering thermodynamics, Internal combustion engine fundamental

Evaluation Method: Assignment (25%), Subjective Report (25%) and Written Exam (50%)

Course Description:

This course is combined with some pre-requisites such as engineering thermodynamics and internal combustion engine fundamental and its main content is consisted of combustion theory, application technology, emission performance, long-term service experience, and also the questions and solutions of alternative fuels. The purpose of the course is make students to systematically study and grasp the necessary engineering and technology knowledge after they have understand gasoline and diesel fuels. The basic requirement is that the students can realize and understand the status and prospects of ICE alternative fuels in-depth, and combine the basic theory with the realistic problems. Consequently innovation capability and research interests are enhanced. This is helpful to that students are engaged in such R&D work fields as vehicle power system, automobile new energy, power machinery and engineering and the power system of energy saving and emission reduction.

Recommended Textbooks/References:

1. Bian Yaozhang, New Energy Source for Automobiles, China Communications Press, 2003.
2. Jiang Deming, Combustion of Alternative Fuels for Internal Combustion Engine, Xi'an Jiaotong University Press, 2007.

Course Number: 0000829

Course Title: Automation of Refrigeration and Air Conditioning Systems

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Principles and equipments of refrigeration, Principles and equipments of air conditioning, Electrical Engineering, Power Electronic Technology, Principle of Automatic Control

Evaluation Method: Written Exam

Course Description:

The fundamentals of automatic control theory and the related application in refrigeration and air conditioning systems will be learnt in this course. The basic topics include: structures, features and functions of normally used sensors, controller, controlled devices; the methods to obtain the characteristics of controlled object; selection of the suitable control methods according to the characteristics of controlled object; evaluation of the control quality by the respond curve of the controller to step signal; tuning methods of PID controllers in engineering; design method of electrical control circuits in various kinds of refrigeration equipments; the application cases of automatic control technologies in refrigeration and air condition systems. Cascade control, feed forward and PLC are also introduced. The students are expected to have the ability to design automation systems for refrigeration and air conditioning systems after the course study.

Recommended Textbooks/References:

1. ZHU Ruiqi, Automation in Refrigeration Equipments (2nd edition), Xi'an Jiaotong University Press, 2008
2. CHEN Zhijiu, WU Jingyi, Automation in Refrigeration Equipments (2nd edition), China Machine Press, 2010
3. Ross Montgomery, Robert Mcdowall, Fundamentals of HVAC Control Systems, Elsevier, 2008
4. K.J.Astroem, T. Haegglund, PID controllers: Theory, Design and Tuning, 2nd Edition, Instrument Society of America, 1995

Course Number: 0000831

Course Title: Refrigeration Plant

Credit: 2 **Total Credit Hours:** 32

Students: New Energy Science and Engineering (refrigeration and air conditioning module)

Prerequisites: Refrigeration principles and equipment, Air conditioning principle and equipment, Refrigeration compressor I.

Evaluation Method: Written Exam

Course Description:

The course belongs to professional course, and the Pre-requisites are Refrigeration principle and equipment, Air conditioning principle and equipment, Refrigeration compressor. In the process of training professional personnel, through the course, students will combine the principle of refrigeration and air conditioning combination with industry, agriculture and manufacturing, as well as everyday life in the air conditioning and refrigeration products and devices, study and grasp the cooling device concrete structure of cooling consumption, application in deep, master the general principles and basic methods of refrigeration equipment computer-aided design and computer, and to further understand the energy-saving design, operation and maintenance of the refrigeration equipment。Through study of the course, students will establish a sense of energy-saving of refrigeration equipment, and grasp the energy-saving design, operation and maintenance of the refrigeration equipment.

Recommended Textbooks/References:

1. Liu Zhongbao, Dong Sujun, Wang Zhiyuan. Air conditioning and Refrigeration Equipment and the System Simulation, China Machine Press, 2011
2. Zheng Xiande, Refrigeration Equipment and Devices, China Machine Press, 2001.

Course Number: 0004975

Course Title: Wind Energy Utilization

Credit:2 **Total Credit Hours:** 32

Students: Undergraduate students Major in New Energy Science and Engineering

Prerequisites: Higher Mathematics, Engineering Mechanics, Electrical Engineering Technology, Engineering Fluid Mechanics

Evaluation Method: Written Exam

Course Description:

This is a specialized optional course.The students can deeply understand wind energy utilization and development of wind power generation industry. The main contents of the course is wind power generation technology. The students are expected to understand theory of wind turbine, working principle of wind power generation, site selection of wind power field, economic analysis and construction of wind power field. In which, classification of wind turbine, structure and theory of horizontal axis wind turbine, stress analysis of wind wheel, engineering calculation of wind turbine, working principle of wind power generation and site selection of wind power field should be mastered. In the course basic knowledge of wind power (formation of wind, measurement of wind and wind power calculation) and other form of wind power utilization(water supply and heating) are also introduced.

Recommended Textbooks/References:

1.Song Haihui. Wind Power Generation Technology and Engineering. China Water Conservancy and Hydropower Press, 2009

2.Guo Xinsheng. Wind Energy Utilization. Chemical Industry Press, 2007

3.Liao Mingfu. Wind Power Generation Technology. Northwestern Polytechnical University Press, 2008

Course Number: 0007428

Course Title: Energy Saving and Emission Reduction

Credit: 2.0 **Total Credit Hours:** 32

Students: New Energy Science and Engineering, Thermal energy and power engineering

Prerequisites: Engineering Thermodynamics; Heat Transfer; Heat Engineering Progress and Equipment

Evaluation Method: Investigate Report

Course Description:

The objective of this course is to teach the basic concepts and theories of energy saving and pollutants emission reduction. Through the studying of this course, let the undergraduate students know that: the concept of energy saving and pollutants emission reduction, the purpose of energy saving and pollutants emission reduction, the important of energy saving and pollutants emission reduction for measurement and validation, the latest and most comprehensive international knowledge of energy conservation and emission reduction, laws and regulations, the international general measuring method of greenhouse gas emission reduction and carbon emissions transactions. And let them learn the general energy-saving technologies and these applications in power, electromechanical, electronic information, building, traffic and agricultural industry area. To equip the student knowledge and skills in mastering the technology of energy saving and emission reduction, including the method for measurement and verification of energy

consumption and energy-saving, waste heat recovery and cogeneration technology in industrial applications in the field.

Recommended Textbooks/References:

1. Zhang Hui-li, Hao Ping. Energy Saving and Emission Reduction (knowledge reader). Posts and Telecommunications Press, August, 2009.
2. Yang Shen-zhong, Yang Wei, Zhu Tong-yu, Lu Yongkai. Energy Saving Technology and Energy Consumption Evaluation in Industry. Machinery Industry Press, July, 2011.
3. China Energy Conservation Technology Policy. National Development and Reform Commission. December, 2006.

Course Number: 0001589

Course Title: Automobile Air-conditioning

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduates Major in New Energy Science and Engineering, Energy and Power Engineering

Prerequisites: Engineering Thermodynamics II, Heat Transfer IV, Principles and Equipments of Refrigeration, Principles and Equipments of Air-conditioning, Refrigeration & Air-conditioning Compressors I

Evaluation Method: Examination

Course Description:

This is an optional course for undergraduates majoring in new energy science engineering and thermal energy and power engineering, which tells automotive air conditioning system and automotive air conditioning unit. It helps undergraduates to lay the foundation of designing, testing and research in the future. Through the study of this course, students will understand how to determine the automotive air conditioning air calculation of parameters, and master automobile air conditioner heat and moisture load calculation method; be familiar with automotive air conditioning refrigeration system; understand the car-used air conditioning compressor's working principle and structure; master the car-used heat exchanger's (evaporator and condenser) characteristics and design methods; understand the expansion valve, the liquid dryer's working principle and structure, and understand the heat source of the automotive air conditioning and heating device; be able to design small cooling device.

Recommended Textbooks/References:

1. Zhang Lei. Automotive Air Conditioning. Beijing: Mechanical Industry Press,2003
2. Ma Mingjin. Automotive Air Conditioning Tectonic Use and Maintain. Beijing: Peking University Press,2005

Course Number: 0002245

Course Title: New Technology in Refrigeration

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduates Major in New Energy Science and Engineering

Prerequisites: Engineering Thermodynamics II, Heat Transfer IV, Principles and Equipments of Refrigeration, Principles and Equipments of Air-conditioning, Refrigeration & Air-conditioning

Compressors I

Evaluation Method: report

Course Description:

This is a optional course for undergraduates majoring in new energy science engineering which tells new technology, new product, new craft, industry enterprise advanced management mode and new enterprise cultures in the field of refrigeration, air conditioning and energy power. It helps students to understand the latest development of the related field. Through visiting, students have direct-viewing understanding to the new technology, craft, and process in refrigeration field.

Recommended Textbooks/References:

1. Li Hongqi. Refrigeration and Air Conditioning and Energy Power System New Technology. Beijing. Beijing aerospace university press, 2006.9

Course Number: 0003861

Course Title: Design for Air-Conditioning System

Credit: 2 **Total Credit Hours:** 60

Students: Undergraduate students Major in New Energy Science and Technology (Refrigeration and Air condition Direction)

Prerequisites: Principles and Equipments of Air-conditioning

Evaluation Method: Design Report

Course Description:

The course is a practical requirement course. Through the course study, students could understand air conditioning theory thoroughly, and master basic design methods of air conditioning systems, and master primary design drawing methods, and also know engineering design steps. The course aims at an air conditioning system design, which includes: cooling load calculation, air conditioning system selection, design condition analysis in psychometric chart, space air diffusion calculation, air flow in ducts design, equipments selection, drawing and report. The course study contributes to extension of students' specialized knowledge and optimization of students' knowledge structure, and contributes to cultivate relationship between theories and practice, and contributes to cultivate analysis and solution engineering ability.

Recommended Textbooks/References:

1. LU Shikui, YAO Shouguang. Course Design Guidebook of Air Conditioning and Refrigeration. Beijing: Chemical Industry Press, 2005
2. Code for Design of Heating Ventilation and Air Conditioning (GB50019-2003), Beijing,2003
3. ZHAO Rongyi, FAN Cunyang, XUE Dianhua, QIAN Yiming. Air Conditioning (Fourth Edition). Beijing: China Architecture Industry Press, 2009

Course Number: 0007434

Course Title: Practice of Production Technology of Refrigeration and Air Conditioning Specialty

Credit: 3 **Total Credit Hours:** 90

Students: Undergraduates Major in New Energy Science and Engineering

Prerequisites: Principles and Equipments of Refrigeration, Principles and Equipments of

Air-conditioning, Refrigeration & Air-conditioning Compressors I

Evaluation Method: Comprehensive Evaluation

Course Description:

This course creates a miniature enterprise production simulation environment through the specialized production technology practice, provides opportunities of combining theory and practice, applying knowledge into reality to students, who can master the following knowledge: the general process and the integral product technology from product design to produce products; structure and composition of typical refrigeration equipment; cooling device production processing preparation and optimization; the simple product cost accounting and the forecast of economic benefit; the general concepts of production organization and management; the importance of cooperation and coordination in the technology development and the establishment of corresponding ideas and thinking; debugging and testing refrigeration products; the technical data collection and filing; Market development and marketing. Above content covers all professional courses of refrigeration profession, and also uses knowledge about metal manufacture, automatic control and marketing, production management, quality control, organization management.

Recommended Textbooks/References:

Course Number: 0005234

Course Title: Senior Project

Credit: 16 **Total Credit Hours:** 480

Students: Major in New Energy Science and Engineering (Refrigeration and Air-conditioning Module)

Prerequisites: All fundamental and professional courses

Evaluation Method: Tutor Marking + Reviewers Evaluation + Defense

Course Description:

After studying all theoretical and practical courses, a senior student can choose a task in refrigeration and heat pump system and plant, heating, ventilating and air conditioning system and equipment, automation of refrigeration and air conditioning, energy saving, new energy utilization, etc. as his/her project, compose thesis.

Recommended Textbooks/References:

According to the tutor’s recommendation.

Course Number: 0007409

Course Title: Professional Practice of Refrigeration and Air-conditioning Specialty

Credit: 4 **Total Credit Hours:** 120

Students: Undergraduates Major in new energy science and engineering

Prerequisites: Principles and Equipments of Refrigeration, Principles and Equipments of Air-conditioning, Refrigeration & Air-conditioning Compressors I

Evaluation Method: Comprehensive Evaluation

Course Description:

Students can practice in enterprise through visiting and work practice, understanding the performance and the mode of enterprise refrigeration product, and management mode; students

can also get deep understanding of refrigeration enterprise and its related industry through the work practice, which is helpful to students' employment.

Recommended Textbooks/References:

Course Number: 0005375

Course Title: Cognitive Practice of Refrigeration and Air Conditioning Specialty

Credit: 1 **Total Credit Hours:** 30

Students: Undergraduates Major in new energy science and engineering

Prerequisites:

Evaluation Method: Comprehensive Evaluation

Course Description:

Visiting the enterprise allows freshmen to understand the field of refrigeration and air conditioning, and have perception understandings about the future direction of employment. By using more practices students can make plans about the four years study in college, clear learning goals, and increase interest in learning.

Recommended Textbooks/References:

None