

Life Sciences

[C] = Compulsory [S] = Selective

Semester 1

[C] Mathematical Analysis (A) I

Credits: 5 Class Hours: 112

The basic content of this course contains: Limits and Continuity, Single Variable Differential Calculus, Single Variable Integral Calculus, Multivariable Differential Calculus, Multivariable Integral Calculus, Theory of Series, Improper Integral and Integral Cosine Depending on a Parameter.

This course not only enable students to gradually acquire the abstract general conclusion, relevant concept, basic theory and method, but also cultivate students' systematic, rigorous abstract logical thinking and verification ability, scientific and standardized expression ability. In order to make them master the ideology and method of utilizing mathematical tools to analyze problems, transform problem and solve problem.

[C] Introduction to Physics (A) I

Credits: 5 Class Hours: 96

An introductory Physics course usually covers Mechanics, Thermal Physics, Electricity and Magnetism, Optics, and Modern Physics. Typically it takes two years to go through these subjects. We, on the other hand, will have only one year to cover all this material. A great challenge before us is to master the material in a short period of time, and do it well. Another challenge is that this class consists of students with intention of pursuing rather different majors - mathematics, physics, and life sciences. The preparations and backgrounds are also very different. To address this challenge, we will focus on the most fundamental aspects of physics, emphasizing concepts and general approaches.

[C] Chemical Principles

Credits: 4 Class Hours: 64

Chemical Principles is the foundation course for Zhiyuan Students. The course is about the basic principles of physical chemistry widely applied in the field of Chemistry, and the course is prerequisite of all subsequent chemistry courses (Inorganic Chemistry, Organic Chemistry, Physical Chemistry, and Analytical Chemistry and Chemical Engineering Elective Courses). It includes Atomic Molecular Electronic Structure, Molecular Structure, Molecular Interaction, the Basic Properties of Gas Liquid Solid (Crystal), the Three Laws of Thermodynamics, Thermodynamic Equilibrium and Reaction Kinetics.

[C] Introduction to Biology I

Credits: 4 Class Hours: 64

This course is an introduction of the Basic Principles of Modern Biology. It will introduce Biochemistry, Molecular and Cell Biology, and Genetics and Development Biology. The purpose of this course is not only clarifies the important basic principles, meanwhile, discusses the discovery process and experimental methods, as well as introduces the methods of Applied Statistics, Mathematics and Computer Science to research complex biological system. The course is also suitable for those students majoring in Mathematics and Physics who have interest in basic biology knowledge of molecular and cellular.

[C] Introductory Biology Seminar I

Credits: 2 Class Hours: 64

This course is a part of Introductory Biology Seminar through seminars, including reading original scientific papers, introducing the discovery process and experimental methods of scientific theory and intersectional realm of biology and chemistry. This course is suitable for students who are interested in science research.

[C] Chemical Principles Laboratory

Credits: 3 Class Hours: 51

General Chemistry Experiment is an experimental course supporting for the corresponding theoretical courses of general chemistry. In General Chemistry Experiments, students will have the chances to get better understanding on the fundamental concepts in many fields such as biology, chemistry and physics. This experimental course will use some different experimental techniques and instruments including distillation, extraction and titration to help the students learning basic chemical knowledge and skills. The students will also be required to analysis their experimental data and finish corresponding reports with high quality. By such processes, they will have the chance to learn the basic procedures in experimental sciences.

This course is composed of several sections covering different topics from the theoretical courses, and each section will need 4-6 hours. The students should finish one independent section of experiment in one week.

Semester 2

[C] Mathematical Analysis (A) II

Credits: 5 Class Hours: 112

The basic content of this course contains: Number Entries, Series of Functions, Multivariable Differential Calculus, Multivariable Function Integral Calculus, Integral Depending on a Parameter, Fourier Series.

This course not only enable students to gradually acquire the abstract general conclusion, relevant concept, basic theory and method, but also cultivate students' systematic, rigorous abstract logical thinking and verification ability, scientific and standardized expression

ability. In order to make them master the ideology and method of utilizing mathematical tools to analyze problems, transform problem and solve problem.

[C] Introduction to Physics (A) II

Credits: 5 Class Hours: 96

The course is designed for two semesters. Introduction to Physics I covers the core content of classical mechanics, hydrodynamics and thermal physics. Introduction to Physics II covers the core content of electromagnetism, physical optics and modern physics. The course also introduces a considerable number of expansions of the content. In the teaching process, it cover the classical, highlight the characteristics and key points, etc. Each chapter includes the basic content, reading materials, exercises and small paper, etc. In the teaching process, it try to express the content clearly in appropriate difficulty, and attractively, with particular attention to the application of physical principles and physical ideas in practice.

Through the course of study, the students can gradually grasp the ideas and methods of solving problems by physics. They can not only acquire the knowledge, but also their ability to establish physical model, and the capacity of calculation and estimation of quantitative analysis and qualitative analysis, and the ability to obtain knowledge independently, the ability of linking theory to practice can be synchronously improved and developed. Students can open their thinking, inspire their spirit of exploration and innovation, enhance their adaptability, and enhance their quality of science and technology. Through the course of the study, to enable students to master the scientific learning method and form good learning habits, form the dialectical-materialism-theory-formation world outlook and the methodology.

[C] Organic Chemistry

Credits: 4 Class Hours: 64

Organic Chemistry is a fundamental course about basic substance of organic structure, property and change in consisting carbon-based substances. It is a compulsory course in atomic and molecular level to help us comprehend the natural world and acquire the methods to change and create substances.

The course uses the original mainstream English teaching materials to help students directly apply the global language for chemistry, thus better learn, understand and grasp the content. Language is the carrier of knowledge and communication, but not the goal and content of the course.

The ultimate purpose is to let the students learn, discover and comprehend the features and inner logic connection of organic chemistry, cultivate the interest and desire to explore the natural world, especially the world of organic chemistry. On the base of fully understanding, generalizing, thinking, and grasping existing knowledge, the students will generally own the thinking and practice ability of discover, analyze and solve the problems.

Main content of the course is about basic concepts and theories of organic chemistry, including structure, property and changes of organic compounds, reaction mechanism of typical organic chemicals reactions and its application in the synthesis of organic compounds.

[C] Introduction to Biology II

Credits: 4 Class Hours: 64

This course aims to let the students understand the whole picture of the development of life science, and to explore a series of hot spots in scientific research. The course sets evolution, biological diversity and ecology as the main line, analyzes the important moments in the history of scientific development, builds a systematic knowledge and ideology system and the ability to explore biological phenomena. This course lays solid foundation for the students to become potential scientists with international vision, forefront of the science development, and strong speculative ability.

[C] Introductory Biology Seminar II

Credits: 2 Class Hours: 64

The main purpose of this course is to cultivate students' ability to raise questions. Students can hold open research upon important discoveries in the history of biological development, classical scientific papers, or the urgent biological issues the society is facing nowadays. Topics cover the origin of biological evolution, development of evolution thought, origin of genes, the origin of species and species diversity, the principle of classification and genetic analysis of complex traits, and the interactions between creatures and environment. The course faces the classical or frontier problems of biological development, and the analysis and discussion are all in English, which may be a great stimulus for the students.

[C] Organic Chemistry Laboratory

Credits: 4 Class Hours: 64

Organic chemistry is an important branch of chemistry. It is a course to examine the composition, structure, properties and the rules of changing of organic compounds. Organic chemistry experiment is an important part of Organic chemistry teaching, experimental teaching certification, and to consolidate and strengthen the most of the theoretical knowledge and accompany dependents students on the proper choice of synthetic organic compounds, the separation and identification methods, analysis and resolution of experimental problems encountered in the thinking and practical ability and train the students to the style of linking theory with practice, seeking truth from facts, rigorous serious scientific attitude and good work habits, training students to the basic skills of organic chemistry experiments and experimental methods and collated experimental data, the preparation of test reports the ability to lay a solid foundation for relevant professionals.

[C] Physics Laboratory I

Credits: 1.5 Class Hours: 26

The course is set up to make students hold the ideas, the fundamental principles and the basic methods of the physical experiments, and to teach students how to use the basic experimental instruments and apparatus and how to deal with the data. What's more, the course is set up

also to make students have the attitude of working hard and coming down to bedrock and have the hard-bitten style, and lastly to make students basically hold the ability to research.

Semester 3

[C] Linear Algebra

Credits: 5 Class Hours: 80

This course is a basic linear algebra course for Zhiyuan students majoring in chemistry and biology, which covers the basic content of linear algebra. The course enables students to master the basic theories, thoughts and methods of linear algebra and polynomial, also systematically trains and enhances the calculation ability and abstract thinking ability. This course lays solid foundation in linear algebra for future study of other majors. The course emphasizes abstract thinking while pays special attention to illustrating the mathematical thoughts and thinking threads with detailed applicable examples. The course introduces the relations with other subjects and cutting-edge scientific results to broaden the horizon of the students.

[C] Biochemistry

Credits: 4 Class Hours: 64

This is an undergraduate biochemistry course. The course introduces the structure and the function of proteins, nucleic acids, carbohydrates, and lipids. We will also discuss concepts and researches related to the flow of genetic information, protein synthesis, enzymology and metabolism.

[C] Biochemistry Seminar

Credits: 2 Class Hours: 64

This is an undergraduate biochemistry discussion course offered in parallel with the Biochemistry lecture.

[C] Physics Laboratory II

Credits: 1.5 Class Hours: 26

Through the learning of this course, students should review and reinforce the understandings about operations of instrument, realization of experiments and analysis of data. They should know about the underlying motivation of designing physical experiments, and be able to briefly design reasonable schemes based on the aim of experiment and instruments, also determine the parameters. They should acquire fundamental methodologies to analyze errors and evaluate results.

Through experiments, students should acquire the ability to observe, analyze and judge. They shall be cultivated to possess manners of scientific research, and acquire elementary research ability.

[C] Biology Laboratory I

Credits: 4 Class Hours: 64

Aim at students for Zhiyuan sciences and related majors. The teaching orientation is the training of the basic skills of biology experiment, students' experiment ability, quality and habit.

The contents of the experiment include the classical contents of biology, medicine and pharmacy, such as the application of the microscope, the classic film production technology, and animal and plant morphology observation. Prepare good foundation for the students to enter the life science related professional learning and the general mobilization of professional learning from the thought.

After study of this course, students should achieve the level of professional basis in the aspects of ideas, knowledge, operational technology and application ability.

Semester 4

[C] Genetics

Credits: 4 Class Hours: 64

Genetics is a subject studying the law of biological heredity and variation. It is an important fundamental theoretical subject belonging to Biological Science. Thus, Genetics is a compulsory course of biology majors. This course includes three parts that are Transfer of Genetic Information, Expression of Genes and Mutation. More specifically, it includes Monogenetic Inheritance, Transfer of Genes, Gene Mapping, Inheritance of Bacteria and Viruses, Interactions between Genes, DNA Structure and Replication, RNA Transcription and Processing, Protein Synthesis, Gene Separation and Operation, Gene Expression Regulation of Prokaryote, Gene Expression Regulation of Eukaryote, Gene expression Regulation in Development, Genomics, Transposon, Mutation, Recombination and Repair, Replacement of Large Fragment of Chromosome, Population Genetics, Complex-Traits Inheritance, Evolution of the Genes and Traits. Through this course, students will have a clear idea on the research scope of genetics, the nature of heredity and mutation, major research methods, thinking pattern and analysis features of genetics, while acquiring the connection with other research areas.

[C] Genetics Seminar

Credits: 2 Class Hours: 64

The course aims to help students understand and apply Genetics knowledge through reading and discussion of relevant professional documents.

[C] Biology Laboratory II

Credits: 4 Class Hours: 64

This course is the experimental course supporting the corresponding Biochemistry theoretical courses. It is a compulsory basic experiment course for undergraduates in Zhiyuan College. This course trains the students with basic biochemical experiment methods and techniques, familiarizes them with common qualitative and quantitative analysis of Biological Macromolecules, routine techniques to isolate and identify biological molecules, and introduces them to the basic knowledge of Enzyme Kinetics. It cultivates the ability of innovative thinking, experiments design and ideology and lab report with formal language.

Semester 5

[C] Cell Biology

Credits: 4 Class Hours: 64

Cell biology is one of the major fundamental courses for biology majors. Cell Biology deciphers various kinds of life activities from three distinct levels, cellular, sub-cellular and molecular level of cells. In this course, students will learn to combine the cellular structures and components to their biological functions and understand the various cellular process in a dynamic and global view. These processes include signal transduction and cell-cell recognition, protein processing, folding and sorting, cell proliferation and programmed cell death, etc. By learning this course, students will understand the basic phenomenon in life, including growth, development, differentiation, reproduction, movement, genetics, and mutation, aging, as well as how precise they are regulated. In addition to the training of scientific thinking by introducing classical experimental designs and the history of most important scientific findings, students are also encouraged to keep updated the hot spots in contemporary cell biology research and future development.

[C] Cell Biology Seminar

Credits: 2 Class Hours: 64

The Tutorial Course of Cell Biology closely maps the syllabus of Cell Biology, in which topics on classical seminal discoveries of biology and most recent development in the field are carefully selected and given to students for self-learning beforehand. Discussion and debate in the tutorial course help students clarify basic concepts and key processes of cell biology, grasp the essences of biological research from various aspects such as identifying research problems and raising hypothesis, designing experiments and drawing conclusions, as well as writing skills and styles. This course is also designed to strengthen students' competence in scientific thinking.

[C] Biology Laboratory III

Credits: 4 Class Hours: 64

Biological Experiments 3 contains many experimental researches and provides the key basis for genetics study. It is one of the most important courses in Life Sciences and is compulsory for the undergraduates in the subjects of Life Sciences, Medicine, and Agronomist al. It reveals the essential phenomenon and principles in genetics.

The course contains three modules: First, it is classical genetics module, which tests and verifies the classical principles, analyze and understand the basic theory in individual level

by the hybridization of wide with mutant fruit fly. Second, it is cellular genetics module, which observes and understands the chromosomal basis of genetics by preparation of giant chromosome from fruit fly salivary glands. Thirdly, it is molecular genetics module, which knocks out PDS gene in the model plant--arabidopsis thaliana using cysteine-rich secretory proteins (CRISPs) system, observe the mutant phenotype and verify by RT-PCR. These give not only the validation experiments but also the integrated and exploratory experiments, which make students understand deeply the theory and relative technology from the individual, cellular, chromosomal to molecular levels. These experiments also help students grasp correctly the basic skills and advanced technology in genetics.

After trained by Biological Experiments 3, students can comprehend thoroughly the theory and grasp the advanced technology, and analyze and resolve the problems effectively, promote the scientific quality, which lays a solid foundation for scientific work in future.

Semester 6

[S] Neurobiology

Credits: 4 Class Hours: 64

This course provides an introduction to principles of neurobiology from molecular, cellular and systems level, highlights important concepts and mechanisms of the nervous system functions. This course covers foundation of neurobiology from the components of the nervous system, neurons and glia, the way they connect and interact in processes such as action potential generation, propagation, and synaptic transmission, to sensory and motor systems, from higher brain functions from learning and memory to cognition, and finally diseases affecting nervous system. The basic knowledge of Cell Biology, Biochemistry and Genetics is helpful. This course is suitable to students in biology and basic medicine majors, and will benefit students in chemistry, computer science, physics and mathematics, who are interested in understanding how human brain works and what artificial intelligence can learn from the way human brain processes vast amount of information.

[S] Neurobiology Seminar

Credits: 2 Class Hours: 32

This course provide an opportunity for students to critically examine the course of important discoveries as well as the cutting-edge frontiers in Neuroscience. Literature on classic findings and most exciting advances related to the topics of the lecture is selected and student groups are required to present and discuss the literature under the supervision of lecturers.

[S] Developmental & Regenerative Biology

Credits: 4 Class Hours: 64

This course provides an introduction to principles of developmental biology across a wide range of organisms, and highlights medical applications of animal development and tissue regeneration. Developmental biology is to study how a single cell (fertilized egg) undergoes a series of changes in space and time to produce a complex multicellular organism with multiple functional organs. This course also highlights the most advanced technologies in developmental biology, and reveals association of development with regeneration and human diseases. This course consists of Animal Development and Plant Development. This course

is suitable to students in biology and basic medicine majors, and will benefit to students in chemistry, physics and mathematics, who are interested in understanding developmental biology and human disorders.

[S] Developmental & Regenerative Biology Seminar

Credits: 2 Class Hours: 32

This course provides an extension and discussion section to the main course in developmental biology. Professors will select a few outstanding publications that are related to lectures in the main course. Professors can also give additional lectures that are related to their own research. Usually students should read the publications and lead the discussion section.

Semester 7

[S] Immunology

Credits: 4 Class Hours: 64

This course is a half-year course, which introduces the basic principles of modern immunology. It will focus on the generation, development and regulation of the immune system and its function in human epidemics, immunological diseases, inflammation and tumor. The aim of this course is not only to elucidate these key principles of immunology, but also to discuss its history of discovery and some major experimental techniques. The course will also introduce the close relationship of immunology to the other sub disciplines of life science and research methods. This course is not only suitable for the students who majors in life science or medical science, but is also good for the students who major in biomedical engineering who want to pick up some basic knowledge in immunology.

[S] Immunology Seminar

Credits: 2 Class Hours: 32

This course discusses immunology's history of discovery and some major experimental techniques. The course will also introduce the close relationship of immunology to the other sub disciplines of life science and research methods.

[S] Computational Biology and Bioinformatics

Credits: 4 Class Hours: 64

[S] Computational Biology and Bioinformatics Seminar

Credits: 2 Class Hours: 32

Semester 8

[C] Undergraduate Project (Thesis)

Credits: 6 Class Hours: 96

This course is designed to be the first systematic training in performing scientific research, in completing a small project for undergraduate students in the final year. Under supervision of the adviser, students are required to identify a question, to devise appropriate steps to answer the question. At the end of the course, an oral defense is held to evaluate the understanding of the background, quality of the project and the amount of work.