

Introduction to Physics

1 Course Description

Code: 325005

Title: Introduction to Physics

Course type: elective course

Total class hours: 32

Credit: 1

Duration: 1 semester

Restricted to: undergraduates majoring in Physics

Introduction to the course:

Physics is the natural science that studies the structure and properties of matter, its motion and the interaction laws. It is one of the most fundamental scientific disciplines. The study of Physics includes mechanical motion, thermal motion, electromagnetic induction, optical motion, microscopic particle motion, which are the topic of Mechanics, Thermodynamics, Electromagnetics, Optics and Quantum Mechanics respectively. These branches of Physics constitute basic courses that undergraduates majoring in Physics need to learn. This course gives a brief account of the logic system and the development history of each branch of Physics. Through more than 100 vivid examples, the ways and means of applying the principles of Physics to science, technology and life are explained. Through this course, students will gain a macroscopic view of the outline and development of the Physics edifice, and understand the logical, historical and practical characteristics of Physics. Therefore, this course will broaden their horizons, promote their interests in studying Physics and other natural sciences, and cultivate the ability of logical thinking, analysis and problem-solving, laying a solid foundation for future courses.

Objectives:

This course offers students a unique perspective on the logic system, development and application fields of Physics. For freshmen who have just entered the university, this course can help them to complete the transition more smoothly from acquiring the knowledge of elementary Physics to the study of theories of advanced Physics, and gain a better understanding of the logical system, thinking characteristics and learning methods of college Physics. Through lectures, 86 AR demos, 25 animation demos, 147 object demos, and the audio recordings of biographies of 108 scientific giants, students will appreciate the beauty of Physics and the truth of human civilization, as well as develop abilities of finding, analyzing,

and solving problems, laying a solid foundation for future courses.

Assessment::

Assessment will be based on participation and a final course paper.

Type: elective course

Textbook and references:

Textbook:

Introduction to Physics (3rd edition), Higher Education Press, 2019, Zhang Hanzhuang, Ni mucui, Wang Lei

References:

Mechanics (4th edition), Higher Education Press, 2019, Zhang Hanzhuang

Online resources:

[http:// zhanghz.jlu.edu.cn](http://zhanghz.jlu.edu.cn)

2. Contents of each chapter and allocation of class hours

Chapter	Section	Class hour
Introduction An outline of the edifice of Physics	1. Classification of research contents for Physics 2. Overview of the logical relations of physical laws 3. Overview of scientists and research methods in branches of Physics 4. Overview of application of physical laws 5. Overview of demo resources of <i>Introduction to Physics</i> 6. Advices on learning Physics	4
Chapter 1 Mechanical motion	1. 1 Overview of the logic of mechanical movement laws 1.1.1 Basic overview of the logic of mechanical movement laws ★ 1.1.2 Advanced overview of the logic of mechanical movement laws 1.2 Overview of the development course of basic mechanical movement laws 1.2.1 Laws observed in celestial motion 1.2.2 Laws confirmed by experiment on earth 1.2.3 The theories and laws that unit the heaven and earth 1.2.4 The dynamic role of the theories and laws 1.2.5 Further improvement and development of the theories and laws 1.3 Basic mechanical movement laws and application cases	8

	<ul style="list-style-type: none"> 1.3.1 Basic laws of the point mass 1.3.2 Motion laws and conservation 1.3.3 Basic laws of the rigid body 1.3.4 Basic laws of the fluid 1.3.5 Basic laws of vibration 1.3.6 Basic Law of fluctuation 	
Chapter 2 Thermal motion	<ul style="list-style-type: none"> 2.1 Overview of the logic of thermal motion laws <ul style="list-style-type: none"> 2.1.1 Basic overview of the logic of thermal motion laws ★ 2.1.2 Advanced overview of the logic of thermal motion laws 2.2 Overview of the development course of basic thermal motion laws <ul style="list-style-type: none"> 2.2.1 Macroscopic laws 2.2.2 Microscopic theories 2.3 Basic thermal motion laws and application cases <ul style="list-style-type: none"> 2.3.1 Macroscopic laws 2.3.2 Microscopic theories 2.3.3 Typical thermodynamic problems 	4
Chapter 3 Electromagnetic induction	<ul style="list-style-type: none"> 3.1 Overview of the logic of electromagnetic laws <ul style="list-style-type: none"> 3.1.1 Basic overview of the logic of electromagnetic laws ★3.1.2 Advanced overview of the logic of electromagnetic laws 3.2 Overview of the development course of basic electromagnetic laws <ul style="list-style-type: none"> 3.2.1 Steady electric and magnetic fields 3.2.2 Steady currents create steady magnetic fields 3.2.3 Uniform time-varying magnetic flux create stable electric field 3.2.4 Unified theory of electromagnetic fields 3.3 Basic electromagnetic laws and application cases <ul style="list-style-type: none"> 3.3.1 Generation of steady electric field and magnetic field and the electromagnetic force 3.3.2 Coupling of electric field and magnetic field 3.3.3 Electric circuit 	4
Chapter 4 Optics	<ul style="list-style-type: none"> 4.1 Overview of the logic of optic laws <ul style="list-style-type: none"> 4.1.1 Basic overview of the logic of optic laws ★4.1.2 Advanced overview of the logic of optic laws 4.2 Overview of the development course of basic optic laws <ul style="list-style-type: none"> 4.2.1 Geometrical Optics 4.2.2 Wave Optics 4.2.3 Wave-particle duality 	4

	<p>4.3 Basic optic laws and application cases</p> <p>4.3.1 Geometrical Optics</p> <p>4.3.2 Wave Optics</p> <p>4.3.3 Quantum Optics</p>	
Chapter 5 Microcosms	<p>5.1 Overview of the logic of microcosmic laws</p> <p>5.1.1 Basic overview of the logic of microcosmic laws</p> <p>★5.1.2 Advanced overview of the logic of microcosmic laws</p> <p>5.2 Overview of the development course of basic microcosmic laws</p> <p>5.2.1 The background of modern Physics</p> <p>5.2.2 The discovery of particles and the Bohr model of atom</p> <p>5.2.3 Quantization of energy and semi-classical quantum theory</p> <p>5.2.4 Quantum theory</p> <p>5.3 Basic microcosmic laws and application cases</p> <p>5.3.1 Atomic Physics</p> <p>5.3.2 Nuclear Physics</p> <p>5.3.3 Molecular Physics</p>	4
Chapter 6 Structure	<p>6.1 Overview of the logic of spatial-temporal structure laws</p> <p>6.2 Overview of the development course of basic spatial-temporal structure laws</p> <p>6.2.1 The background of special relativity</p> <p>6.2.2 Searching for the ether according to the classical view of space and time</p> <p>6.2.3 Two basic postulates of special relativity</p> <p>6.2.4 Kinematics and Dynamics of special relativity</p> <p>6.2.5 From special relativity to general relativity</p> <p>6.3 The basic principles of spatial-temporal structure, the phenomena it predicted and verification through experiment</p> <p>6.3.1 Special relativity</p> <p>6.3.2 General relativity</p> <p>6.3.3 The universe and the celestial bodies</p>	4

Written by: Ni Mucui

Date: 2019. 09.01

Reviewer: