Physics and Life

1. Course Description

Code: tg02320501

Title: Physics and Life

Course type: elective course

Total class hours: 32

Credit: 2

Duration: 1 semester

Restricted to: undergraduates

Introduction to the course:

The particularity of research contents and methods of Physics has made Physics education one of the most effective means to cultivate the scientific and cultural quality of college students. This course is for college students not majoring in Physics, and the objectives are imparting knowledge, cultivating the ability of discovering, analyzing, and solving problems, and improving scientific and cultural quality.

This course summarizes the knowledge system and the development history of Mechanics, Thermodynamics, Electromagnetics, Optics, microstructure and spatial-temporal structure. Based on introduced Physics principles, more than 110 cases, 86 AR demos, 25 animation demos, 147 object demos, and the audio recordings of biographies of 108 scientific giants will be shown, enabling learners to understand the principles of various phenomena occurring in nature and daily life, to know how to use physical principles to guide scientific activities and promote the progress of science and technology.

Objectives:

This course offers students a unique perspective on the logical system, development, and application of Physics. Through the explanation of cases, students will be able to understand the close relationship between phenomena in daily life and Physics, and have a better grasp of the logical system and thinking characteristics of Physics, cultivating the ability of discovering, analyzing, and solving problems.

Assessment:

Assessment will be based on participation and the final exam.

Course type: elective course

Textbook and references:

Textbook:

Physics and Life (1st edition), Higher Education Press, 2019, Zhang Hanzhuang, Wang Lei, Ni Mucui

References:

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

2. R. P. Feynman, R. B. Leighton, M.Sands, and others, translated by Zheng Yongling and Hua Hongming, *The Feynman Lectures on Physics* (new millennium edition), Volume 1-3, Shanghai: Shanghai Scientific and Technical Publishers, 2013

3. Translated by Xu Liangying and Fan Dainian, *The Collected Works of Einstein*, Vol. 1. First edition. Beijing: Commercial Press, 1976
Translated by Xu Liangying and Fan Dainian, *The Collected Works of Einstein*, Vol. 2. First edition. Beijing: Commercial Press, 1977

4. Steven Weinberg, translated by Zou Zhenlong and Zhang Lining. *Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity*. Beijing: Science Press, 1980

5. Zhao Zheng. *Sixteen Lectures on Physics and Human Civilization*. Beijing: Higher Education Press, 2008

6. Qin Kecheng. *The History of Physics on Stamps*. Beijing: Tsinghua University Press, 2005

7. Ni Guangjiong, Wang Yansen. *Physics and Culture* (2nd edition). Beijing: Higher Education Press, 2009

8. Guo Yiling, Shen Huijun. *The History of Physics* (2nd edition). Beijing: Tsinghua University Press, 2005

9. Shi Daning. *Cultural Physics*. Beijing: Higher Education Press, 2011

10. Huang Shuqing, *The Course on Thermology* (3rd edition), Higher Education Press, 2012

11. Zhao Kaihua, Chen Ximou. *Electromagnetics* (2nd edition), Higher Education Press, 2012

12. Zhao Kaihua, Zhong Xihua. *Optics* (1st edition), Peking University Press

13. Chu Shenglin. *Atomic Physics* (1st edition), Higher Education Press, 2012

14. Zeng Jinyan. *Introduction to Quantum Mechanics* (2nd edition), Peking University Press

Online resources:

http:// zhanghz.jlu.edu.cn

2. Contents of each chapter and allocation of class hours

Chapter	Section	Class hour
Introduction Building the mountain of Physics for millennia	1. What does Physics study? 2. What are the basic core courses in Physics? 3. What methods did scientific giants apply to obtain physical laws? 4. What's the significance of studying Physics? 5. How can we use demo resources to demonstrate the utility of Physics? 6. How to learn Physics well?	4
Chapter 1 The invisible hand of power	1. 1 Overview of the logic of mechanical movement laws 1.2 Overview of the development course of basic mechanical movement laws	8

	1.2.1 Look up at the heaven 1.2.2 Bend down to the earth 1.2.3 Unite the heaven and the earth 1.2.4 Theory instruction 1.2.5 Further development 1.3 Basic mechanical movement laws and daily life 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 The mystery of coldness and warmth	2.1 Overview of the logic of thermal motion laws 2.2.1 Macroscopic laws 2.2.2 Microscopic theories 2.3 Basic thermal motion laws and daily life 2.3.1 Macroscopic laws 2.3.2 Microscopic theories 2.3.3 Typical thermodynamic problems	4
Chapter 3 The world-changing Electromagnetics	3.1 Overview of the logic of electromagnetic laws 3.2 Overview of the development course of basic electromagnetic laws 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 daily life 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 Messengers of the light	4.1 Overview of the logic of optic laws 4.2 Overview of the development course of basic optic laws 4.2.1 Geometrical Optics 4.2.2 Wave Optics 4.2.3 Wave-particle duality 4.3 Basic optic laws and daily life 4.3.1 Geometrical Optics 4.3.2 Wave Optics 4.3.3 Quantum Optics	4
Chapter 5 The world of the step	5.1 Overview of the logic of microcosmic laws 5.2 Overview of the development course of basic	4

	microcosmic n laws 5.2.1 The background of modern Physics 5.2.2 The discovery of particles and the Bohr model of atom 5.2.3 Quantization of energy and semi-classical quantum theory 5.2.4 Quantum theory 5.3 Basic microcosmic laws and daily life 5.3.1 Atomic Physics 5.3.2 Nuclear Physics 5.3.3 Molecular Physics	
Chapter 6 The world of curved space-time	6.1 Overview of the logic of spatial-temporal structure laws 6.2 Overview of the development course of basic spatial-temporal structure laws 6.2.1 The background of special relativity 6.2.2 Searching for the ether according to the classical view of space and time 6.2.3 Two basic postulates of special relativity 6.2.4 Kinematics and Dynamics of special relativity 6.2.5 From special relativity to general relativity 6.3 The basic principles of spatial-temporal structure, the phenomena it predicted and verification through experiment 6.3.1 Special relativity 6.3.2 General relativity 6.3.3 The universe and the celestial bodies	4

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