

# Department of Physics

## Physics

### I. Introduction

Physics is one of the oldest disciplines of natural science based on experiments, which involves the studies of motions of objects ranging from subatomic to cosmic levels, and the exploring of interactions and transformations of substances. It keeps developing as human explores the Nature. Until the 17th century, the Newtonian mechanics had been established, and the laws of motion of various objects including celestial bodies were well understood. In the late 19th century, physics became a systematic and rigorous discipline that contains mechanics, thermodynamics, electromagnetism, optics, etc., known as classic physics nowadays. The modern physics was developed at the beginning of the 20th century with the establishment of relativity and quantum mechanics. Significant breakthroughs in exploring the fundamental structure of the universe were made that greatly facilitated the development of technology and pushed forward the frontier of human cognition. However, the exploration of nature is far from complete. Many fundamental problems were still not being solved, such as the motion law of celestial objects in cosmic level, a more fundamental structure of elementary particles, and the physics laws of complex and strongly correlated macroscopic materials.

Physics is closely related to many other natural science disciplines. It has been a driving force to various of subjects including mathematics, chemistry, biology, geology, materials science, and information science. In addition, physics also makes great contributions to the revolutions of new technology arising from the theoretical breakthroughs, including nuclear energy, semiconductor, superconductor, laser, aerospace industry, etc. In short, physics plays a very important role in our economy and daily life. Progresses in areas such as fusion energy, novel semiconductor materials, high temperature superconductivity, nanomaterials and quantum information are expected in the foreseeable future, and these progresses will lead to the developments of many other new areas of science and technology.

Physics Department at Southern University of Science and Technology, was established in 2011. It is one of the five earliest departments in SUSTech. At present, its research fields include quantum transport and regulation, surface physics, materials physics, computational physics, condensed matter theory, quantum information and quantum computation, high energy physics and astrophysics (in planning), etc.

## **II. Objectives**

Through the physics program, students acquire a solid mathematical background, systematic physics knowledge and experimental techniques, the ability to innovate, and interdisciplinary collaboration. After graduation, students can pursue higher degree in physics-related fields, or work in the electronic or material industries.

## **III. Period of Study and Degree Requirement**

**Time length:** 4 years

**Degree conferred:** Bachelor of Science

**The minimum credit requirement for graduation:** 148.5 credits (Subdivided requirements are detailed in Part 7.)

## **IV. Discipline**

Physics

## **V. Main Courses**

Calculus, Linear Algebra, General Physics, Mathematical Methods in Physics, Analytical Mechanics, Electrodynamics I, Thermodynamics and Statistical Physics I, Introduction to Quantum Mechanics, Statistical Mechanics II, Quantum Mechanics II, Electrodynamics II, Modern Optics, Atomic Physics, Physics Laboratory, etc.

## **VI. Practice-Based Courses**

See Table 3.

## **VII. Course Structure and Credit Rules**

General Education (GE) Required Courses: 66.5 credits.

General Education (GE) Elective Courses: 10 credits.

Major Foundational Courses: 26 credits.

Major Core Courses: 12 credits.

Major Elective Courses: 24 credits.

Research Projects, Undergraduate Thesis/Projects : 10 credits.

The minimum credit requirement for graduation: 148.5 credits.

Annotation: Major Required Courses contain of Major Fundamental Courses and Major Core Courses.

## VIII. Course Arrangement

Table 1: Major Required Course (Foundational and Core Courses)

Course Category	Course Code	Course Name	Credit	Experiment Credit	Weekly Credit Hours	Semester (Fall/Spring/Summer)	Recommended Academic year and Semester	Teaching Language	Pre-required Course	Department
Major Foundational Courses	PHY203-15	数学物理方法 Mathematical Methods in Physics	4		4	Fall	2/ Fall	Chinese and English	高等数学上、下 (GE101 和 GE102) 大学物理 A 上、下 (PHY101A 和 PHY102A), 线性代数 I (GE103b) Calculus I (GE101), Calculus II (GE102), General Physics I (PHY101A), General Physics II (PHY102A), Linear Algebra I (GE103b)	Department of Physics
	PHY205-15	分析力学 Analytical Mechanics	3		3	Fall	2/ Fall	Chinese	高等数学上、下 (GE101 和 GE102), 大学物理 A 上、下 (PHY101A 和 PHY102A), 线性代数 I (GE103b) Calculus I (GE101), Calculus II (GE102), General Physics I (PHY101A), General Physics II (PHY102A), Linear Algebra I (GE103b)	Department of Physics
	PHY207-15	电动力学 I Electrodynamics I	3		3	Fall	2/Fall	Chinese	高等数学上、下 (GE101 和 GE102), 大学物理 A 下 (PHY102A), 线性代数 I (GE103b), 数学物理方法 (PHY203-15, 可同时选修)	Department of Physics

									Calculus I (GE101), Calculus II (GE102), General Physics I (PHY101A), General Physics II (PHY102A), Linear Algebra I (GE103b), Mathematical Methods in Physics (PHY203-15, selecting at the same semester is acceptable )	
	PHY201-15	综合物理实验 Physics Laboratory II	2	2	4	Fall	2/Fall	Chinese	高等数学上 (GE101), 大学物理 A 上 (PHY101A) 或大学物理 B 上 (PHY101B) Calculus I (GE101), General Physics A (I) (PHY101A) or General Physics B (I) (PHY101B)	Department of Physics
	PHY202	现代物理技术实验 Physics Laboratory III	2	2	4	Spr.	2/Spr.	Chinese	高等数学上 (GE101), 大学物理 A 上 (PHY101A) 或大学物理 B 上 (PHY101B) Calculus I (GE101), General Physics A (I) (PHY101A) or General Physics B (I) (PHY101B)	Department of Physics
	PHY204	热力学与统计物理 I Thermodynamics and Statistical Physics I	3		3	Spr.	2/Spr.	Chinese and English	高等数学上、下 (GE101 和 GE102), 大学物理 A 上、下 (PHY101A 和 PHY102A) Calculus I (GE101), Calculus II (GE102), General Physics I (PHY101A), General Physics II (PHY102A)	Department of Physics
	PHY206-15	量子力学 I Introduction to Quantum Mechanics	3		3	Spr.	2/Spr.	Chinese	分析力学 (PHY205-15) Analytical Mechanics (PHY205-15)	Department of Physics
	PHY208	电动力学 II Electrodynamics II	3		3	Spr.	2/Spr.	Chinese	电动力学 I (PHY207-15) Electrodynamics I (PHY207-15)	Department of Physics
	PHY210	原子物理学 Atomic Physics	3		3	Spr.	2/Spr.	English	大学物理 A 上、下 (PHY101A 和 PHY102A) General Physics I (PHY101A),	Department of Physics

									General Physics II (PHY102A)	
	Summation		26	4	30					
Major Core Courses	PHY301	研究型物理实验 Physics Laboratory IV	3	3	6	Fall	3/Fall	Chinese	高等数学上 (GE101), 大学物理 A 上 (PHY101A) 或大学物理 B 上 (PHY101B) Calculus I (GE101), General Physics A (I) (PHY101A) or General Physics B (I) (PHY101B)	Department of Physics
	PHY305	量子力学 II Quantum Mechanics II	3		3	Fall	3/Fall	Chinese	量子力学 I (PHY206-15) Introduction to Quantum Mechanics (PHY206-15)	Department of Physics
	PHY303	统计物理 II Statistical Mechanics II	3		3	Fall	3/Fall	Chinese and English	热力学与统计物理 I (PHY204) Thermodynamics and Statistical Physics I (PHY204)	Department of Physics
	PHY307	近代光学 Modern Optics	3		3	Fall	3/Fall	Chinese and English	大学物理 A 上、下 (PHY101A 和 PHY102A) General Physics I (PHY101A), General Physics II (PHY102A)	Department of Physics
	Total		12	3	15					

**Table 2: Major Elective Courses**

Course Code	Course Name	Credit	Experiment Credit	Weekly Credit Hours	Semester (Fall/Spring/Summer)	Recommended Academic year and Semester	Teaching Language	Pre-required Course	Department
ME102	CAD 与工程制图 CAD Engineering Design	3	1	4	Spr. & Fall	1/ Spr.	Chinese		Department of Mechanics and Energy Engineering
MA104b	线性代数 II Linear Algebra II	4		4	Spr.	1/ Spr.	Chinese/English, or both Chinese and English	线性代数 I (GE103b) Linear Algebra (GE103b)	Department of Mathematics
PHYS001	基础物理开放实验 Open Physics Laboratory I	1	1	2	Smr.	1/ Smr.	Chinese	高等数学上 (GE101), 大学物理 A 上 (PHY101A) 或大学物理 B 上 (PHY101B) Calculus I (GE101), General Physics A (I) (PHY101A) or General Physics B (I) (PHY101B)	Department of Physics
PHY221	综合物理开放实验 Open Physics Laboratory II	1	1	2	Fall	2/Fall	Chinese	高等数学上 (GE101), 大学物理 A 上 (PHY101A) 或大学物理 B 上 (PHY101B) Calculus I (GE101), General Physics A (I) (PHY101A) or General Physics B (I) (PHY101B)	Department of Physics
EE201-15	模拟电路 Analog Circuit	4	1	5	Fall	2/Fall	Chinese	高等数学上、下 (GE101 和 GE102), 线性代数 I& (GE103b, MA104b), 大学物理 A 或 B 上、下 (PHY101A、PHY102A 或 PHY101B、PHY102B), 电路基础 (EE104) Calculus I&II (GE101, GE102), Linear Algebra &II (GE103b, MA104b), Physics A or B (I)& (II) (PHY101A&PHY102A or PHY101B&PHY102B ), Fundamentals of Electric Circuits(EE104)	Department of Electrical and Electronic Engineering

MA212	概率论与数理统计 Probability and Mathematical Statistics	3		3	Spr. & Fall	2/ Fall	Chinese or English	高等数学上、下 (GE101 和 GE102), 线性代数 I (GE103b) Calculus I (GE101), Calculus II (GE102), Linear Algebra I (GE103b)	Department of Mathematics
MA202	复变函数 Complex Analysis	3		3	Spr.	2/Spr.	Chinese and English	数学分析 I& II & III (MA101a, MA102a, MA103a), 或高等数学上&下 (GE101 和 GE102); 线性代数 I Mathematical Analysis I & II & III (MA101a, MA102a, MA103a), or Calculus I & II (GE101, GE102); Linear Algebra I (GE103b)	Department of Mathematics
EE202-15	数字电路 Digital Circuit	4	1	5	Spr.	2/ Spr.	Chinese	固态电子学 (EE203), 模拟电路 (EE201-15) Solid-state Electronics (EE203), Analog Circuit (EE201-15)	Department of Electrical and Electronic Engineering
MA305	数值分析 Numerical Analysis	3		3	Fall	3/Fall	Chinese	数学分析 I& II & III (MA101a, MA102a, MA103a), 或高等数学上&下 (GE101 和 GE102); 线性代数 I&II Mathematical Analysis I & II & III (MA101a, MA102a, MA103a), or Calculus I & II (GE101, GE102); Linear Algebra I&II (GE103b, MA104b)	Department of Mathematics
GE3131	文献检索和科技写作 Literature Search and Writing in Science and Technology	1		1	Fall	3/Fall	Chinese		
PHY321-15	固体物理 Introduction to Solid State Physics	4		4	Fall	3/Fall	Chinese and English	量子力学 I (PHY206-15) Introduction to Quantum Mechanics (PHY206-15)	Department of Physics
PHY322	科研软件选讲 Lectures on Selected Research Software	2		2	Spr.	3/ Spr.	Chinese	计算机程序设计基础 (GE105), 大学物理 A 上、下 (PHY101A 和 PHY102A), 高等数学上、下 (GE101 和 GE102) Basics of Computer Programming Design	Department of Physics



								(GE105), General Physics I (PHY101A), General Physics II (PHY102A), Calculus I (GE101), Calculus II (GE102)	
PHY330	固体光电子学 Solid Optoelectronics	3		3	Spr.	3/ Spr.	Chinese	量子力学 I (PHY206-15), 近代光学 (PHY307) Introduction to Quantum Mechanics (PHY206-15), Modern Optics (PHY307)	Department of Physics
PHY334	固体理论导论 Introduction to Solid State Theory	4		4	Spr.	3/ Spr.	Chinese	固体物理 (PHY321-15) Introduction to Solid State Physics (PHY321-15)	Department of Physics
PHY332-15	表面物理 Surface Physics	4		4	Spr.	3/ Spr.	Chinese and English	固体物理 (PHY321-15) Introduction to Solid State Physics (PHY321-15)	Department of Physics
PHY324	激光原理 Laser Fundamentals	3		3	Spr.	3/ Spr.	Chinese	近代光学 (PHY307), 原子物理学 (PHY210) Modern Optics (PHY307), Atomic Physics (PHY210)	Department of Physics
PHY326-15	半导体物理与器件 Semiconductor Physics and Devices	4		4	Spr.	3/ Spr.	Chinese and English	固体物理 (PHY321-15), 数学物理方法 (PHY203-15) Introduction to Solid State Physics (PHY321-15), Mathematical Methods in Physics (PHY203-15)	Department of Physics
PHY328	低温物理学 Low Temperature Physics	3	1	4	Spr.	3/ Spr.	Chinese and English	热力学与统计物理 I (PHY204) Thermodynamics and Statistical Physics I (PHY204)	Department of Physics
PHY336	计算物理 Introduction to Computational Physics	3		3	Spr.	3/ Spr.	Chinese	计算机程序设计基础 (GE105), 数值分析 (MA305), 热力学与统计物理 I (PHY204), 固体物理 (PHY321-15) Basics of Computer Programming Design (GE105), Numerical Analysis (MA305), Thermodynamics and Statistical Physics I (PHY204), Introduction to Solid State Physics (PHY321-15)	Department of Physics
PHYS002	物理学前沿问题选讲	2		2	Smr.	3/ Smr.	Chinese	大学物理 A 上、下 (PHY101A 和 PHY102A) General Physics I (PHY101A), General	Department of Physics

	Lectures on Selected Frontiers Physics							Physics II (PHY102A)	
PHYS003	物理学中的数值算法 Numerical Algorithms in Physics	1		1	Smr.	3/ Smr.	Chinese	固体物理(PHY321-15), 数值分析(MA305) Introduction to Solid State Physics(PHY321-15), Numerical Analysis (MA305)	Department of Physics
PHYS004	光合作用和分子晶体中的能量传输 Energy transfer in photosynthesis and molecular crystals	1		1	Smr.	3/ Smr.	Chinese		Department of Physics
PHY423-15	薄膜物理 Physics of Thin Films	3		3	Fall	4/Fall	English	固体物理 (PHY321-15), 热力学与统计物理 I (PHY204) Introduction to Solid State Physics(PHY321-15), Thermodynamics and Statistical Physics I (PHY204)	Department of Physics
PHY425	现代材料分析技术 Modern Techniques in Materials Characterization	3	1	4	Fall	4/Fall	Chinese and English	量子力学 I (PHY206-15) Introduction to Quantum Mechanics (PHY206-15)	Department of Physics
PHY427	微纳结构加工 Introduction to Microelectronic fabrication	2	1	3	Fall	4/Fall	Chinese and English	化学原理 (CH101) 半导体物理与器件 (PHY326-15) General Chemistry (CH101), Semiconductor Physics and Devices (PHY326-15)	Department of Physics
PHY429	先进电子显微学 Advanced Electron Microscopy	3	1	4	Fall	4/Fall	Chinese and English	固体物理 (PHY321-15) Introduction to Solid State Physics(PHY321-15)	Department of Physics
Total		72	9	81					
<p>Annotation 1: Students should report their schemes of major elective courses before the second week, the first term of the third academic year after confirming with their academic advisors. The minimum credit requirement of major elective course is 24.</p> <p>Annotation 2: The courses whose course codes start with PHYS are summer semester courses. They may be changed depending on the situation.</p> <p>Annotation 3: Major elective courses of specific semesters may be changed according to the situation. New Major elective courses may be opened and are not included in the table. Please pay attention to the course plan of corresponding department at beginning of each semester.</p>									

**Table 3: Overview of Practice-Based Courses**

Course Code	Course Name	Credit	Experiment Credit	Weekly Credit Hours	Semester (Fall/Spring/Summer)	Recommended Academic year and Semester	Teaching Language	Pre-required Course	Department
PHY480	科技创新项目 Research Projects	2	2	4					Department of Physics
PHY490	毕业论文/设计 Undergraduate Thesis/Projects	8	8	16					Department of Physics
Total		10	10	20					
Annotation 1: Students can start their Research Projects at terms after the first academic year. The minimum credit hours of each project are 64-72.									

**Table 4: Overview of Course Hours and Credits**

Course Category	Total Course Hours	Total Credits	The Minimum Credit Requirement
General Education (GE) Required Courses	1168	66.5	66.5
General Education (GE) Elective Courses	3144	182.5	10
Major Foundational Courses	480	26	26
Major Core Courses	240	12	12
Major Elective Courses	1296	72	24
Research Projects, and Undergraduate Thesis/Projects	About 320	10	10
<b>Total</b>	6648	369	148.5
Annotation 1: The total credit hours are calculated based on 16 weeks per term..			