南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

课程详述
COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	**课程名称 Course Title**	应用固体物理 Applied Solid State Physics
2.	**授课院系** **Originating Department**	材料科学与工程系 Department of Materials Science and Engineering
3.	**课程编号** **Course Code**	MSE335
4.	**课程学分 Credit Value**	3
5.	**课程类别** **Course Type**	专业基础课 Major Foundational Course
6.	**授课学期** **Semester**	秋季 Fall
7.	**授课语言** **Teaching Language**	中英双语 English & Chinese
8.	**授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师）** **Instructor(s), Affiliation& Contact** **（For team teaching, please list all instructors）**	邬家臻助理教授 Assistant Prof. Jiazhen Wu 材料科学与工程系 Department of Materials Science and Engineering 联系方式 Contact Information: wujz@sustech.edu.cn
9.	**实验员/助教、所属学系、联系方式** **Tutor/TA(s), Contact**	待公布 To be announced
10.	**选课人数限额(可不填)** **Maximum Enrolment（Optional）**	无 NA

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other（Please specify）	总学时 Total
学时数 Credit Hours	44	4			48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	高等数学（下） Calculus II 大学物理（下） College Physics II
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 NA
14. 其它要求修读本课程的学系 Cross-listing Dept.	电子系、微电子、机械系等

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

应用固体物理是材料科学、电子信息科学、凝聚态物理等专业的重要基础课程。课程讲授固体物性的基础理论和实验知识，涉及材料的电、声、磁、光等性质。主要内容包括固体的结合方式、晶体结构、晶格动力学、电子结构、电子输运与动力学、磁性、半导体物理、介电和铁电物理等基础物理知识。此外，课程还重视物性的实验测量和数据分析方法的介绍。通过本课程的学习，学生将理解固体材料中的基本物理概念和现象，建立起晶体结构—电子结构—物理性质之间的关联，从而为进一步开展信息功能材料和器件、高性能能源材料和器件、量子材料等前沿方向的研究打下基础。

“Applied Solid State Physics” is an important major foundational course for materials science, electronic information science, condensed matter physics and other materials related specialties. This course requires multi-disciplinary knowledge of crystallography, thermodynamics of materials, and quantum mechanics. It provides basic theoretical and experimental knowledge of physical properties in solids, including electronic, phononic, magnetic, and optical properties. The main content of this course includes cohesion in solids, crystal structure, lattice dynamics, electronic structure, electrical transport properties, magnetic properties, semiconductor physics, dielectrics and ferroelectrics, etc. In addition, this course also introduces experimental method and data analysis for physical properties. By taking this course, undergraduates will understand the fundamental physical concept and phenomenon in solids, and be familiar with the relationship between crystal structure, electronic structure and physical properties. This course serves as a basis for the following frontier research areas, such as information functional materials and devices, high-performance energy materials and devices, quantum materials and devices, and other related fields.

16. 预达学习成果 Learning Outcomes

1、掌握固体的化学键、晶体结构、电子结构、晶格动力学、电子动力学、磁相互作用等基础知识；
2、掌握固体的力、热、电、光、磁等物性的结构和物理基础；
3、理解晶体结构、电子结构和物理性质之间的关系；

4、熟悉固体物理性质的常用实验测量技术和数据分析方法；

5、了解固体物理在材料科学研究中的基础性和重要性及相关科学前沿的发展动态。

1. Grasp the fundamental knowledge of chemical bonds, crystal structure, electronic structure, lattice thermal dynamics, electrical dynamics, magnetic interactions, etc.;

2. Understand the fundamentals of the mechanical, thermal, electrical, optical, magnetic properties in solids;

3. Understand the relationship between crystal structure, electronic structure and physical properties;

4. Be familiar with the common experimental techniques and data analysis method for investigation of physical properties in solids;

5. Understand the fundamentality and importance of solid-state physics in materials science, and know the related research frontiers.

17. 课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）
Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

第一章：晶体的结合与结构（6 学时）

第二章：原子振动与晶体的热学性质（6 学时）

第三章：固体的电子结构：能带（6 学时）

第四章：自由电子与金属（6 学时）

第五章：半导体物理基础（4 学时）

第六章：电子结构的表征（2 学时）

第七章：介电和铁电物理（6 学时）

第八章：固体的磁性（6 学时）

第九章：超导简介（2 学时）

Chapter 1: Cohesion and crystal structures of solids (6 credit hours)

Chapter 2: Atomic vibrations and thermal properties of crystals (6 credit hours)

Chapter 3: Electronic states of solids: band structure (6 credit hours)

Chapter 4: Free electrons in metals (6 credit hours)

Chapter 5: Fundamentals of semiconductor Physics (4 credit hours)

Chapter 6: Characterization of electronic structures (2 credit hours)

Chapter 7: Dielectrics and Ferroelectrics (6 credit hours)

Chapter 8: Magnetism in solids (6 credit hours)

Chapter 9: Introduction to Superconductivity (2 credit hours)

18. 教材及其它参考资料 Textbook and Supplementary Readings

1. C. Kittel, Introduction to Solid State Physics, 8th ed.; Wiley: Hoboken, NJ, 2004.
2. 黄昆，韩汝琦，固体物理学，高等教育出版社，1998.
3. N. W. Ashcroft, N. D. Mermin, Solid State Physics, Brooks Cole, 1976.
4. J. I. Gersten, F. W. Smith, The Physics and Chemistry of Materials, Wiley, 2001.

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		30		
期中考试 Mid-Term Test		20		
期末考试 Final Exam		40		
期末报告 Final Presentation				
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)				

20. 记分方式 grading system

☑ A. 十三级等级制 Letter Grading
☐ B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 Review and Approval

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority