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**	应用量子力学 Applied Quantum Mechanics
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**	MSE344
4.	**课程学分 Credit Value**	3
5.	**课程类别** **Course Type**	专业核心课 Major Core Courses
6.	**授课学期** **Semester**	秋季 Fall
7.	**授课语言** **Teaching Language**	中英文
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）**	冯军 教授 材料科学与工程系 fengj@sustech.edu.cn Jun Feng, Professor Department of Materials Science and Engineering fengj@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）**	

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	48				48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	PHY 105B 大学物理（下）B General Physics II B
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	
14. 其它要求修读本课程的学系 Cross-listing Dept.	

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

量子科技是当今世界最重要的前沿科技领域之一。普朗克、爱因斯坦、玻尔、海森堡、费米、薛定谔……20 世纪科学界许多最为杰出的头脑，都为一个概念着迷——量子。基于量子力学理论提出的量子通信与量子计算，将迎来量子科学时代的带来。量子力学对于原子，分子和晶体尺度的材料科学与工程至关重要。材料很多重要的光、电、磁特性只能用量子力学解释。本课程是量子力学的入门课程，重点介绍材料科学的应用。目标是为材料科学与工程专业的学生提供量子力学的基本概念，并应用原理和方法来理解材料属性和设备应用。涉及的主题包括薛定谔的波动方程，狄拉克符号，量子谐振子和微扰理论。通过应用这些量子力学概念，详细解释了电子传播，光学跃迁等。完成本课程后，学生将深入了解重要的材料属性，为探索前沿材料研究奠定坚实的基础。

Quantum science is one of the most important scientific research frontiers in the world. Many great brains like Planck, Einstein, Bohr, Schrodinger, Dirac, Pauli, etc., were fascinated by its beauty and mysterious. Quantum mechanics is essential to materials science and engineering at the atomic, molecular and crystal scales. Important optical, electrical, and magnetic properties of materials can only be well understood within the realm of quantum mechanics. This course is an introductory course for quantum mechanics with emphasis on applications in materials science. The objective is to provide students in materials science and engineering with basic concepts in quantum mechanics and apply the principles and methodologies to understand materials properties and device applications. Topics to be covered include Schrödinger's wave equation, Dirac notations, quantum harmonic oscillators, and perturbation theory. By applying those quantum mechanical concepts, electron propagation, optical transitions and so on are explained in detail. After completing this course, students will have in-depth understanding of important materials properties and build a solid foundation to explore frontier materials research.

16. 预达学习成果 Learning Outcomes

1. 理解和简单运用薛定谔方程解决简单问题。
2. 了解某些材料属性的量子起源。
3. 理解波与物质相互作用中的物理概念。
4. 在两级系统中开发和应用量子力学方法。
5. 为今后设计先进材料打下坚定的量子力学基础。

Knowledge：

1. Introduce quantum mechanics.
2. Understand the quantum origin of the properties of some materials.

3. Understand the physical concepts in wave and matter interaction.

Skills：
1. Develop and apply quantum mechanics methods in a two-level system.
2. Design advance materials applying quantum mechanics.

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.)

1. 量子概念（2 学时）

2. 量子力学简史（4 学时）

3. 波粒二相性和薛定谔方程（9 学时）

4. 波函数和测不准原理（9 学时）

5. 电子与自旋（9 学时）

6. 量子力学与材料科学（9 学时）

7.量子计算和量子通信 （6 学时）

1. What is quanta（2 credit hours）

2. History of quantum mechanics（4credit hours）

3. Wave-particle duality and Schrödinger equation（9 credit hours）

4. Wave function and uncertainty relations （9 credit hours）

5. Electron and spin（9 credit hours）

6. Quantum mechanism and materials science（9 credit hours）

7.Quantum computing and quantum communication （6 credit hours）

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

Textbook:
1:Introduction to quantum mechanics in Chemistry, Materials science and Biology, Author: Sy M.Blinder, Publisher: Academic Press (2004 年 6 月 21 日) , ISBN-13 : 978-0121060510
2:Quantum mechanics for engineering: Materials science and Applied Physics, Author: Herbert Kroemer, Publisher: Prentice Hall, 1994, ISBN: 0137470983, 9780137470983
3:Applied Quantum Mechanics, Author: A. F. J. Levi, Publisher: Cambridge University Press 2nd ed. 2012, ISBN: 0521183995

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				
课堂表现 Class Performance		20		
小测验 Quiz		10		

课程项目 **Projects**				
平时作业 **Assignments**		10		
期中考试 **Mid-Term Test**		25		
期末考试 **Final Exam**		35		
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