

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	MSE5023 / Advanced Physics of Materials (高等材料物理)
2.	课程性质 Compulsory/Elective	专业核心课
3.	开课单位 Offering Dept.	材料科学与工程系
4.	课程学分/学时 Course Credit/Hours	3/48
5.	授课语言 Teaching Language	English
6.	授课教师 Instructor(s)	XU Baomin (徐保民)
7.	开课学期 Semester	Fall
8.	是否面向本科生开放 Open to undergraduates or not	No
9.	先修要求 Pre-requisites	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) General Physics, Crystal Theory
10.	教学目标 Course Objectives	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) The purpose of the course is to let students fully understand the electric, magnetic, optical, and thermal properties of materials from the point view of modern physics, that is, quantum mechanics. Students will also learn how to characterize these properties and the device applications based on these properties.
11.	教学方法 Teaching Methods	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) Teaching methods include live lectures by the teacher, along with video and live shows of materials properties, discussion among classmates, and presentations of cutting-edge literatures by students themselves. Students can be involved in the active learning of the knowledge and achieve the understanding through multi-channels. Combining the basic theory and the state of art discoveries, the students can obtain more updated knowledge and the research motivations.
12.	教学内容 Course Contents	(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)
	Section 1	Principle of quantum mechanics for materials physics -Wave-particle duality and Schrodinger equation -Solutions of Schrodinger equation -Energy bands and electrons in a crystal

Section 2	Semiconductors -Intrinsic and extrinsic semiconductors -Silicon, III-V and II-VI compounds, and amorphous semiconductors -Measurement of semiconductor properties
Section 3	Principle of semiconductor devices -p-n junction and diodes -Bipolar and field effect transistors -Fabrication of semiconductor devices
Section 4	Metals and conductors -Classical theory of metals -Quantum mechanics of metals -Thermoelectric and Galvanoelectric phenomena
Section 5	Dielectrics and ferroelectrics -Dielectric properties and dielectric spectrum -Piezoelectric and ferroelectric properties -Device applications of piezoelectric and ferroelectric properties
Section 6	Superconductors -Superconductivity phenomena -Basic theory of superconductivity -High T _c and new superconductors
Section 7	Magnetic properties of materials -Classical theory of magnetic phenomena -Quantum mechanics of magnetic properties -Modern applications: spintronics and magnetoresistance
Section 8	Optical properties of materials -Atomic theory of optical properties -Quantum mechanical treatment of optical properties -Measurement of optical properties
Section 9	Lasers and optoelectronics -Laser and laser materials -Light detectors and light emitting diodes -Integrated optoelectronics
Section 10	Thermal properties of materials -Classical theory of thermal properties -Phonon and quantum mechanical theory of thermal properties
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13. 课程考核 Course Assessment	
	(① 考核形式 Form of examination; ②. 分数构成 grading policy; ③ 如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) Grading policy: Class participation: 15%; Homework: 25%; Midterm (2 hours, closed book): 30%; Final exam (2 hours, closed book): 30%.
14. 教材及其它参考资料	

Textbook and Supplementary Readings

Rolf E. Hummel, Electronic Properties of Materials, 4th Edition, Springer, 2011
L. Solymar, D. Walsh, R. Syms, Electrical Properties of Materials, 9th Edition, Oxford, 2004
Other reference materials provided by teacher