

上海交通大学研究生课程开设申请表

New Graduate Course Application Form, SJTU

| 课程基本信息 Basic Information | | | | |
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| *课程名称 Course Name | (中文 Chinese) 高等材料物理 | | | |
| | (英文 English) Advanced Material Physics | | | |
| *学分 Credits | 2 | *学时 Teaching Hours | 32 (1 学分≥16 课时) | |
| *开课学期 Semester | 春季学期 Spring | *是否跨学期 Cross-semester? | 否 No | 跨 Spanning over 个学期 Semesters (含夏季学期)。 |
| *课程性质 Course Category | 公共课 General Course | *课程分类 Course Type | 全日制课程 For full-time students | |
| *授课语言 Instruction Language | 中文 Chinese | 主要授课方式 Teaching Method | 课堂教学 In class teaching | |
| *成绩类型 Grade | 等第制 Letter grading | 主要考核方式 Exam Method | 考查 Tests | |
| *开课院系 School | 材料科学与工程学院 | | | |
| 所属学科 Subject | 材料科学与工程 | | | |
| 负责教师 Person in charge | 姓名 Name | 工号 ID | 单位 School | 联系方式 E-mail |
| | 凌惠琴 | | 材料学院 | Hqling@sjtu.edu.cn |
| 课程扩展信息 Extended Information | | | | |
| *课程简介 (中文) Course Description | <p>(分段概述课程定位、教学目标、主要内容、先修课程等；不少于 200 字。)</p> <p>功能材料在材料科学研究和应用中占据越来越重要的地位，固体物理和量子力学是功能材料的理论基础。本科阶段的材料物理主要讲授了晶格振动和能带论基本理论，这些理论在功能材料上的应用和拓展并未涉及，高等材料物理衔接本科的材料物理，将进一步提高学生对功能材料理解的深度和广度，为相关材料的研究打下扎实的理论基础。</p> <p>本课程将首先回顾材料物理基本理论，强调材料物理的线索即为周期场中的波动过程，由此引出能带论，光子晶体和声子晶体的概念和基本应用；然后主要讲解半导体物理和器件物理，它是集成电路、LED、太阳能电池、光催化、半导体激光器等半导体功能材料的理论基础；其次介绍一些半导体人工结构的基本原理和应用；再次讲解磁性的基本原理和磁电子学；最后介绍与相变相关的材料物理性能。</p> | | | |
| *课程简介 (English) Course Description | <p>(须与中文一致，翻译请力求信达雅。)</p> <p>Functional materials become more and more important in the research and application of materials science. Solid state physics and quantum mechanics are the theoretical basis of functional materials. In undergraduate programs, "Material physics" course introduce the basic theories of lattice vibration and energy band theory . The application and development of these theories in functional materials are not involved. The convergence of advanced material physics with undergraduate material physics will further improve students' understanding of functional materials and lay a solid theoretical foundation for the research of related materials.</p> <p>This course will first review the basic theory of material physics, emphasizing that the clue of material physics is the wave process in the periodic field, which leads to the energy band theory, the concept and basic application of photonic crystal and phononic crystal; then it will mainly explain the semiconductor physics and device physics, which is the theory of semiconductor functional materials such as integrated circuit, led, solar cell, photocatalysis, semiconductor laser, etc Secondly, the basic principles and applications of some</p> | | | |

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| | semiconductor artificial structures are introduced; thirdly, the basic principles of magnetism and Magnetoelectronics are explained; finally, phase change and material properties are introduced. | | | |
| *教学大纲 (中文) Syllabus | (建议列表形式, 各列内容: 章节、主要内容、课时数、教学方式) | | | |
| | 教学内容 Content | 授课学时 Hours | 教学方式 Format | 授课教师 Instructor |
| | 绪论、材料物理回顾 | 4 | 课堂讲授 | 凌惠琴 |
| | 周期场中的波动过程: 光子晶体、声子晶体 | 6 | 课堂讲授 | 凌惠琴 |
| | 半导体物理和器件物理 | 6 | 课堂讲授 | 凌惠琴 |
| | 量子点、量子阱和超晶格 | 6 | 课堂讲授 | 凌惠琴 |
| | 本磁性: 基本理论, 磁性功能材料 | 6 | 课堂讲授 | 凌惠琴 |
| | 相变和材料性能 | 4 | 课堂讲授 | 肖飞 |
| *教学大纲 (English) Syllabus | (须与中文一致, 翻译请力求信达雅。) | | | |
| | Content | Hours | Format | Instructor |
| | Introduction and review of Material Physics | 4 | lecture | Huiqin Ling |
| | Wave propagation in periodic structure: photonic crystal, phononic crystal | 6 | lecture | Huiqin Ling |
| | Semiconductor physics and device physics | 6 | lecture | Huiqin Ling |
| | Quantum dots, quantum wells and Superlattices | 6 | lecture | Huiqin Ling |
| | Solid magnetism: basic theory, magnetic functional materials | 6 | lecture | Huiqin Ling |
| | Phase change and material properties | 4 | lecture | Fei Xiao |
| *课程要求 (中文) Requirements | (课程考核方式、考核标准等; 不少于 50 字) 平时成绩 50%: 不随意迟到早退, 缺课, 积极参与课堂互动, 按时完成作业。 期末大作业 50%: 充分调研文献, 针对问题提出解决方案, 逻辑清晰, 理论分析得当。 | | | |
| *课程要求 (English) Requirements | Usual performance: 50% of final grade, including attendance and participation in class discussions, homework. Final assignment: 50% of the final grade, including literature research, propose solutions to the problems, clear logic and proper theoretical analysis. | | | |

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| <p>课程资源 (中文) Resources</p> | <p>(教材、教参、网站资料等。)</p> <ol style="list-style-type: none"> 1. 《固体物理学》陆栋, 蒋平, 徐至中, 上海科技出版社 2. 《固体物理学》胡安, 章维益, 高等教育出版社 3. 《半导体材料研究进展》王占国, 郑有焯, 高等教育出版社 4. 《光子声子晶体理论与技术》雯熙森, 科学出版社 <p>《The physics of structural phase transitions》M. Fujimoto, Springer</p> |
| <p>课程资源 (English) Resources</p> | <p>(须与中文一致, 请力求信达雅。)</p> <ol style="list-style-type: none"> 1. 《固体物理学》陆栋, 蒋平, 徐至中, 上海科技出版社 2. 《固体物理学》胡安, 章维益, 高等教育出版社 3. 《半导体材料研究进展》王占国, 郑有焯, 高等教育出版社 4. 《光子声子晶体理论与技术》雯熙森, 科学出版社 5. 《The physics of structural phase transitions》M. Fujimoto, Springer |
| <p>备注 Note</p> | |