# 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.

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| 1. | 课程名称 Course Title | 光学材料与超构材料 Photonic Materials and Metamaterials |
| 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 | MSE327 |
| 4. | 课程学分 Credit Value | 3 |
| 5. | 课程类别 Course Type | 专业选修课 Major Elective Courses |
| 6. | 授课学期 Semester | 秋季 Fall |
| 7. | 授课语言 Teaching Language | 英文 English |
| 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） | Dr. Guixin Li/李贵新 副教授<br>Department of Materials Science and Engineering<br>ligx@sustc.edu.cn<br>0755-8808957 |
| 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 |

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| 12. | 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements | PHY105B 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

This is an introduction into advanced topics in propagation of electromagnetic waves in a medium and interaction of electromagnetic waves with matter. Topics cover includes derivation of optical constants such as susceptibility and dielectric constants, photonic crystals, plasmonics and metamaterials.

课程意义：

有助于学生了解光在材料中的传播机制，以及掌握利用光子晶体、等离激元共振、超构材料等人工微纳结构调控光传播的基础知识与技术。

### 16. 预达学习成果 Learning Outcomes

Knowledge：

1. Introduce physics of electromagnetic waves in medium.
2. Develop the analytical skill in deriving optical constants and other optical phenomena in wave and matter interaction.
3. Understand the physical concepts in wave and matter interaction.

Skills：

4. Develop and apply Maxwell Equations in the propagation of electromagnetic waves in solids.
5. Design advance devices in control of electromagnetic wave propagation in solids.

Modelling of electromagnetic wave propagation in a media.

### 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.)**

I. The Propagation of Light (9 Credit hours)
1.1 Introduction to Electromagnetism
1.2 Maxwell’s Equations
1.3 Materials Equations
1.4 Wave Equations
1.5 Basic Properties of Electromagnetic Wave
1.6 Optical Constants of Materials

II. Polarization, Interference and Diffraction of Light (12 Credit hours)
2.1 Polarized Light

2.2 Jones Vector and Matrix
2.3 Fresnel Equations
2.4 Coherence and Interference of Light
2.5 Diffraction of Light
2.6 Propagation of Light in Crystals
2.7 Nonlinear Optics

III. Photonic Crystals (12 Credit hours)
3.1 One Dimensional Photonic crystals
3.2 Two Dimensional Photonic crystals
3.3 Three Dimensional Photonic Crystals
3.4 Fabrication of Photonic Crystals
3.5 Applications of Photonic Crystals

IV. Plasmonics and Photonic Metamaterials (15 Credit hours)
4.1 Localized and Surface Plasmon Resonances.
4.2 Photonic Metamaterials
4.3 Photonic Metasurfaces
4.4 Fabrication of Metamaterials and Metasurfaces
Applications of Plasmonic and Metamaterial devices.

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

1. Introduction to Modern Optics, Grant R. Fowles.
2. Optical Metamaterials: Fundamentals and Applications, Cai Wenshan, Shalaev Vladimir.

## 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 | | 0 | | |
| 小测验 Quiz | | 5 | | |
| 课程项目 Projects | | 0 | | |
| 平时作业 Assignments | | 10 | | |
| 期中考试 Mid-Term Test | | 35 | | |
| 期末考试 Final Exam | | | | |
| 期末报告 Final Presentation | | 40 | | |
| 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**

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| ☑A. 十三级等级制 **Letter Grading**<br>☐ 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**

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