

## 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 <b>Course Title</b>	先进激光加工与检测技术 Advanced Laser-Based Processing and Detection Technology				
2.	授课院系 <b>Originating Department</b>	机械与能源工程系 Department of Mechanical and Energy Engineering				
3.	课程编号 <b>Course Code</b>	ME356				
4.	课程学分 <b>Credit Value</b>	3				
5.	课程类别 <b>Course Type</b>	专业选修课 Major Elective Courses				
6.	授课学期 <b>Semester</b>	秋季 Fall				
7.	授课语言 <b>Teaching Language</b>	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) <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	郭亮, 机械与能源工程系 guol3@sustech.edu.cn				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	陈志明, 11849041@mail.sustc.edu.cn				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>	30				
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>	总学时 <b>Total</b>
	学时数 <b>Credit Hours</b>	48		16		48

<b>12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements</b>	高等数学（下）A CalculusII A, MA102B 大学物理（下）B General Physics II B, PHY105B
<b>13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite</b>	激光原理 Principles of Lasers, EE310
<b>14. 其它要求修读本课程的学系 Cross-listing Dept.</b>	

**教学大纲及教学日历 SYLLABUS**

**15. 教学目标 Course Objectives**

通过本课程的学习，使学生深入理解激光的相关物理知识与实际应用，并掌握相关的物理、电子、机械等交叉学科的知识。本课程希望为激光加工、光子学、光谱学等领域的学生起到引领作用，鼓励他们关注前沿，拓宽他们的视野，加强学科交叉意识。

This course intends to help students to have a deep understanding of laser-related physics and application and master inter-disciplinary knowledge of physics, electrical engineering, mechanical engineering, etc. This course hopes to lead the way for students in the field of laser processing, photonics, spectroscopy and so on, to encourage them to follow the scientific frontier, to broaden their vision and to solidify their notion of crossing disciplines.

**16. 预达学习成果 Learning Outcomes**

- 1) 理解激光的产生原理，尤其是脉冲激光的产生原理
- 2) 熟悉基于激光的先进技术，如加工、精密测量、光谱等
- 3) 培养对激光相关学科的兴趣

- 1) To well understand the physics of generation of laser, especially pulsed laser
- 2) To be familiar with laser-based advanced technologies such as laser processing, precise measurement, and spectroscopy.
- 3) To kindle interest in laser-related disciplines

**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.)**





课程内容	学时分配 (48)
光学基础, Basics of Optics 光的可调自由度, Optical Degree of Freedom; 几何光学, Geometrical Optics; 波动光学, Wave Optics	4
频域分析, Frequency-Domain Analysis 傅里叶变换原理, Theorem of Fourier Transform; 常用函数的傅里叶变换, Fourier Transform of Common Functions; 傅里叶变换在光学中的应用, Application of Fourier Transform in Optics	4
量子物理简介, Introduction to Quantum Physics 能级, Energy Level; 电子与空穴, Electron and Hole; 声子, Phonon	4
激光的产生原理, Physics of Laser Generation 粒子数反转, Population Inversion; 增益介质, Gain Medium; 激光器结构, Laser Structure	2
飞秒激光的产生原理, Physics of Generation of Femtosecond Laser 锁模, Mode Locking; 色散补偿, Compensation of Dispersion	2
非线性光学, Nonlinear Optics 极化, Polarization; 二倍频, Second Harmonic Generation; 光学参数放大过程, Optical Parametric Amplification; 自相位调制, Self-Phase Modulation	4
飞秒激光的表征与整形, Characterization and Shaping of Femtosecond Laser 脉宽测量, Measurement of Pulse Width; 相位测量, Measurement of Spectral Phase; 脉冲整形, Pulse Shaping	2
期中考试及试卷讲评 Mid-term exam and analysis of the problems	3
激光加工, Laser Processing 激光焊接, Laser Welding; 激光诱导表面结构, Laser-Induced Surface Structure; 突破衍射极限的技术: Technologies Breaking the Diffraction Limit	6
光谱技术, Spectroscopy 拉曼光谱, Raman Spectroscopy; 傅里叶变换红外光谱, Fourier Transform Infrared Spectroscopy; 吸收光谱, Absorption Spectrum; 光致发光光谱, Photoluminescence Spectrum; 飞秒光谱, Femtosecond Spectroscopy	4
光镊技术, Optical Tweezer 光镊原理, Mechanism of Optical Tweezer; 光镊应用, Application of Optical Tweezer	2
参观郭亮教授实验室, Tour of Prof. Liang Guo' s Lab	2
激光测量学, Metrology by Laser 激光测距, Distance Measurement by Laser; 激光测速, Velocity Measurement by Laser; 激光干涉引力波天文台, Laser Interferometer Gravitational-Wave Observatory	3
激光的非常规应用, Eccentric Applications of Laser	2
期末报告 Final presentation	4

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

主要参考书 References:  
 Introduction to optics by Frank L. Pedrotti, Leno S. Pedrotti, Leno Matthew Pedrotti.  
 Ultrafast optics by Andrew M. Weiner  
 Nonlinear optics by Robert W. Boyd

**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		5		
课堂表现 Class Performance		5		
小测验 Quiz		10		
课程项目 Projects				
平时作业 Assignments		20		
期中考试 Mid-Term Test		20		
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**

- 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