

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	MEE5207, 先进激光加工与检测技术 Advanced Laser-Based Processing and Detection Technology
2.	课程性质 Compulsory/Elective	专业选修课; Major Elective Course
3.	课程学分/学时 Course Credit/Hours	3/48
4.	授课语言 Teaching Language	中英双语; Chinese-English Bilingual
5.	授课教师 Instructor(s)	郭亮; Liang Guo
6.	是否面向本科生开放 Open undergraduates or not to	是 Yes
7.	先修要求 Pre-requisites	无; None
8.	教学目标 Course Objectives	
	<p>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。</p> <p>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.</p>	
9.	教学方法 Teaching Methods	
	<p>课堂讲座式授课+实验室内实地授课</p> <p>Classroom Lectures + Lab Field Lectures</p>	
10.	教学内容 Course Contents	
	Section 1, 2 hours	<p>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</p>
	Section 2, 4 hours	<p>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</p>
	Section 3, 2 hours	<p>半导体物理简介, Introduction to Semiconductor Physics: 能级, Energy Level; 电子与空穴, Electron and Hole; 声子, Phonon</p>
	Section 4, 4 hours	<p>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</p>
	Section 5, 2 hours	<p>激光与材料相互作用, Laser-Matter Interaction: 吸收, Absorption; 散射, Scattering; 介电常数, Dielectric Constant</p>
	Section 6, 4 hours	<p>飞秒激光的产生与表征, Generation and Characterization of Femtosecond Laser: 锁模, Mode Locking; 脉宽测量, Measurement of Pulse Width; 相位测量, Measurement of Spectral Phase</p>

	Section 7, 2 hours	参观机械系郭亮教授实验室, Tour of Liang Guo' s Lab
	Section 8, 4 hours	非线性光学, Nonlinear Optics: 偏振, 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
	Section 9, 2 hours	飞秒激光脉冲整形, Pulse Shaping for Femtosecond Laser: 脉冲整形原理, Theorem of Pulse Shaping; 脉冲整形器, Pulse Shaper
	Section 10, 4 hours	期中考试, Mid-Term Exam
	Section 11, 6 hours	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
	Section 12, 2 hours	光谱技术, Spectroscopy: 拉曼光谱, Raman Spectroscopy; 傅里叶变换红外光谱, Fourier Transform Infrared (FTIR) Spectroscopy; 吸收光谱, Absorption Spectrum; 光致发光光谱, Photoluminescence Spectrum; 飞秒光谱, Femtosecond Spectroscopy
	Section 13, 4 hours	参观物理系郭亮教授实验室, Tour of Guo Liang' s Lab
	Section 14, 2 hours	光频梳技术, Optical Comb: 光频梳原理, Theorem of Optical Comb; 光频梳的应用, Application of Optical Comb
	Section 15, 4 hours	阿秒激光, Attosecond Laser: 阿秒激光的产生, Generation of Attosecond Laser; 阿秒光谱, Attosecond Spectroscopy
	Section 16, 2 hours	期末报告; Final Report
11.	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.) 出勤 5%, 课堂表现 5%, 小测验 10%, 平时作业 20%, 期中考试 20%, 期末报告 40%。	
12.	教材及其它参考资料 Textbook and Supplementary Readings	
	激光原理及应用, 陈鹤鸣, 赵新彦 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	