

## 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>	激光原理与技术 Principles and Technologies of Lasers				
2.	授课院系 <b>Originating Department</b>	电子与电气工程系 Department of Electrical and Electronic Engineering				
3.	课程编号 <b>Course Code</b>	EE310				
4.	课程学分 <b>Credit Value</b>	3				
5.	课程类别 <b>Course Type</b>	专业基础课 Major Foundational Courses				
6.	授课学期 <b>Semester</b>	春季 Spring				
7.	授课语言 <b>Teaching Language</b>	中英文 Chinese/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) <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	邵理阳, 副教授, 电子与电气工程系 Email: shaoly@sustech.edu.cn SHAO Liyang, Assoc. Prof., Department of Electrical and Electronic Engineering Email: shaoly@sustech.edu.cn				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	待公布 To be announced				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>	40				
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>	36	习题 5/讨论 10			51

<p>12. 先修课程、其它学习要求 <b>Pre-requisites or Other Academic Requirements</b></p>	<p>EE210 光学基础 EE210 Fundamentals of Optics</p>
<p>13. 后续课程、其它学习规划 <b>Courses for which this course is a pre-requisite</b></p>	<p>本课程为电子与电气工程系光电专业必修课，主要阐述激光器的基本原理、理论与应用；其它专业学生如果想学习相关知识也可选修本课程。 This course should be taken by everyone in Optoelectronics Science and Technology, and it includes the basic principle of laser, mechanism and applications. It should however also be suitable for non-specialists, i.e. for all those students who show interests in lasers to gain a certain amount of relevant knowledge.</p>
<p>14. 其它要求修读本课程的学系 <b>Cross-listing Dept.</b></p>	<p>无 None</p>

### 教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

<p>学生在完成本课程学习后，应能够掌握：（1）激光原理的基本知识、激光特性,了解激光器的组成；（2）了解光谐振腔模式的波动理论；（3）掌握谱线加宽的机制、速率方程理论的分析方法、以及均匀加宽和非均匀加宽工作物质的增益系数的特性；（4）掌握激光振荡特性；了解弛豫振荡和线宽等概念。（5）激光调制的概念；（6）声光效应和声光调制；（7）电光效应和电光调制；（8）激光调 Q 的基本原理；（9）锁模原理及技术等；</p> <p>After the completion of this course, students should know the following items. (1) The basic knowledge, characteristics, and the components of lasers. (2) The ray and wave propagation theory for cavity. (3) Line broadening mechanisms, the analysis method of the rate equation, and the characteristics of gain coefficient the various kinds of materials. (4) The oscillation characteristics of laser, the relaxation oscillation frequency and linewidth of lasers; (5) The concept of laser modulation; (6) Acousto-optic effect and modulation; (7) Electro-optic effect and electro-optic modulation; (8) principle of Q-switched laser; (9) Mode-locking principle</p>
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16. **预达学习成果 Learning Outcomes**

<p>通过这门课程的学习，学生能够</p> <ol style="list-style-type: none"> <li>1. 掌握各种激光器的基本原理和特性</li> <li>2. 掌握高斯光束变换和各类稳定性谐振腔的设计；</li> <li>3. 掌握激光振荡特性和线宽等原理；</li> <li>4. 运用声光调制器和电光调制器等进行激光信号调制；</li> <li>5. 掌握调 Q 激光器的工作原理和运作方式；</li> <li>6. 分析锁模激光器的锁模条件等。</li> </ol> <p>After the completion of this course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. understand the basic principles and characteristics of different type of lasers</li> <li>2. understand the Gauss beam propagation and design of various stable optical cavity.</li> <li>3. understand the laser oscillation characteristics and linewidth.</li> <li>4. know how to generate the modulated laser with acousto-optic modulator and electro-optic modulator</li> <li>5. master the working principle and operation mode of Q-switched laser;</li> <li>6. analyze mode-locking conditions of mode-locked lasers</li> </ol>
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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.)**

Chapter 1. The Basic Principle of The Lasers: The Concept of Coherence of Photons; The Concept of Spontaneous and Stimulated Emission, Absorption; Light Amplification By Stimulated Emission of Radiation; The Self-Excited Oscillation Theory of Light; The Optical Characteristics of Lasers.

Chapter 2. Cavities and Gauss Beam: The Characteristics of Resonators; Concept of Longitudinal Mode and Transverse Mode; Stability Condition of Various Konds of Cavities; Basic Properties of Gauss Beam; Characteristics of Unstable Resonators.

Chapter 3. The Resonance between Electromagnetic Field and Material: The Classical Theory of Interaction between Light and Matter; Line Broadening Mechanisms; Rate Equation; Gain Coefficients In Homogeneous And Inhomogeneous Broadening Medium.

Chapter 4. The Properties of Laser Oscillation: The Concept of Laser Oscillation Threshold; Understanding Modes of Laser Oscillation; Calculation of Output Power and Energy of Lasers; Concept of Relaxation Oscillation; Limit of the Single Mode Laser Linewidth.

Chapter 5. Techniques of Laser: Laser Beam Transformation, Laser Modulation; Laser Mode Locking Technique; Amplification, Frequency Conversion, Pulse Compression and Pulse Expansion

Chapter 6. Introduction of Typical Lasers: Solid State Laser; Gas Laser; Dye Laser; Semiconductor Laser; and Oher Lasers.

Chapter 7. The applications of Lasers: Industry; Agriculture; National Defense; Science And Technology.

Note: Whether Chapter 7 will be taught or not will depend upon the progress of teaching.

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

指定教材：周炳琨、高以智、陈倜嵘，激光原理（中文），第七版，国防工业出版社（北京），2014

推荐参考资料：Orazio Svelto, Principles of Lasers, 5<sup>th</sup> Ed. Springer (New York), 2009

Required: Zhou Binkun, Gao Yizhi, Chen Chourong, Laser Principle (Chinese Edition), 7<sup>th</sup> Ed. National Defence Industry Press (China), 2014

Recommended: Orazio Svelto, Principles of Lasers, 5<sup>th</sup> Ed. Springer (New York), 2009

**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				
课堂表现 Class Performance				
小测验				

<b>Quiz</b>			
课程项目 <b>Projects</b>	<b>30</b>		
平时作业 <b>Assignments</b>	<b>10</b>		
期中考试 <b>Mid-Term Test</b>	<b>10</b>		
期末考试 <b>Final Exam</b>	<b>30</b>		
期末报告 <b>Final Presentation</b>	<b>20</b>		
其它（可根据需要 改写以上评估方 式） <b>Others (The above may be modified as necessary)</b>			

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**

