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 Course Title**	**光谱技术与应用 SPECTRAL TECHNOLOGY AND APPLICATION**
2.	**授课院系 Originating Department**	电子与电气工程系 Department of Electrical and Electronic Engineering
3.	**课程编号 Course Code**	EE321
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**	春季 Spring
7.	**授课语言 Teaching Language**	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）Instructor(s), Affiliation& Contact （For team teaching, please list all instructors）**	陈锐，副教授，电子与电气工程系 办公室：第二科研楼 323 室 Email：chen.r@sustech.edu.cn 电话：0755-8801-8536 CHEN Rui, Assoc. Prof., Department of Electrical and Electronic Engineering Office: Room No. 323, No.2 Research Building Email: chen.r@sustech.edu.cn Telephone: 0755-8801-8536
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）**	30

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

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无 None
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	本课程为电子与电气工程系光电专业选修课，主要系统介绍现代激光光谱学中的基本理论、方法和应用。其它专业学生如果想学习相关知识也可选修本课程。 This course is the elected course for undergraduate student in Optoelectronics Science and Technology, and it includes the basic theory, method and application of modern laser spectroscopy. 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.
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 None

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

学生在完成本课程学习后，应能掌握：（1）各种光谱技术的原理，对各类检测方法有较全面的了解，在今后的科研工作中能够将光谱学知识应用于自己的研究；（2）掌握光谱学基础、光谱仪器系统、常规光谱技术和激光光谱技术等。

After the completion of this course, students should know the following items. (1) Familiar with the principle of all kinds of spectrum technology; have a comprehensive understanding of all kinds of detection methods which will be useful for their future research work; (2) Understand the specific content including spectroscopy, conventional spectra-system and laser spectroscopy technology.

16. 预达学习成果 Learning Outcomes

本课是光信息科学与技术专业的主干专业课，学生将掌握激光器的基本原理，学会并培养分析解决光谱物理问题的能力，深入理解物理概念，为今后从事光信息技术科研及开发工作打下良好的专业基础。预达到的学成成果可以归纳如下：

1）应用数学、科学和工程知识的能力
2）了解各种激光光谱仪器
3）拥有设计和进行光学实验的能力
4）拥有分析和解释实验数据的能力
5）能够使用工程实践所需的技术、技能和现代工程工具

This course is the core course for students in Optoelectronics Science and Technology. Students will learn the basic principle of spectroscopy, learn and cultivate the ability to analyze and solve the problem in the filed of spectrum physics, and in-depth understanding of their physical concepts. It is essential for students to engage in research and development of optical information technology in the future. The learning outcome can be classified as following.

1) An ability to apply knowledge of mathematics, science, and engineering
2) An understanding of various laser spectroscopy
3) An ability to design and conduct optical experiments
4) An ability to analyse and interpret data
5) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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. Introduction: Introduce the outline of the course

Chapter 2. Absorption and Emission of Light: Cavity Modes; Thermal Radiation and Plancks Law; Absorption，Induced， and Spontaneous Emission; Basic Photometric Quantities; Polarization of Light; Absorption and Emission Spectra; Transition Probabilities; Coherence Properties of Radiation Fields

Chapter 3. Spectroscopic Instrumentation: Spectrographs and Monochromators; Interferometers; Comparison Between Spectrometers and Interferometers; Accurate Wavelength Measurements; Detection of Light;

Chapter 4. Lasers as Spectroscopic Light Sources: Fundamentals of Lasers; Laser Resonators; Spectral Characteristics of Laser Emission; Experimental Realization of Single-Mode Lasers; Controlled Wavelength Tuning of Single-Mode Lasers; Linewidths of Single-Mode Lasers; Tunable Lasers; Nonlinear Optical Mixing Techniques; Gaussian Beams

Chapter 5. Nonlinear Spectroscopy: Linear and Nonlinear Absorption; Saturation of Inhomogeneous Line Profiles; Saturation Spectroscopy; Polarization Spectroscopy; Multiphoton Spectroscopy; Special Techniques of Nonlinear Spectroscopy

Chapter 6. Laser Raman Spectroscopy: Basic Considerations; Experimental Techniques of Linear Laser Raman Spectroscopy; Nonlinear Raman Spectroscopy; Special Techniques; Applications of Laser Raman Spectroscopy

Chapter 7. Time-Resolved Laser Spectroscopy: Generation of Short Laser Pulses; Measurement of Ultrashort Pulses; Lifetime Measurement with Lasers; Pump-and-Probe Technique

Chapter 8. Coherent Spectroscopy: Level-Crossing Spectroscopy; Quantum-Beat Spectroscopy; Excitation and Detection of Wave Packets in Atoms and Molecules; Optical Pulse-Train Interference Spectroscopy; Photon Echoes; Optical Nutation and Free-Induction Decay; Heterodyne Spectroscopy; Correlation Spectroscopy

Chapter 9. Laser Spectroscopy of Collision Processes: High-Resolution Laser Spectroscopy of Collisional Line Broadening and Line Shifts; Measurements of Inelastic Collision Cross Sections of Excited Atoms and Molecules; Spectroscopic Techniques for Measuring Collision-Induced Transitions in the Electronic Ground State of Molecules; Spectroscopy of Reactive Collisions; Spectroscopic Determination of Differential Collision Cross Sections in Crossed Molecular Beams; Photon-Assisted Collisional Energy Transfer; Photoassociation Spectroscopy of Colliding Atoms

Chapter 10. New Developments in Laser Spectroscopy: Optical Cooling and Trapping of Atoms; Spectroscopy of Single Ions; Optical Ramsey-Fringes; Atom Interferometry; The One-Atom Maser; Spectral Resolution Within the Natural Linewidth; Absolute optical Frequency Measurement and Optical Frequency Standards; Squeezing

Chapter 11. Applications of Laser Spectroscopy: Applications in Chemistry; Environmental Research with Lasers; Applications to Technical Problems; Applications in Biology; Medical Applications of Laser Spectroscopy

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

指定教材：德姆特勒德，激光光谱学，第三版，世界图书出版公司，2008
推荐参考资料： Sune Svanberg, Atomic and Molecular Spectroscopy: Basic Aspects and Practical Applications, Springer-Verlag, 2003

Textbook: Demtroder W., Laser Spectroscopy: Basic concepts and Instrumentation, 3rd Ed. Springer-Verlag, 1982
Supplementary Readings: Sune Svanberg, Atomic and Molecular Spectroscopy: Basic Aspects and Practical Applications, Springer-Verlag, 2003

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 Quiz				
课程项目 Projects		50		
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		50		
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