课程大纲
COURSE SYLLABUS

1.	**课程名称(中英文)** **Course Title(Chinese and English)**	**现代激光技术** **Modern Laser Technology**
2.	**课程类别 Course Type**	专业选修课 Subject Elected
3.	**授课院系** **Originating Department**	电子与电气工程系 Department of Electrical and Electronic Engineering
4.	**课程学时 Credit Hours**	32
5.	**课程学分 Credit Value**	2
6.	**授课语言** **Teaching Language**	英文 English
7.	**授课教师 Instructor(s)**	陈锐 Chen Rui
8.	**先修课程、其它学习要求** **Pre-requisites or Other Academic Requirements**	无 None

9. 教学目标 Course Objectives

本课是光信息科学与技术方向研究生的专业选修课，学生在完成本课程学习后，应能够掌握：（1）超快激光产生的原理；（2）超快激光的性质；（3）超快激光的调制；（4）超快激光的应用。学生将掌握超快激光脉冲的基本知识，学会并了解超快激光的产生、性质与应用，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。

This course is the elected course for graduate students in Optoelectronics Science and Technology. After the completion of this course, students should know the following items. (1) The basic priciple of ultrashot lasers, (2) Property of ultrashort pulse, (3) The modulation of ultrashort pulse, and (4) the application of ultrafast lasers. Students will need to grasp the basic principle of ultrafast short pulse, learn and cultivate the ability to analyze and solve the problem in the filed of ultrafast photonics, 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.

10. 教学方法及授课创新点 Teaching Methods and Innovations

教学方法：课堂教授，习题，学生选择相关主题进行演讲比讨论。

创新：本课程将为学生提供第一手的机会，掌握现代激光技术的原理与应用。除了理论教学，本课程将包括各

种应用于科学研究的现代激光技术，不仅可以使学生掌握相关的知识，也有利于他们基于这些先进的测试手段服务于研究生阶段的科学研究。

Teaching Methods: lecture, tutorial, students will choose the related topics to present and discuss during the lecture.

Innovations: This course will provide students first-hand opportunities to master problem-solving skills with modern laser technology. In addition to theoretical teaching, this course will include a variety of modern laser technology applied to scientific research. This course will not only enable students to master the relevant knowledge, but also can serve for their graduate research based on these advanced measurement techniques.

11. **教学内容及学时分配 Course Contents and Course Schedule**

Week 1. Introduction: Brief overview and motivation of the course, discussing key attributes of ultrashort laser pulses and some application examples. Important background material, including simple electromagnetic and laser essentials, is reviewed.

Week 2 & 3. Ultrafast Laser Generation: Basic principles of laser mode-locking in some depth. The intent is not only to cover one of the most interesting topics at the outset, but to use the discussion on mode-locking as a physical context in which to introduce a variety of important ultrafast optical effects (e.g., dispersion, filtering, self-phase modulation), many of which are themselves treated in detail in subsequent chapters.

Week 4 & 5. Amplification of Ultrashort Pulse: Femtosecond pulse amplification technique, leading to realization of pulse with ultrahigh peak power, will be discussed in detail.

Week 6, & 7. Ultrafast Nonlinear Optics: 2^{nd} and higher-order nonlinearities, including the second-harmonic generation (SHG), refractive index, etc, Topic include self-phasemodulation, pulse compression, solitons, continuum generation, etc.

Week 8 & 9. Time Resolved Photoluminescence: The important application of time resolved photoluminescence will be introduced. Various kinds of measurement techniques including time correlated single photon counting (TCSPC), streak camera and time resolved upconversion technique will be discussed in detail.

Week 10 & 11. Ultrafast Transient Absorption: The basic principle of time resolved transient absorption technique will be discussed in detail. The optical component, the basic principle and the application of transient absorption will be shown.

Week 12 & 13. Ultrafast Laser Micromachining: Theory of laser ablation, the fundamentals of laser-material interaction and application to multiscale surface modification will be discussed. Moreover, laser manipulation, laser synthesis of nanomaterials, and ultrafast laser micromachining and patterning will be introduced.

Chapter 14 & 15. Introduction to THz: General introduction of THz and the THz time-domain spectroscopy, a technique that provides exciting capability for materials characterization and sensing in a spectral region that is difficult to access by either direct electronic or optical means, is discussed.

12. **课程考核 Course Assessment**

作业（30%），报告（30%）和项目（40%）

Assignments (30%), Presentation (30%), and Project (40%)

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

教材：
Andrew M. Weiner, Ultrafast Optics, Wiley, 2009
参考资料：
1) Orazio Svelto, Principles of Lasers, 5th Ed. Springer (New York), 2009
2) Wolfgang Demtroder, Laser Spectroscopy: Basic Concepts and Instrumentation, 3rd Ed. Springer (New York), 2013

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