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**	**光电仪器设计 Optoelectronic Instrumentation**
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**	EE343
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**	秋季 Fall
7.	**授课语言 Teaching Language**	中英双语 English & Chinese （English with Detailed Explanations in 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）**	孙小卫 教授 电子与电气工程系 第二科研楼 501 电话： +86-755-88018558 电邮: sunxw@sustc.edu.cn Xiaowei Sun Professor Department of Electrical and Electronic Engineering, Faculty Research Building 2, room 501 Tel: +86-755-88018558 Email: sunxw@sustc.edu.cn
9.	**实验员/助教、所属学系、联系方式** **Tutor/TA(s), Contact**	徐琳琳，教学工程师， 电子与电气工程系 一教 131 电话： +86-755-88018762 电邮: xull@sustc.edu.cn Linlin Xu, Teaching Engineer, Department of Electrical and Electronic Engineering，Teaching building 1 Tel: +86-755-88018762 Email: xull@sustc.edu.cn
10.	**选课人数限额(可不填)** **Maximum Enrolment（Optional）**	12

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	32		32		64

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	EE106 光电子导论；EE204 半导体器件导论 EE106Introduction to Optoelectronic；Introduction to Semiconductor Devices
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	
14. 其它要求修读本课程的学系 Cross-listing Dept.	

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程主要讲授光电仪器的设计原理和设计原则，详细介绍和分析组成光电仪器的各个模块，如光源，探测器，标准器等，并详细介绍和分析现代先进光电仪器的工作原理和发展趋势。培养学生自己动手设计光电仪器的能力。

The objectives of the course are to introduce and analyze the design principle and design discipline of the optoelectronic instruments, the element modules of the optoelectronic instruments (including light source, detector, calibrator, and so on), and the work principle and trends of the modern advanced optoelectronic instruments. Let students have the ability to design optoelectronic instruments.

16. 预达学习成果 Learning Outcomes

通过该课程的学习，学生将掌握光电仪器设计原理和设计原则，熟悉常用光电仪器的工作原理，了解现代先进光电仪器的原理和发展趋势。为今后从事电学相关仪器研究及开发工作打下良好的专业基础。

After completing this course, the students should master the design principle of optoelectronic instrument, familiar with the commonly used optoelectronic instrument, know about the work principle and trends of the modern advanced optoelectronic instruments. To have a good professional foundation for the study and the development of related instruments in the future.

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.)

理论课教学内容：

第一章 光电仪器设计概论：几种典型光电仪器的发展及应用介绍、光电仪器的特点、光电仪器的分类与组成、光电仪器总体设计的基本观点及步骤以及现代光电仪器的设计方法等。2 个学时。

第二章 光电仪器精度分析与设计:仪器的误差与精度介绍， 仪器误差的分析与计算、仪器误差的合成、提高精度的基本设计原则以及仪器误差的补偿方法等。 4 个学时。

第三章 光电仪器的典型元系统：本章主要内容包括：光源及照明系统介绍、 光电探测系统介绍、标准量与标准器介绍以及运动与对准介绍等。12 个学时。

第四章 现代先进光电仪器关键技术分析: 本章主要内容包括：数字全息显微技术的原理及分析、 非视距成像技术的原理及分析以及现代激光干涉仪技术的原理及分析等。14 个学时。

Contents of lecture:

Chapter 1. Introduction to the design of optoelectronic instruments: The main contents of this chapter including: development and application of several typical photoelectric instruments, characteristics of photoelectric instrument, classification and composition of optoelectronic instruments, the basic ideas and steps of the overall design of optoelectronic instruments and design method of modern photoelectric instrument. 2 credit hours.

Chapter 2. Accuracy analysis and design of the photoelectric instrument: The main contents of this chapter including: error and accuracy of instrument, analysis and calculation of errors of the photoelectric instrument, synthesis of errors of the photoelectric instrument, basic design principles for improving accuracy of the photoelectric instrument, compensation method of errors of the photoelectric instrument, and so on. 4 credit hours.

Chapter 3. Typical element system of photoelectric instrument: The main contents of this chapter including: light source and lighting system, photoelectric detection system, standard quantities and calibrations, motion and alignment, and so on. 12 credit hours.

Chapter 4. Analysis of key technologies of modern advanced photoelectric instruments: Principle and analysis of digital holography microscopy, principle and analysis of non-line-of-sight imaging, principle and analysis of modern laser interferometer, and so on. 14 credit hours.

实验教学安排如下：

Arrangement of the experiment teaching is as follows:

序号 Number	实验项目 Projects	主要内容 Main contents	注意事项 Dos and don'ts	安排 Credit hours.
1	LED 特性测试仪设计 Design of LED characteristic tester	设计可以测量 LED 的 I-V 曲线，亮度，光空间分布等的一体测试仪。 Design the integrated tester that can be used to test I-V curve, luminance, spatial intensity distribution of the LED.	1. 实验过程中注意用电安全和避免激光直射眼睛； 2. 学期的第 16 周进行实验项目验收； 3. 实验项目验收内容包括完整的实验系统展示和实验项目总结 PPT 报告； 1. During the experiment, pay attention to power safety and avoid direct eye shooting by laser; 2. Acceptance of the projects is in the 16th week of	32
2	三维形貌测量仪设计 Design of 3D profilometer.	设计用于测量物体三维形貌的测量仪，并对所设计的系统进行精度分析。 Design the profilometer that can be used to test the 3D surface roughness, and analyze the accuracy of the profilometer.		32
3	AR 应用系统设计 Design the application system of AR	设计基于 AR 技术的应用系统，如 AR 定位、交互和显示等。 Design the application system		32

		that based on AR technology, such as AR location, interaction display, and so on.	the semester; 3. The requirement of the project acceptance including displaying the designed experimental system and the PPT report.	
4	激光测速仪设计 Design of laser velocimeter	设计用于测量血管中血液流速的测速仪，并对所设计的系统进行精度分析。 Design a velocimeter that used to measure blood velocity in blood vessels, and analyze the accuracy of the velocimeter.		32
5	数字全息显微系统设计 Design of holographic microscope system	设计用于无标记生物细胞观测和动态三维形貌测量的数字全息显微系统。 Design a digital holographic microscope system used for unlabeled biological cell observation and dynamic 3D shape measurement.		32
6	激光干涉仪设计 Design of Laser Interferometer	设计用于精密长度测量的双频激光干涉仪，并对所设计的系统进行精度分析。 Design a dual-frequency laser interferometer used for precise length measurement, and analyze the accuracy of the interferometer.		32

注意：学生根据给定的实验项目，两个人一组，选择一个项目来做。学生也可以自行设计实验项目主题，经指导老师审核合理后，两人一组独自完成自行设计的实验项目。

一个项目的完成时间为 32 个学时，即学生两个人一组，利用从第 1 到第 16 周的时间完成实验所选择的一个实验项目。

Notice: Two students in groups, each chooses one of the given projects and finishes it in the given time. Besides, students can design project topics on their own, after checked by the teacher, the self-designed project can be done by students in pairs.

The completion time of one project is 32 credit hours, which means two students in groups to finish the chosen project in the period of from the 1st week to the 16th week.

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

指定教材：郝群，光电仪器原理与设计，第一版，机械工业出版社（北京），2013; Myung K. Kim, Digital holographic microscopy : principles, techniques, and applications, 1st Ed., Springer (New York), 2011.

参考教材：范希智，物理光学，第二版，清华大学出版社（北京），2016；李玉和，郭阳宽，现代精密仪器设计，第二版，清华大学出版社（北京），2010；Didier Decoster and Joseph Harari, Optoelctronic sensors, 1st Ed., ISTE Ltd., (London), 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		10		

Performance				
小测验 Quiz				
课程项目 Projects		30		
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam		60		
期末报告 Final Presentation				
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