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**	光学设计 Optical Design
2.	**授课院系 Originating Department**	电子与电气工程系 Department of Electrical & Electronic Engineering
3.	**课程编号 Course Code**	EE311
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业核心课 Major Core Courses
6.	**授课学期 Semester**	秋季 Fall
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）**	王 恺，副教授（理论课），电子与电气工程系，Email: wangk@sustech.edu.cn Kai WANG, Associate Professor (Theory Course), Department of Electrical & Electronic Engineering, Email: wangk@sustech.edu.cn 徐琳琳，教学工程师（实验课），电子与电气工程系，Email: xull@sustech.edu.cn Linlin XU, Teaching Engineer (Experiment Course), Department of Electrical & Electronic Engineering, Email: xull @sustech.edu.cn
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	肖翔天，助教，电子与电气工程系，Email: xiaoxt@mail.sustc.edu.cn Xiangtian XIAO, Teaching Assistant, Department of Electrical & Electronic Engineering, Email: xiaoxt@mail.sustc.edu.cn
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	

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	无 No
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 No
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

光学设计是电子与电气工程系四年制本科光电信息科学与工程专业课程设置中的专业核心课程之一，其他学科专业具备相应基础知识且有兴趣的学生可以选修。

本课程主要任务是通过各个教学环节及教学手段使学生掌握非成像光学、成像光学和薄膜光学设计的基本概念、基本原理、基本分析与设计方法；培养学生在非成像光学、成像光学和薄膜光学设计方面的基本技能，培养学生解决光学设计问题的基本能力，具备光学系统设计的基础知识；并在此基础上，通过大量科学研究和工程应用中较前沿的光学设计案例分析与设计实践，使学生掌握先进的非成像光学、成像光学和薄膜光学设计算法与方法；为以后从事光电子科学与技术领域的工程技术工作、科学研究工作以及开拓新技术领域奠定基础。

Optical Design is one of the major core courses for the undergraduates with the major of Optoelectronics Information Science and Engineering, Department of Electrical & Electronic Engineering. Undergraduates with other majors are also welcome to select this course.

The main objective of this course is to make students know well of the basic concepts, principles as well as analysis and design methods of nonimaging optics, imaging optics and thin film optics. This course will cultivate students to obtain the design skills of nonimaging optics, imaging optics and thin film optics, and the abilities of solving different optical design problems. Students will learn and master algorithms and design methods of nonimaging optics, imaging optics and thin film optics through case analysis and design training of emerging optical designs both from scientific research and engineering applications. This course will lay a solid foundation for doing scientific research and engineering technics development in the area of optoelectronics in the future.

16. 预达学习成果 Learning Outcomes

本课程通过理论课教学，使学生理解非成像光学、成像光学和薄膜光学三大类光学设计的基本思路与方法；掌握各种自由曲面光学算法与设计方法，及其在 LED 显示与照明领域的实际应用；掌握成像光学设计中的像差理论和像质评价方法；掌握目视光学系统、照相物镜等光学系统的设计方法；了解并掌握介质膜光学特性。

本课程通过实验课教学，使学生进行非成像光学与成像光学系统设计的基本技能训练；掌握非成像光学与成像光学的计算机辅助设计和仿真分析的方法（ZEMAX、MATLAB、SolidWorks 等），培养基本的光学系统设计能力；并以科学研究和工程应用中较前沿的光学设计案例为例，通过一些新型光学透镜/系统的设计，使学生掌握先进的非成像光学和成像光学设计算法与方法。通过实践教学环节不仅要培养学生基本设计能力，还要培养学生良好的科学素养。

Through the theory course of Optical Design, students will have a well understand of the basic concepts of nonimaging optics, imaging optics and thin film optics, and obtain kinds of algorithms and design methods of freeform optics for LED displays and lighting applications. Besides, students will know well of aberration theory and image quality assessment in imaging optics, and obtain optical design methods for visual optical system and photographic lens. Moreover, students will know well of optical characterises of thin films.

Through the experiment course of Optical Design, students will have a good training on the optical design of nonimaging optics and imaging optics. In addition, students will acquire design methods of computer assistant design and simulation analysis (e.g. ZEMAX, MATLAB, SolidWorks, etc.) for nonimaging optics and imaging optics. Students will also obtain detailed algorithms and design methods of nonimaging optics and imaging optics through taking part in optical designs of

some new freeform lenses and optical systems emerged in scientific research and engineering applications. Through this experiment course, not only the abilities of optical design, but also the scientific literacy, of students will be well cultivated.

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.)

本课程的主要内容有：光学设计概述、LED 芯片与封装光学设计、自由曲面光学设计算法、自由曲面光学在 LED 显示与照明领域的应用、初级像差理论与像差校正、像质评价、公差分析、目视光学系统设计、照相物镜设计、介质膜光学特性、介质膜系设计及其应用等。重点内容是自由曲面光学设计算法、自由曲面光学在 LED 显示与照明中的应用、像差理论、像质评价。难点是非成像光学、成像光学和薄膜光学系统的分析。本课程由理论教学和课程实验两部分组成，其中理论授课学时为 32 学时，课程实验学时为 32 学时。

The main course contents of Optical Design including introduction of optical design, optical design of LED chip and packaging, algorithms of freeform optics, applications of freeform optics for LED displays and lighting, primary aberration theory and aberration correction, image quality assessment, tolerance analysis, visual optical system, photographic lens, and optical characterization of thin films. This course contains two parts, theory course with 32 class hours and experiment course with 32 class hours.

本课程理论课的教学日历如下 Theory Course

课程内容 Course contents		学时 Class hours	教学周 Week
非成像光学设计 Nonimaging Optical Design	第一章 光学设计概述 Chapter 1. Introduction of Optical Design	2	Week 1
	第二章 LED 芯片与封装光学设计 Chapter 2. Optical Design of LED Chip and Packaging	2	Week 2
	第三章 自由曲面光学设计算法 Chapter 3. Algorithms of Freeform Optics	6	Week 3-5
	第四章 自由曲面光学在 LED 显示与照明领域的应用 Chapter 4. Freeform Optics for LED Displays and Lighting	4	Week 6-7
成像光学设计 Imaging Optical Design	第五章 初级像差理论与像差校正 Chapter 5. Primary Aberration Theory and Aberration Correction	4	Week 8-9
	第六章 光学系统的像质评价和像差公差 Chapter 6. Image Quality Assessment and Tolerance Analysis	4	Week 10-11
	第七章 目视光学系统设计 Chapter 7. Visual Optical System Design	2	Week 12
	第八章 照相物镜设计 Chapter 8. Photographic Lens Design	2	Week 13
薄膜光学设计 Thin Film Optical Design	第九章 薄膜光学设计 Chapter 9. Thin Film Optical Design	6	Week 14-16

本课程实验课的教学日历如下

序号 No.	实验项目 Experiments	学时 Class hours	教学周 Week
1	基于 DIALux 的道路照明设计 Road Lighting Design Based on DIALux Software	2	Week 1
2	基于 SolidWorks 的三维实体构造 3D Structure Construction Based on SolidWorks Software	2	Week 2
3	侧入式 LCD 背光源设计 Design of Side Emitting LCD Backlighting	2	Week 3

4	均匀 LED 圆光斑自由曲面透镜设计 Design of Freeform Lens with Uniform Circular Lighting Pattern for LED	6	Week 4-6
5	LED 阵列均匀照明自由曲面透镜设计(DHR=2) Design of Freeform Lens for LED Array Uniform Lighting (DHR=2)	6	Week 7-9
6	ZEMAX 成像光学设计软件学习 ZEMAX Software Learning	2	Week 10
7	显微镜设计 Design of Optical System of Microscope	6	Week 11-13
8	变焦镜头设计 Design of Optical System of Zoom Lens	6	Week 14-16

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

（一）教材 Textbook

1. 李晓彤、岑兆丰 编著，《几何光学•像差•光学设计》，浙江大学出版社，2014。
Xiaotong Li and Zhaofeng Lin, Geometrical Optics, Aberrations and Optical Design, Zhejiang University Press, 2014.
2. 卢进军 著，《光学薄膜技术（第 2 版）》，电子工业出版社，2011。
Jinjun Lu, Optical Thin Film Technology (2nd Edition), Electronic Industry Press, 2011.

（二）主要参考书 Supplementary Readings

1. Kai Wang, Sheng Liu, Xiaobing Luo and Dan Wu, Freeform Optics for LED Packages and Applications, John Wiley & Sons, 2017.
2. Koshel R. John, Illumination Engineering Design with Nonimaging Optics, Wiley-Blackwell (an imprint of John Wiley & Sons), 2013.（中译本： R. John Koshel 著；葛鹏，赵茗，刘祥彪 译；《照明工程：非成像光学设计》，华中科技大学出版社，2016）

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		40		
平时作业 Assignments		15		
期中考试 Mid-Term Test		15		
期末考试 Final Exam		30		
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