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**	光电子技术基础 Fundamentals of Optoelectronic Technology
2.	**授课院系 Originating Department**	电子与电气工程 Electrical and Electronic Engineering
3.	**课程编号 Course Code**	EE303
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业基础课 Major Foundational 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）**	罗 丹 副教授 电子与电气工程系 第二科研楼 525 电话： +86-755-88018552 电邮: luo.d@sustc.edu.cn Dr. Dan Luo Associate Professor Department of Electrical and Electronic Engineering, Faculty Research Building 2, room 525 Tel: +86-755-88018552 Email: luo.d@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 xull@sustc.edu.cn 15338737651 Linlin Xu, Teaching Engineer, Department of Electrical and Electronic Engineering xull@sustc.edu.cn 15338737651
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	50

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	PHY105B 大学物理（下）B PHY105B General Physics B (II)
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	本课程为光电子和微电子专业必修课，是光纤通信原理与技术以及激光原理的先修课程；其它非光电子和微电子专业学生如果想学习光电子技术应用方面的知识，也可选修本课程。 This course should be taken by everyone contemplating doing Optoelectronic and Microelectronics in the following years and it is a prerequisite for most Optical Fiber Communication and Fundamental of Laser. It should however also be suitable for non-specialists, i.e. for all those students who wish to study the knowledge of optoelectronic technology.
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

本课程适合光电子、微电子专业本科三年级，是非常基本并且重要的。通过该课程的学习，学生将了解和掌握光电子学的许多方面：例如，光在介质中的传播，波导光学和光纤，光的偏振和调制，发光二极管、激光、光电二极管和探测器，使得学生对光学领域知识有着系统，全面，和深刻的理解。

This course is suitable for optoelectronic and microelectronic year 3 undergraduate, is very basic and important. By learning the curriculum, students will understand and grasp several aspects of photonics: the propagation of light in the medium , optical waveguides and optical fibers, polarization and modulation, light emitting diodes, lasers, photodiodes and detectors, which allows students to systematically comprehensive and understand the optics domain knowledge.

16. 预达学习成果 Learning Outcomes

通过该课程的学习，学生将了解和掌握光电子学的许多方面：例如，光在介质中的传播，波导光学和光纤，光的偏振和调制，发光二极管、激光、光电二极管和探测器。学生将具备初步的光电器件理论知识和应用知识结合的能力，能够将理论与实际相结合，具备一定的分析能力，和动手能力。

Through this course , students will learn and master the many aspects of photonics : for example, the light propagation in the medium , optical waveguides and optical fibers , polarization and modulation， light emitting diodes , lasers, photodiodes and detectors. Students will possess athe ability to combine preliminary theoretical knowledge of optoelectronic devices and application, the ability to combine theory and practice , with some analytical skills, and ability.

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 Wave Nature of Light

1.1 Light Waves in a Homogeneous Medium

1.2 Refractive Index and Dispersion

1.3 Group Velocity and Group Index

1.4 Magnetic Field, Irradiance, and Poynting Vector

1.5 Snell's Law and Total Internal Reflection (TIR)

1.6 Fresnel's Equations

1.7 Antireflection Coatings and Dielectric Mirrors

1.9 Temporal and Spatial Coherence

1.10 Superposition and Interference of Waves

1.11 Multiple Interference and Optical Resonators

1.12 Diffraction Principles

Chapter 2 Dielectric Waveguides and Optical Fibers

2.1 Symmetric Planar Dielectric Slab Waveguide

2.2 Modal and Waveguide Dispersion in Planar Waveguides

2.3 Step-Index Optical Fiber

2.4 Numerical Aperture

2.5 Dispersion In Single-Mode Fibers

2.6 Dispersion Modified Fibers and Compensation

2.7 Bit Rate, Dispersion, and Electrical and Optical Bandwidth

2.8 The Graded Index (GRIN) Optical Fiber

2.9 Attenuation in Optical Fibers

2.10 Fiber Manufacture

Chapter 3 Semiconductor Science and Light-Emitting Diodes

3.1 Review of Semiconductor Concepts and Energy Bands

3.2 Semiconductor Statistics

3.3 Extrinsic Semiconductors

3.4 Direct and Indirect Bandgap Semiconductors:

3.5 pn Junction Principles

3.6 pn Junction Reverse Current

3.7 pn Junction Dynamic Resistance and Capacitances

3.8 Recombination Lifetime

3.9 pn Junction Band Diagram

3.10 Heterojunctions

3.11 Light-Emitting Diodes: Principles

3.12 Quantum Well High Intensity LEDs

3.13 LED Materials and Structures

3.14 LED Efficiencies and Luminous Flux

3.15 Basic LED Characteristics

3.16 LEDs for Optical Fiber Communications

3.17 Phosphors and White LEDs

Chapter 4 Stimulated Emission Devices: Optical Amplifiers and Lasers

4.1 Stimulated Emission, Photon Amplification, and Lasers

4.2 Stimulated Emission Rate and Emission Cross-Section

4.3 Erbium-Doped Fiber Amplifiers

4.4 Gas Lasers: The He-Ne Laser

4.5 The Output Spectrum of a Gas Laser

4.6 Laser Oscillations: Threshold Gain Coefficient and Gain Bandwidth

4.7 Broadening of the Optical Gain Curve and Linewidth

4.8 Pulsed Lasers: Q-Switching and Mode Locking

4.9 Principle of the Laser Diode

4.10 Heterostructure Laser Diodes

4.11 Quantum Well Devices

4.12 Elementary Laser Diode Characteristics

4.13 Steady State Semiconductor Rate Equations:

4.14 Single Frequency Semiconductor Lasers

4.15 Vertical Cavity Surface Emitting Lasers

4.16 Semiconductor Optical Amplifiers

Chapter 5 Photodetectors and Image Sensors

5.1 Principle of the pn Junction Photodiode

5.2 Shockley–Ramo Theorem and External Photocurrent

5.3 Absorption Coefficient and Photodetector Materials

5.4 Quantum Efficiency and Responsivity

5.5 The pin Photodiode

5.6 Avalanche Photodiode

5.7 Heterojunction Photodiodes

5.8 Schottky Junction Photodetector

5.9 Phototransistors

5.10 Photoconductive Detectors and Photoconductive Gain

5.11 Basic Photodiode Circuits

5.12 Noise in Photodetectors

5.13 Image Sensors

Chapter 6 Polarization and Modulation of Light

6.1 Polarization

6.2 Light Propagation in an Anisotropic Medium:Birefringence

6.3 Birefringent Optical Devices

6.4 Optical Activity and Circular Birefringence

6.5 Liquid Crystal Displays

6.6 Electro-Optic Effects

6.7 Integrated Optical Modulators

6.8 Acousto-Optic Modulator

6.9 Faraday Rotation and Optical Isolators

6.10 Nonlinear Optics and Second Harmonic Generation

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

推荐教材 Textbook：

S. O. Kasap，Optoelectronic and Photonics: Principles and Practices, 电子工业出版社。

参考书目 Supplementray Readings：

- “Fundamentals of Photonics”, B.E.A. Saleh, John Wiley&Sons
- “Optoelectronic Devices”, S. D. Smith, Prentice Hall 1995, ISBN 0-13-143769-0.

“Photonics and Lasers: An Introduction”, R. S. Quimby, John Wiley and Son

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		0%		
课堂表现 Class Performance		0%		
小测验 Quiz		0%		
课程项目 Projects		20%		
平时作业 Assignments		10%		
期中考试 Mid-Term Test				
期末考试 Final Exam		50%		
期末报告 Final		0%		

Presentation				
实验 Experiments		**20%**		
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