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**	光电智感 Optoelectronics Intellisense
2.	**授课院系 Originating Department**	电子与电气工程系
3.	**课程编号 Course Code**	EE108
4.	**课程学分 Credit Value**	3 学分
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**	英文 English
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）**	沈平、讲席教授、电子与电气工程系、shenp@sustech.edu.cn Shum Ping, Chair Professor, Department of Electrical and Electronic Engineering、shenp@sustech.edu.cn
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）**	

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	0	0	0	48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无 NA
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 NA
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 NA

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

《光电智感》课程使学生了解人工智能时代下智能感知的基本理论以及常用的传感器测量原理，了解设计传感器时要注意的基本问题，了解光电传感器的关键技术，了解各种光电传感技术前沿应用及发展。培养学生应用传感器的基本技能和逻辑思维能力，增强学生的科学素养，使学生具有理论联系实际能力，为国家未来信息领域发展培养高层次复合型人才。

The course aims to enable students in the era of artificial intelligence to understand the basic theory of intellisense and common sensor measurement principles, understand the basic issues when designing sensors, understand the key technologies of photoelectric sensors, and understand the frontiers of various optoelectronics sensing technologies as well as its application and development. The course aims to cultivate students' analytical skills in applying sensors, enhance students' scientific literacy, enable students to have the ability to integrate theory with practice, and cultivate high-level compound talents for the development of modern information field.

16. 预达学习成果 Learning Outcomes

1：学生了解传感的基本理论以及常用的传感器测量原理；掌握数学、自然科学知识，能够将数学、自然科学、工程基础和专业知识运用于信息工程的复杂工程问题的恰当表述。

2：学生基于传感基础知识具有理论联系实际能力，能够应用数学与自然科学基本原理、工程基础与专业知识，对复杂信息系统和过程进行识别和准确表达，

3：学生了解设计传感器及传感系统要注意的基本问题及需求，能够掌握本专业涉及的工程设计概念、原则和方法，能够针对信息领域的复杂工程问题确定设计需求。

4：培养学生在传感领域方面的书面报告、口头沟通的专业技能和科学素养，对信息领域复杂工程问题，能够以书面和口头形式表达设计思想、方法及成果，与业界同行及社会公众进行有效沟通和交流。

1: Students understand the basic theory of sensing and commonly used sensor measurement principles; master mathematics and natural science knowledge, and be able to apply mathematics, science, engineering foundation and professional knowledge to the appropriate expression of complex engineering problems in information engineering.

2: Students can integrate theory with practice based on basic sensing knowledge, and can apply basic principles of

mathematics and science, engineering foundations and professional knowledge to identify and accurately express complex information systems and processes.

3: Students can understand the basic issues and requirements that should be paid attention to when designing sensors and sensing systems, can master the engineering design concepts, principles and methods involved in the major, and can equip with analytical skills that determine design requirements for complex engineering problems in the information field.

4: Cultivate students' written reports, oral communication professional skills and scientific literacy in the field of sensing, and be able to express design ideas, methods and results in written and oral presentation, and conduct with industry peers and the effective public communication.

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 Industrial Applications of Artificial Intelligence ***3 Teaching Hours***

1.1 Introduction of AI

1.2 Key technologies of AI

1.3 Industrial applications of machine learning

第一章 人工智能及其工业应用 *3 学时*

1. 1 人工智能概述

1. 2 人工智能关键技术

1.3 机器学习及其工业应用

Chapter 2 IoT and Intellisense ***3 Teaching Hours***

2.1 Introduction of IoT

2.2 Key technologies of IoT

2.3 IoT and sensing technologies

2.4 IoT based optoelectronics intellisense

第二章 智能物联与感知技术 *3 学时*

2. 1 概述

2. 2 物联网的关键技术

2.3 物联网与传感技术

2. 4 基于物联网的光电传感技术

Chapter 3 Basic Principle of optoelectronics Sensors ***6 Teaching Hours***

3.1 Introduction

3.2 Amplitude/phase/polarization/wavelength-based sensors

3.3 Optical fiber for optoelectronics sensors

3.4 The development of fiber sensing

第三章 传感器及基本原理 *6 学时*

3.1 传感器概述

3.2 振幅/相位/偏振/波长型光电传感器

3.3 光电传感器中的光纤技术

3.4 光纤传感技术的发展趋势

Chapter 4 Multiple Sensors Networks ***6 Teaching Hours***

4.1 Introduction

4.2 Optical access networks

4.3 Optical networks

4.4 Optical sensing networks applications

第四章 多传感器的光网络技术 *6 学时*

4.1 概述

4.2 光纤网络的连接技术

4.3 光网络技术

4.4 光传感器网实例

Chapter 5 Sensing and Signal Processing ***6 Teaching Hours***

5.1 Introduction

5.2 Phase-modulation sensors and demodulation technique

5.3 Fiber-based phase-locked loop technique

5.4 Fiber interferometer-based modulation/demodulation technique

第五章 光传感信号处理技术 *6 学时*

5.1 概述

5.2 相位调制型光传感器的信号解调技术

5.3 光纤锁相环法

5.4 干涉型光纤传感器复用解复用方法

Chapter 6 Sensor Packaging Technique ***4 Teaching Hours***

6.1 Introduction

6.2 Packaging technique of optical sensors

6.3 Packaging technology of quartz planar optical waveguide

第六章 传感器的封装技术 *4 学时*

6.1 概述

6.2 光传感器的封装技术

6.3 石英平面光路器件的封装技术

Chapter 7 Multi-sensor Information Fusion technique ***4 Teaching Hours***

7.1 Introduction

7.2 Basic principles of multi-sensor information fusion

7.3 System architecture and theoretical method

7.4 Typical application of multi-sensor information fusion

第七章 多传感器信息融合技术 *4 学时*

7.1 概述

7.2 多传感器信息融合的基本原理

7.3 多传感器信息融合的系统结构及理论方法

7.4 多传感器信息融合的典型应用

Chapter 8 Sensing Application in Power System ***4 Teaching Hours***

8.1 Introduction

8.2 Current/Voltage/Power Sensor

8.3 Switchgear sensor-non-electricity sensor

8.4 Typical applications

第八章 光电传感技术在电力系统的应用 *4 学时*

8.1 概述

8.2 电流/电压/功率传感器

8.3 开关设备的传感器-非电量传感器

8.4 典型应用

Chapter 9 Sensing Application in Petrochemical Industry ***4 Teaching Hours***

9.1 Introduction

9.2 Distributed temperature and pressure sensing

9.3 Downhole oil, gas and water spectrum analyzer

9.4 Optical fiber sensor in seismic exploration

第九章 光电传感技术在石油化工领域应用 *4 学时*

9.1 概述

9.2 分布式光纤温度和压力传感器

9.3 井下油气水光谱分析仪

9.4 地震勘探中的光纤传感器

Chapter 10 Sensing Application in Biochemistry Field ***4 Teaching Hours***

10.1 Introduction

10.2 Photobiosensor

10.3 Photomedical sensor

10.4 Photobiochemical sensor

第十章 光电传感技术在生物化学领域应用 *4 学时*

10.1 概述

10.2 光生物传感器

10.3 光医学传感器

10.4 光生化传感器

Chapter 11 Sensing Application in Defense Field ***4 Teaching Hours***

11.1 Introduction

11.2 Fiber Optic Gyroscope

11.3 Fiber optic hydrophone

11.4 Optical sensor in safety protection

第十一章 光电传感技术在国防领域应用 *4 学时*

11.1 概述

11.2 光纤陀螺

11.3 光纤水听器

11.4 光学传感器在安全防范中的应用

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

Textbook:

[1] Pedro Larrnaga, et al, Industrial Applications of Machine learning, 1st Edition, CRC Press, Taylor&Francis group, 2019, (ISBN: 978-0-8153-5622-6)

[2] Keiser Gerd, Optical Fiber Communications, 5th Edition, McGrw Hill, 2015. (ISBN 978-981-4575-69-0)

[3] Shizhuo Yin, Fiber Optic Sensors, 2nd Edition, CRC Press, Taylor&Francis group, 2008, (ISBN: 978-1-4200-5365-4)

References:

[4] T. Scheper, et al, Optical sensor systems in Biotechnology, 1st Edition, Springer, 2018, (ISBN: 978-3-642-03469-5)

[5] Ginu Rajan, et al, Structural health monitoring of composite structures using fiber optic methods, 1st Edition, 2017, (ISBN: 978-1-4987-3317-5)

[6] 廖延彪等，《光纤传感技术及应用》，第一版，清华大学出版社，2009 年，（ISBN: 978-7-302-17866-8）

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		30		
课程项目 Projects		0		
平时作业 Assignments		40		
期中考试 Mid-Term Test		0		
期末考试 Final Exam		0		
期末报告 Final Presentation		30		
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)		0		

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

电子与电气工程系课程设置与培养方案委员会