

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 | 现代传感技术 Modern sensing technology |
| 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 | EE348 |
| 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 | 春季 Spring |
| 7. | 授课语言 Teaching Language | 中文 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) | 王太宏, 讲席教授, 电子与电气工程系 办公室: 工学院南楼 227 室 Email: wangth@sustech.edu.cn 电话: 0755-8801-8503 Wang Taihong, Chair Prof., Department of Electrical and Electronic Engineering Office: Room 227, South Building, School of Engineering Email: wangth@sustech.edu.cn Telephone: 0755-8801-8520 |
| 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) | 20 |

| 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 | | | | 48 |
| 12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements | 无 None | | | | |
| 13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite | 无 None | | | | |
| 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

《现代传感技术》是电子科学与技术专业的专业选修课程。通过本课程的学习，学生能了解传感器的基本概念、传感器的构成、传感器工作的有关定律、传感器的作用、传感器和现代检测技术发展的趋势；培养学生利用现代电子技术、传感器技术和计算机技术解决生产实际中信息采集与处理问题的能力，为工业信息获取与测控系统的设计、开发奠定基础。

Modern Sensing Technology is a major elective course in electronic science and technology. Through the study of this course, students can understand the basic concepts of sensors, the composition of sensors, the relevant laws of sensor work, the role of sensors, the development trend of sensors and modern detection technology; To cultivate students' ability to use modern electronic technology, sensor technology and computer technology to solve information collection and processing problems in production practice, and lay a foundation for the design and development of industrial information acquisition and measurement and control systems.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生（1）掌握现代传感技术的定义、原理和分类，了解传感系统的构建方法。（2）掌握代传感技术的应用方法和要点。（3）能够针对现代传感技术进行有效沟通和交流，具有对现代传感技术的发展动态和新成果的自学能力。传感技术同计算机技术与通信一起被称为信息技术的三大支柱。从物联网角度看，现代传感技术是衡量一个国家信息化程度的重要标志，是解决我国多项卡脖子技术的重要基础。

Through the study of this course, students (1) master the definition, principles and classification of modern sensing technology, and understand the construction methods of sensing systems. (2) Master the application methods and key points of generation sensing technology. (3) Be able to effectively communicate and exchange for modern sensing technology, and have the ability to self-learn the development dynamics and new achievements of modern sensing technology. Sensing technology, together with computer technology and communications, is known as the three pillars of information technology. From the perspective of the Internet of Things, modern sensing technology is an important symbol to measure the degree of informatization of a country, and an important basis for solving a number of stuck neck technologies in China.

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.)

课程将讲授目前研究最热门、最受关注的传感技术，包括触觉传感技术、毫米波传感技术、机器人传感技术、医用传感技术、脑电传感器等等。的基本原理、特性及相应的测量电路，同时也介绍各类传感器的实际应用及传感器技术发展的状况及新成果，具体按以下八章来讲授。

第一章、现代传感技术简介（2学时）

第二章、触觉传感（10学时）

第三章、肌电传感（6学时）

第四章、脑电传感（6学时）

第五章、毫米波传感（6学时）

第六章、机器人传感（6学时）

第七章、医用传感（6学时）

第八章、人机接口（6学时）

第一章讲授时间为2学时，第二章讲授时间为10学时，第三章至第八章讲授时间皆为4学时。

The course will teach the most popular and concerned sensing technologies in current research, including tactile sensing technology, millimeter wave sensing technology, robot sensing technology, medical sensing technology, EEG sensors, etc. The basic principles, characteristics and corresponding measurement circuits, but also introduce the practical application of various sensors and the status and new achievements of sensor technology development, which are taught in the following eight chapters.

Chapter 1: Introduction to Modern Sensing Technology (2 hours)

Chapter 2: Haptic Sensing (10 hours)

Chapter 3: EMG Sensing (6 hours)

Chapter 4: EEG Sensing (6 hours)

Chapter 5: Millimeter Wave Sensing (6 hours)

Chapter 6: Robotic Sensing (6 hours)

Chapter 7: Medical Sensing (6 hours)

Chapter 8: Human Machine Interface (6 hours)

The first chapter is taught for 2 hours, the second chapter is taught for 10 hours, and the third to eighth chapters are all taught for 4 hours.

第一章现代传感技术简介

(1) 教学目的与要求：明确“现代传感器技术”在专业培养计划中的地位，课程的性质、任务和大体内容，现代传感技术在工业生产、生活中的作用；了解现代传感器的静、动态特性；掌握现代传感技术的应用方法。

(2) 教学重点：现代传感器的发展现状与趋势。

(3) 教学难点：现代传感技术的应用。

(4) 教学内容：1) 现代传感技术科研、工业生产、机器人、智慧医疗中的应用；2) 现代传感技术的定义与分类；3) 现代传感技术的分类；4) 现代传感技术的发展趋势；5) 传感器的主要技术指标和选用原则；6) 改善现代传感器性能的技术途径与方法。

Chapter 1: An Introduction to Modern Sensing Technology

(1) Teaching purpose and requirements: clarify the status of "modern sensor technology" in the professional training plan, the nature, tasks and general content of the course, and the role of modern sensor technology in industrial production and life; Understand the static and dynamic characteristics of modern sensors; Master the application methods of modern sensing technology.

(2) Teaching focus: the development status and trend of modern sensors.

(3) Teaching difficulties: the application of modern sensing technology.

(4) Teaching content: 1) Application of modern sensing technology in scientific research, industrial production, robotics, and intelligent medical care; 2) Definition and classification of modern sensing technology; 3) classification of modern sensing technologies; 4) The development trend of modern sensing technology; 5) The main technical indicators and selection principles of the sensor; 6) Technical approaches and methods to improve the performance of modern sensor devices.

第二章 触觉传感

(1) **教学目的与要求:** 理解触觉传感器的组成和基本原理, 了解触觉传感器的常用类型。掌握应变传感、电容传感、压电传感和摩擦传感的原理、特点、应用, 以及转换电路, 掌握力触觉传感器的应用方法。

(2) **教学重点:** 触觉传感器基本原理

(3) **教学难点:** 触觉传感器的应用与选用原则

(4) **教学内容:** 1) 触觉传感的工作原理; 2) 触觉传感器的定义、分类、主要参数与转换电路; 3) 触觉传感器的选用标准。

Chapter 2: Haptic Sensing

(1) Teaching purpose and requirements: understand the composition and basic principles of tactile sensors, and understand the common types of tactile sensors. Master the principles, characteristics, and applications of strain sensing, capacitive sensing, piezoelectric sensing and friction sensing, as well as conversion circuits, and master the application methods of force tactile sensors.

(2) Teaching focus: basic principles of tactile sensors

(3) Teaching difficulties: the application and selection principle of tactile sensors

(4) Teaching content: 1) The working principle of tactile sensing; 2) Definition, classification, main parameters and conversion circuits of tactile sensors; 3) Selection criteria for tactile sensors.

第三章 肌电传感

(1) **教学目的与要求:** 掌握肌电传感的构建和工作原理, 了解肌电传感的测量电路和基本使用方法, 掌握肌电的测量方法与肌电传感的应用方法。

(2) **教学重点:** 肌电传感的构建和工作原理。

(3) **教学难点:** 肌电的测量方法与肌电传感应用。

(4) **教学内容:** 1) 肌电传感原理和特性; 2) 肌电测量方法; 3) 肌电传感的应用; 4) 肌电传感的发展现状与趋势。

Chapter Three: EMG Sensing

(1) Teaching purpose and requirements: master the group construction and working principle of EMG sensing, understand the measurement circuit and basic use of EMG sensing, master the MEG measurement method and the application method of EMG sensing.

(2) Teaching focus: the construction and working principle of EMG sensing.

(3) Teaching difficulties: electromyoelectric measurement methods and EMG sensing applications.

(4) Teaching content: 1) The principle and characteristics of EMG sensing; 2) EMG measurement method; 3) Application of EMG sensing; 4) Development status and trend of EMG sensing.

第四章 脑电传感

(1) **教学目的与要求:** 掌握脑电传感方法和原理, 了解脑电传感的特点和应用。

(2) **教学重点:** 脑电传感的特点和应用。

(3) **教学难点:** 脑电传感方法与工作原理。

(4) **教学内容:** 1) 脑电传感现状; 2) 脑电传感方法和原理; 3) 脑电传感的特点和应用; 4) 脑电传感的发展趋势。

Chapter Four: EEG Sensing

(1) Teaching purpose and requirements: master the methods and principles of EEG sensing, and understand the characteristics and applications of EEG sensing.

(2) Teaching focus: the characteristics and application of EEG sensing.

(3) Teaching difficulties: EEG sensing method and working principle.

(4) Teaching content: 1) Current status of EEG sensing; 2) EEG sensing methods and principles; 3. Characteristics and applications of EEG sensing; 4) The development trend of EEG sensing.

第五章 毫米波传感

(1) **教学目的与要求:** 从物理和数学概念上了解毫米波传感的工作原理, 掌握毫米波传感的应用方法。

(2) **教学重点:** 毫米波传感的工作原理与应用。

(3) **教学难点:** 毫米波传感的应用。

(4) **教学内容:** 1) 毫米波传感的概念、定义及工作原理; 2) 毫米波传感的特点与应用分类; 3) 毫米波传感的发展方向。

Chapter 5: Millimeter Wave Sensing

(1) Teaching purpose and requirements: understand the working principle of millimeter wave sensing from physical and mathematical concepts, and master the application methods of millimeter wave sensing.

(2) Teaching focus: the working principle and application of millimeter wave sensing.

(3) Teaching difficulties: the application of millimeter wave sensing.

(4) Teaching content: 1) The concept, definition and working principle of millimeter wave sensing; 2) Characteristics and application classification of millimeter wave sensing; 3) The development direction of millimeter wave sensing.

第六章 机器人传感器

(1) **教学目的与要求:** 理解机器人传感机理与分类; 了解机器人传感的特点和应用范围, 掌握机器人传感的应用方法。

(2) **教学重点:** 理解机器人传感的各种效应与机理; 明确机器人传感的特点和应用范围。

(3) **教学难点:** 机器人传感的特点和应用方法

(4) **教学内容:** 1) 机器人传感机理; 2) 机器人传感特点; 3) 机器人传感分类; 4) 机器人传感应用; 5) 机器人传感发展方向。

Chapter 6: Robotic Sensors

(1) Teaching purpose and requirements: understand the sensing mechanism and classification of robots; Understand the characteristics and application scope of robot sensing, and master the application methods of robot sensing.

(2) Teaching focus: understand the various effects and mechanisms of robot sensing; Clarify the characteristics and application scope of robot sensing.

(3) Teaching difficulties: the characteristics and application methods of robot sensing

(4) Teaching content: 1) robot sensing mechanism; 2) Robot sensing characteristics; 3) Robot sensing classification; 4) Robot sensing applications; 5) The development direction of robot sensing.

第七章 医用传感

(1) **教学目的与要求:** 了解医用传感的原理、分类与结构特点; 掌握医用传感的应用方法和范围。

(2) **教学重点:** 医用传感的原理及应用。

(3) **教学难点:** 医用传感特点与选用标准。

(4) **教学内容:** 1) 医用传感概述; 2) 医用传感原理; 3) 医用传感分类方法与标准; 4) : 医用传感的应用方法。

Chapter VII: Medical Sensing

(1) Teaching purpose and requirements: understand the principle, classification and structural characteristics of medical sensing; Master the application methods and scope of medical sensing.

(2) Teaching focus: the principle and application of medical sensing.

(3) Teaching difficulties: medical sensing characteristics and selection standards.

(4) Teaching content: 1) Overview of medical sensing; 2) Medical sensing principle; 3) Medical sensor classification methods and standards; 4): Application method of medical sensing.

第八章 脑机接口

(1) **教学目的与要求:** 了解脑机接口的发展历程, 理解脑机接口的构成和基本原理, 掌握脑机接口的应用方法。

(2) **教学重点:** 脑机接口的基本原理和应用方法

(3) **教学难点:** 脑机接口基本的实现步骤

(4) **教学内容:** 1) 脑机接口的发展历程、现状; 2) 脑机接口的构成和基本原理; 3) 脑机接口基本的实现步骤; 4) 脑机接口的应用方法, 包括稳态视觉诱发电位和运动想象的脑控机械臂等等应用。

Chapter VIII: Brain-Computer Interfaces

(1) Teaching purpose and requirements: understand the development process of brain-computer interface, understand the composition and basic principles of brain-computer interface, and master the application method of brain-computer interface.

(2) Teaching focus: the basic principles and application methods of brain-computer interface

(3) Teaching difficulties: basic implementation steps of brain-computer interface

(4) Teaching content: 1) The development process and status of brain-computer interface; 2) the composition and basic principles of brain-computer interfaces; 3) Basic implementation steps of brain-computer interface; 4) Application methods of brain-computer interface, including homeostatic visual evoked potentials and brain-controlled robotic arms for motor imaging.

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

SUSTech

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 | | 10 | | |
| 课堂表现 Class Performance | | 10 | | |
| 小测验 | | | | |

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|---|----|--|--|--|
| Quiz | | | | |
| 课程项目 Projects | 40 | | | |
| 平时作业 Assignments | | | | |
| 期中考试 Mid-Term Test | | | | |
| 期末考试 Final Exam | | | | |
| 期末报告 Final Presentation | 40 | | | |
| 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

