南方科技大学 SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

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**	微纳传感器设计 Design of Micro and Nano Sensors
2.	**授课院系 Originating Department**	深港微电子学院 School of Microelectronics
3.	**课程编号 Course Code**	SME315
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业选修课 Major Elective Course
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）**	王敏 助理教授 wangm@sustech.edu.cn Min Wang Assistant Professor wangm@sustech.edu.cn
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	无 NA
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				48

12.	**先修课程、其它学习要求** **Pre-requisites or Other Academic Requirements**	PHY105B 大学物理 B（下） General Physics B (II)
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**

随着物联网和移动互联网技术的快速发展，微电子传感器和执行器在汽车、消费电子、航空工业、生物医学领域有着大量应用，一些新型微传感器也得到快速发展。而随着低功耗微电子器件的开发和应用，自供能微系统概念最近也被提出。因此微型能量采集技术是微传感器新的发展。《微纳传感器设计》作为电子类专业的一门专业和前沿的课程，目的和任务是使本专业学生了解已有微传感器和微执行器的工作原理、结构设计、半导体工艺的加工。阐述相关的国内外行业在该类传感器的发展状况和研发趋势。重点介绍微器件的关键技术和设计原理，为学生未来在科研和工作中掌握基本技能，拓宽相应的思路。

With the quick development of internet of things and mobile internet technologies, micro sensors and actuators have some important applications in the fields of automobile, consumer electronics, aerospace and biomedical science. Some novel micro sensors have been proposed and developed. Moreover, self-powered concept has been proposed due to the development of low power micro devices. Therefore, micro energy harvester technologies will be the new trend for integration of micro sensors. This course will let students master the working principle, structural design and micro fabrication processes of micro sensor and actuators. We will present the development and research trend of these sensors.

16. **预达学习成果 Learning Outcomes**

1．掌握微纳传感器的发展历史和内涵；

2．了解力学传感器和执行器的重要理论知识；

3．通过一系列 MEMS 器件中创新设计的学习，激发学生创新意识，培养创新潜能。

1. To know the development history and connotation of micro and nano sensors,

2. To understand important theoretical knowledge of mechanical sensors and actuators,

3. To inspire the students with the innovative designs of MEMS devices.

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.)

Lecture 1：MEMS 技术的发展历史和现状分析（2 学时）

The development history and current situation of MEMS technology

Lecture 2：力学传感器-微加速度计设计 （6 学时）

Mechanical sensor-accelerometer, its working principle, design points and fabrication process.

Focus on micro/nano mechanics.

Lecture 3：力学传感器-压力传感器设计（4 学时）

Mechanical sensor-pressure sensor, its working principles, design points and successful examples.

Focus on thin film deformation and its sensing.

Lecture 4：力学传感器-mems 麦克风设计（4 学时）

Mechanical sensor- mems microphone, its design principle, theoretically model and fabrications.

Focus on thin film deformation and its sensing.

Lecture 5： RF MEMS-谐振器与继电器设计（6 学时）

RF MEMS-resonators and relays.

Lecture 6： 热传感器设计（6 学时）

Thermal sensor design. Thermal fluids. Thermal isolation structure design.

Lecture 7: 微纳能量采集器设计-机械能转换（6 学时）

Micro/nano energy harvester- Mechanical energy conversion

Vibration control, linear and/or nonlinear case.

Lecture 8：微纳能量采集器设计-声能（6 学时）

Micro/nano energy harvester- sound energy conversion

Energy-conserving transducers design.

Lecture 9：光学 MEMS 设计-数字微镜和 THz 微器件（6 学时）

Optical MEMS- Digital micromirrors and THz microdevices

Lecture 10：期末 pre（对某一个具体 mems 器件进行资料查询，收集，设计并形成大作业）（2 学时）

Final exam (Focus on a specific mems device or product, finish the data query and collection, try to propose a design and complete a report.)

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

教材：

The MEMS handbook, Mohamed Gad-el-Hak, CRC Press,2001

其它参考书目：

微传感器与微执行器全书,[美]格雷戈里 T. A. 科瓦奇 著 张文栋等译 科学出版社 2003 年

Microsystem Design, Stephen D. Senturia, Springer, 2005

Energy Harvesting Technologies, Shashank Priya, Daniel J. Inman,Springer, 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		10		
课堂表现 Class Performance		10		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		20		
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		60	含小论文成绩	
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