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**	纳米电子学 Introduction to Nanoelectronics
2.	**授课院系 Originating Department**	School of Microelectronics
3.	**课程编号 Course Code**	SMES204
4.	**课程学分 Credit Value**	2
5.	**课程类别 Course Type**	专业选修课 Major Elective Courses
6.	**授课学期 Semester**	夏季 Summer
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）**	Jeongwon Park, PhD. SMIEEE Associate Professor, School of Electrical Engineering and Computer Science, University of Ottawa, 25 Templeton St. Ottawa, Ontario, K1N 6N5, Canada Office: ARC 541 Research group: www.jpuottawa.ca Phone: 1-613-562-5800 ext 6679 E-mail:jpark2@uottawa.ca
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）**	

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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

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	Semiconductor Physics （EE204）
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**

The course is to introduce students to the area of Nanoelectronics, concentrating on its nanofabrication techniques and characterization of nanostructures.

16. 预达学习成果 **Learning Outcomes**

Students will be able to a) design and analyze basic nanoelectronics devices such as single electron transistors and b) understand the nanofabrication techniques associated with the nanoelectronics devices such as single electron devices, carbon nanotube electronics, next generation memory and storage devices and sensor arrays.

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.)

This course will address the basic concepts of nanoelectronics, including fundamental principles, novel electronic materials, novel fabrication techniques and devices. In particular, it will focus on novel nanofabrication techniques including nanolithography, growth and assembly processes, and characterization techniques to validate its fabrication process related to the area of Nanoelectronics. It will also address the technical issues to develop nano-scale elements/devices including single electron devices, carbon nanotubes as interconnects or transistors, nanowires, graphene materials and devices, spintronic applications and eventually complex organic molecules as memory and logic units.

1. Nanoelectronics and solid-state physics(4 hours):
    a. Metals and semiconductors, size quantization, tight-binding, interference.
2. Nano-manufacturing and process of nanoscale building blocks (4hours)
3. Nano-scaled CMOS and FinFET devices: Physics and technology(3 hours)
    a. Mobility enhancement through bandstructure engineering by stress, High-k metal gate
4. Nanotube/nanowire devices(3 hours):
    a. Nanotube energy bands, nanotube/nanowire FET, gated all around FET.
    b. Nanotube Esaki diode, thermoelectric power nanowire device.
5. 2D materials: Graphene and Dichalcogenides materials: Physics and technology(3 hours)
6. Emerging electronics: High mobility III-V compounds and GaN(3 hours)
7. Mid-term
8. Molecular electronic devices, nanoglasses, spintronics: Physics and applications(3 hours)
9. Nano-Energy devices: Solar, Battery and LED(3 hours)
10. Display technology and trends (3 hours)
11. Nanoelectronics specific topics(3 hours)

Final: Research project video upload on a server

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

Textbook is not required. The class slides and notes, will be supplemented by white papers, articles and web links.
References :
Nanoelectronics and Information Technology (ISBN-13: 978-3-527-40542-8, ISBN-10: 3-527-40542-9), WILEY-VCH, 2005
In addition, we will use a combination of selections from references books, journal publications and on-line information.
[1] C. W. J. Beenakker and H. van Houten, Solid State Physics, vol. 44, ed. by H. Ehrenreich and D. Turnbull, Academic, 1
[2] T. Yamada, "Nanoelectronics Applications," Chapter 7 of Carbon Nanotubes: Science and Applications, ed. by M. Mey CRC, 2004, pp.163-193.
[3] W. A. Harrison, Electronic Structure and the Properties of Solids, Dover, 1989.
[4] P. Y. Yu and M. Cardona, Fundamentals of Semiconductors: Physics, and Materials Properties, 3rd ed., Springer, 2005
[5] T. H. Lee, Planar Microwave Engineering – A Practical Guide to Theory, Measurements and Circuits, Cambridge, 2004
[6] A. H. Castro Neto, et al., "The electronic properties of graphene," Reviews of Modern Physics, vol. 81, Jan.-March 2 109-162.

Supplementary Reading: links to relevant technical papers or PDFs will be available in the weekly class folders on the website

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		10		
小测验 Quiz				
课程项目 Projects		10		
平时作业 Assignments		10		
期中考试 Mid-Term Test		35		
期末考试 Final Exam				
期末报告 Final Presentation		35		
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)				

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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