

## 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 <b>Course Title</b>	功率电子基础 Introduction to Power Electronics				
2.	授课院系 <b>Originating Department</b>	中英 Chinese & English				
3.	课程编号 <b>Course Code</b>	SME325				
4.	课程学分 <b>Credit Value</b>	3				
5.	课程类别 <b>Course Type</b>	专业选修课 Major Elective Courses				
6.	授课学期 <b>Semester</b>	秋季 Fall				
7.	授课语言 <b>Teaching Language</b>	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) <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	高源 Yuan GAO 助理教授 Assistant Professor 深港微电子学院 School of Microelectronics				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	无 NA				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>					
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>	总学时 <b>Total</b>
	学时数	48				48

Credit Hours

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12. 先修课程、其它学习要求  
**Pre-requisites or Other Academic Requirements**

EE202 模拟电路 Analog Circuits

13. 后续课程、其它学习规划  
**Courses for which this course is a pre-requisite**

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14. 其它要求修读本课程的学系  
**Cross-listing Dept.**

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**教学大纲及教学日历 SYLLABUS**

15. 教学目标 **Course Objectives**

本课程帮助学生熟悉和掌握各种基本的功率电子电路的结构、工作原理、波形分析和控制方法；掌握功率元器件基本特性以及 PWM 技术的工作原理；了解功率电路控制 IC 的基本技术指标和设计流程；介绍包括快速充电、无线充电和电池控制系统功率电子电路领域的一些新的应用和发展动向。

This course introduces 1) principles, analysis and control techniques of power electronics circuits; 2) characteristics of power semiconductor devices and the PWM control method; 3) fundamental of Power IC specification and design flow; 4) novel applications of power electronics, such as fast charger systems, wireless charger systems and battery management systems.

16. 预达学习成果 **Learning Outcomes**

熟悉和掌握基本功率电子电路结构、原理、特性和使用方法。通过该课程培养学生对功率电子电路系统基本分析和设计能力，通过实验课程锻炼学生动手能力，为微电子专业学生将来从事功率芯片设计和功率器件设计科研和工作打好基础。同时，课程通过介绍包括快速充电、无线充电和电池控制系统等功率电子电路新领域的进展，启发学生探索相关项目。

After this course, students are capable of understanding the architectures, working principles, characteristics and control techniques of fundamental power electronics circuits. The students will acquire the ability to analyze and design the power circuits from the lecture, and the skills and experience to design and debug practical circuits from the laboratory and project. Also, the knowledge and practical skills provided by this course benefits the students for their future research or work in the fields of power circuit design and power device design. In addition, the introduction of fast charger systems, wireless charger systems and battery management systems helps the students to know the recent progress of novel applications in this area, which is a good start for exploring these topics.

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.)**

第 1 周：课程介绍，功率电路基本计算

WEEK1: Course introduction and power computation

第 2 周：功率因数、谐波和波峰系数分析；整流电路。

WEEK2: Analysis of Power Factor, harmonics and Crest Factor; Rectifier circuits.

第 3-4 周：非隔离式直流-直流功率转换：拓扑结构和稳态分析。

WEEK3-4: Non-isolated DC-DC conversion: topology and steady state operation

第 5-6 周：隔离式直流-直流、交流-直流功率转换：拓扑结构和稳态分析。

WEEK5-6: Isolated DC-DC/AC-DC conversion: topology and steady state operation

第 7 周：控制方法：PWM 和 PFM 控制。

WEEK7: Control Methodology: PWM and PFM Control

第 8 周：逆变器简介和控制。

WEEK8: Introduction and control of power inverters

第 9 周：MOSFET 动态开关特性。

WEEK9: MOSFET switching dynamics

第 10 周：器件的驱动与保护；动态损耗分析。

WEEK10: device protection, snubbers, switching loss analysis

第 11 周：磁性元器件：变压器和电感的分析与设计。

WEEK11: Magnetics – analysis and design of transformers, inductors

第 12 周：稳定性和补偿技术。

WEEK12: Stability and compensation technique

第 13 周：快速充电系统介绍。

WEEK13: Introduction to Quick Charger System

第 14 周：无线功率系统介绍。

WEEK14: Introduction to Wireless Power System

第 15-16 周：电池管理系统介绍。

WEEK15-16: Introduction to Battery-Management-System

Daniel W. Hart, Power Electronics, McGraw-Hill, 2009.

R.W. Erickson and D. Maksimovic, Fundamentals of Power Electronics (2nd ed.) , Kluwer 2001.

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		40%		
平时作业 Assignments		15%		
期中考试 Mid-Term Test				
期末考试 Final Exam		25%		
期末报告 Final Presentation				
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