

课程大纲

COURSE SYLLABUS

1.	课程名称(中英文) Course Title(Chinese and English)	电源管理集成电路设计 Power Management Integrated Circuits Design
2.	课程类别 Course Type	必修
3.	授课院系 Originating Department	电子与电气工程 Electrical and Electronic Engineering
4.	课程学时 Credit Hours	64
5.	课程学分 Credit Value	3
6.	授课语言 Teaching Language	英语 English
7.	授课教师 Instructor(s)	詹陈长助理教授 Prof. Chenchang Zhan
8.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	电路基础、模拟电子技术、半导体器件物理、信号与系统
9.	教学目标 Course Objectives	
	<p>本课程专注传授电源管理集成电路设计的相关原理和技巧。在复习基本的模拟电路设计知识以及半导体器件原理的基础上，重点讲授带隙基准源、低压差线性稳压器、直流-直流开关电源转换器、开关电容电源转换器，以及整流器。将兼顾电源管理集成电路设计的基础知识、原理以及最新进展，并结合主流 EDA 工具传授设计技术。</p> <p>This course is to introduce the principles and design techniques of power management integrated circuits. A review on the basics of analog IC design and semiconductor devices will be carried out first. Then the focus will be on the topics of bandgap references, low-dropout linear regulators, DC-DC switching converters, switched capacitor power converters, and rectifiers. The aspects of fundamentals, principles, and state-of-the-art development of power management IC will all be comprehensively emphasized. The course will employ the industry-standard EDA tool to deliver the design techniques.</p>	
10.	教学方法及授课创新点 Teaching Methods and Innovations	
	<p>(1) The lectures will be intuition-rich and yet rigorous in delivering the fundamentals of power management integrated circuits.</p> <p>(2) In-class discussions and student involvements will be highly encouraged and carried out.</p> <p>(3) In-class quiz will be designed to help students grasp the knowledge in a short time.</p> <p>(4) Application oriented projects will be designed for students to apply the course contents.</p>	

	(5) Industry-standard EDA tools will be employed throughout the course delivery as well as during the course projects.
11.	教学内容及学时分配 Course Contents and Course Schedule
	<p>Part 1. Introduction to Power Management IC Design: background on power electronics, introduction to power management applications and trends, review on integrated circuits technology, review on analog IC, review on fundamental semiconductor devices and their modelling.</p> <p>Part 2. Voltage and Current References: principles of generating voltage and current references, CTAT and PTAT components, Bandgap voltage references, CMOS references.</p> <p>Part 3. Linear and Low-Dropout Regulators: review on feedback and stability, principle of linear voltage regulator, LDO with external capacitors, LDO with fully on-chip implementations, digital LDO.</p> <p>Part 4: Switched Mode Power Converters: introduction to switching converters, buck converter, boost converter, buck-boost converter, power stage, control strategy, steady-state and efficiency analysis, state-space averaging, compensation and stability.</p> <p>Part 5: Switched Capacitor Power Converters: introduction to SCPC's / charge pumps, step-up and step-down charge pumps, reverse conduction loss, efficiency, control of charge pumps, regulated charge pumps.</p> <p>Part 6: AC-DC Converters: introduction to AC-DC converters / rectifiers, single-stage rectifiers, multi-stage rectifiers, diodes and active diodes, efficiency of rectifiers, introduction to wireless power transfer.</p>
12.	课程考核 Course Assessment
	<p>Homework: 20%;</p> <p>Quiz: 30%;</p> <p>Projects: 50%</p>
13.	教材及其它参考资料 Textbook and Supplementary Readings
	<p>P. R. Gray, P. J. Hurst, S. H. Lewis, and R. G. Meyer, "Analysis and design of analog integrated circuits," 4th edition, John Wiley & Sons, Inc., 2001, 高等教育出版社, 英文影印本, 2003.</p> <p>参考书:</p> <p>B. Razavi, "Design of analog CMOS integrated circuits," 2nd edition, 英文影印本, 清华大学出版社, 2005.</p> <p>T. C. Carusone, D. A. Johns, and K. W. Martin, "Analog integrated circuit design," 2nd edition, John Wiley & Sons, Inc., 2011.</p> <p>S. M. Sze and K. K. Ng, "Physics of semiconductor devices," 3rd edition, John Wiley & Sons, Inc., 2007.</p> <p>R. W. Erickson and D. Maksimovic, "Fundamentals of power electronics," 2nd edition, Springer, 2001.</p>