

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	高阶 CMOS 超大规模集成电路设计 Advanced CMOS VLSI Design												
2.	课程性质 Compulsory/Elective	专业核心课 Major Core Courses												
3.	课程学分/学时 Course Credit/Hours	3/64												
4.	授课语言 Teaching Language	中英 Chinese&English												
5.	授课教师 Instructor(s)	安丰伟 An Fengwei												
6.	先修要求 Pre-requisites	EE202 数字电路, EE204 半导体器件导论 EE202 Digital circuit; Introduction of semiconductor devices												
7.	教学目标 Course Objectives	<p>本课程介绍高阶 CMOS 超大规模集成电路设计的概念和设计方法，包括程序计数器、指令译码器、指令执行模块、有限状态机、随机存储存取器（SRAM）等，也涉及到复杂组合逻辑电路和时序电路等的原理与电路图以及基于标准SRAM设计一个RISC CPU。本课程可以培养学生在以下方面的能力：SRAM相关的理解、大规模集成电路设计和仿真、版图设计等。</p> <p>This course introduces the concepts and design methods for advanced CMOS VLSI design, including a program counter, an instruction decoder, an instruction execution module, a finite state machine, and a static random access memory (SRAM). It also includes the principle and circuit diagram of complicated combinational logic circuits and sequential circuits, and also the design of RISC CPU based on the standard SRAM. This course develops students' skills in the understanding about SRAM, VLSI design and simulation, and layout design.</p>												
8.	教学方法 Teaching Methods	讲授 Lectures, 习题/辅导/讨论 Tutorials, 实验/实习 Lab/Practical												
9.	教学内容 Course Contents	<table border="1"> <tr> <td style="text-align: center;">Section 1</td> <td>Introduction to Advanced CMOS Logic Circuit Design: CMOS Technology, Layout and Packaging. (第 1 课: 高阶 CMOS 超大规模集成电路设计介绍; 2 学时)</td> </tr> <tr> <td style="text-align: center;">Section 2</td> <td>Fundamentals of CMOS image sensors (第 2 课: CMOS 图像传感器的基本知识; 2 学时)</td> </tr> <tr> <td style="text-align: center;">Section 3</td> <td>Smart structures, materials and smart imaging (第 3 课: 智能结构, 材料和智能图像传感; 2 学时)</td> </tr> <tr> <td style="text-align: center;">Section 4</td> <td>Fundamentals of SRAM Memory Cell (第 4 课: SRAM 存储单元的基础知识; 2 学时)</td> </tr> <tr> <td style="text-align: center;">Section 5</td> <td>Low-power Memory Cell Design Technique (第 5 课: 低功耗存储单元设计技术; 2 学时)</td> </tr> <tr> <td style="text-align: center;">Section 6</td> <td>Low-power Array Design Technique</td> </tr> </table>	Section 1	Introduction to Advanced CMOS Logic Circuit Design: CMOS Technology, Layout and Packaging. (第 1 课: 高阶 CMOS 超大规模集成电路设计介绍; 2 学时)	Section 2	Fundamentals of CMOS image sensors (第 2 课: CMOS 图像传感器的基本知识; 2 学时)	Section 3	Smart structures, materials and smart imaging (第 3 课: 智能结构, 材料和智能图像传感; 2 学时)	Section 4	Fundamentals of SRAM Memory Cell (第 4 课: SRAM 存储单元的基础知识; 2 学时)	Section 5	Low-power Memory Cell Design Technique (第 5 课: 低功耗存储单元设计技术; 2 学时)	Section 6	Low-power Array Design Technique
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Section 7	Voltage Sense Amplifiers (第 7 课: 电压感应放大器; 2 学时)
Section 8	Circuit Principles for Current Sensing (第 8 课: 电流感应的电路原理; 2 学时)
Labs	<p>Lab 1. Linux basic and verilog basic. (实验 1: Linux系统基础知识、verilog基础知识; 2 学时)</p> <p>Lab 2. Verilog practice for design and simulation: the practice of blocking and non-blocking statements, sensitive list, and generate-for statements (实验 2: verilog设计和仿真的练习; 2 学时)</p> <p>Lab 3. RISC-V processor introduction. (实验 3: RISC-V处理器的介绍; 2 学时)</p> <p>Lab 4. The replacement of memory in verilog. (实验 4: 在verilog中替换存储器; 2 学时)</p> <p>Lab 5. Synthesis tool Design Compiler introduction. (实验 5: 综合工具DC的介绍; 2 学时)</p> <p>Lab 6. Digital back-end tool IC Compiler introduction. (实验 6: 数字后端工具ICC的介绍; 2 学时)</p>

10. 课程考核

Course Assessment

请再此注明: ①考查/考试; ②分数构成。

考试 Examination

出勤	10%
课堂报告 Presentation	30%
期末项目 Final Project	30%
期末考试 Final Examination	30%

11. 教材及其它参考资料

Textbook and Supplementary Readings

指定教材:

Jun Ohta, Smart CMOS Image Sensors and Applications, 2nd Edition, CRC Press, 2020.

Koichiro Ishibashi and Kenichi Osada, Low Power and Reliable SRAM Memory Cell and Array Design, 1st Edition, Springer Berlin, Heidelberg, 2011.

Bernhard Wicht, Current Sense Amplifiers for Embedded SRAM in High-Performance System-on-a-Chip Designs, Springer Berlin, Heidelberg, 2003.