目录

0010522 复变函数与数学物理方程

课程编码：0010522

课程名称：复变函数与数学物理方程

英文名称：Complex Functions and Mathematical Methods for Physics

课程类型：公共基础必修课

学分： 2.5 **总学时：** 45

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：高等数学（工）、大学物理Ⅰ、线性代数（工）

考核形式： 平时成绩+小考+考试

撰写人： 王鹏

课程简介：

《复变函数与数学物理方程》是电子科学与技术、微电子科学与工程专业的一门重要的公共基础必修课，是连接数学、自然科学和工程技术的桥梁。在培养计划中，本课程衔接《高等数学》、《线性代数》、《大学物理》等前期基础课程和电路分析、固体物理、电磁场理论、半导体物理等进阶课程。通过本课程，目的是使学生掌握复变函数、数学物理方程基本理论；熟悉常见复变函数、数理方程、积分变换的原理和典型应用场景；培养学生建立模型的基本能力，学习在不同条件下求解数理方程的技巧；了解数理方法在电路分析、固体物理、电磁场、半导体物理等学科中的应用；培养学生用数学方法和物理规律解决各类物理、工程技术实际问题的能力。

推荐教材或主要参考书：

[1] 陆庆乐、王绵森. 《工程数学-复变函数（第四版）》. 高等教育出版社，2011 年 3 月

[2] 张元林. 《工程数学-积分变换（第六版）》. 高等教育出版社，2019 年 4 月

0010522 Complex Functions and Mathematical Methods for Physics

Course Number: 0010522

Course Title: Complex Functions and Mathematical Methods for Physics

Course Type: Compulsory Common Basic Course

Credit: 2.5 **Total Credit Hours:** 45

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Advanced Mathematics, University Physics, Linear Algebra

Evaluation Method: Course participation + quiz + written exams

Writer: Wang Peng

Course Description:

Complex Functions and Mathematical Methods for Physics of the Faculty of Information Technology is a compulsory common basic course for undergraduate students majoring in Electronics Science and Technology & Microelectronics Science and Engineering. The purpose of this course is to help the students master the basic theories of complex functions and mathematical methods for physics, familiarize with the principles and applications of the complex functions, equations of mathematical physics, integral transforms, building the ability of modeling and tactics in solving equations of mathematical physics, acquainted with the application of mathematical methods for physics in subjects including circuit analysis, solid state physics, electromagnetic field, semiconductor physics, develop the ability of solving various physical or engineering problems with mathematical methods and physical laws. The keys of this course include the concepts and properties of complex functions, the residue theorem, the Fourier transform. The nodus of this course include the integration of complex functions and the residue theorem.

Recommended Textbooks/References:

1. Qingle Lu, Miansen Wang, Engineering Mathematics, the Complex Functions (4th Edition), *Higher Education Press*, 03-2011

2. Yuanlin Zhang, Engineering Mathematics, the Integral Transforms (6th Edition), *Higher Education Press*, 04-2019

0010073 电路分析基础-2

课程编码：0010073

课程名称：电路分析基础-2

英文名称：Circuit Analysis Foundation-2

课程类型：学科基础必修课

学分： 3.0 **总学时：** 48

面向对象：电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生

先修课程：电路分析基础-1，高等数学（工），大学物理Ⅰ、线性代数（工）

考核形式： 平时成绩+考试

撰写人：刘檬

课程简介：

《电路分析基础-2》是电子科学与技术专业大二学生的必修课，该课程主要系统论述正弦交流电路的计算方法，共分成 6 个部分：第一部分是正弦交流电的基本概念，引入相量数学工具，利用阻抗与导纳描述电压和电流的约束关系，求解交流电路中的有功率功率、无功功率、复功率等基本问题；第二部分是非正弦周期电路的分析方法，用傅立叶级数将激励源函数展开，取有限项，求解不同频率下的响应，然后在时域内用叠加法得到响应；第三部分是交流电路中的谐振问题，在谐振频率处，得到放大的电压或者电流，用于弱信号跟踪放大；第四部分是讲解交流电路中的互感电路，空心变压器和理想变压器的模型与应用；第五部分是讲解三相电源对称的前提下如何求解电路；第六部分是求解线性二端口电路的等效总在 Z 参数、Y 参数和 T 参数。

推荐教材或主要参考书：

[1] 邱关源，罗先觉主编，电路（第 5 版），高等教育出版社，2006

[2] 李翰逊，简明电路分析基础，高等教育出版社，2002

0010073 Circuit Analysis Foundation-2

Course Number: 0010073

Course Title: Circuit Analysis Foundation-2

Course Type: Basic compulsory course

Credit: 3.0 **Total Credit Hours:** 48

Students: Undergraduate students majoring in Electronic Science and Technology, and Microelectronics Science and Engineering

Prerequisites: Circuit Analysis Foundation-1, advanced mathematics, college physics, linear algebra

Evaluation Method: Course participation + written exams

Writer: Liu Meng

Course Description:

"Fundamentals of Circuit Analysis-2" is a compulsory course for sophomore students majoring in electronic science and technology. This course mainly systematically discusses the calculation method of sinusoidal AC circuits. It is divided into 6 parts: The first part is the basic concept of sinusoidal alternating current and introduces phasors. Mathematical tools use impedance and admittance to describe the constraint relationships of voltage and current to solve basic problems such as active power, reactive power, and complex power in AC circuits; the second part is the analysis method of non-sinusoidal periodic circuits, using Fourier series Expand the excitation source function, take finite terms, solve for the response at different frequencies, and then use the superposition method to obtain the response in the time domain; the third part is the resonance problem in the AC circuit. At the resonance frequency, the amplified voltage or current is obtained, Used for weak signal tracking and amplification; the fourth part is to explain the mutual inductance circuit in the AC circuit, the model and application of the air-core transformer and the ideal transformer; the fifth part is to explain how to solve the circuit under the premise of symmetry of the three-phase power supply; the sixth part is to solve The equivalent of the linear two-port circuit is always the Z parameter, Y parameter and T parameter.

Recommended Textbooks/References:

1.Guanyuan Qiu, Xianjue Luo, Electric Circuit (5th Edition), *Higher Education Press*, 2006

2.Hanxun Li, Concise Circuit Analysis Foundation, *Higher Education Press*, 2002

0004333 模拟电子技术

课程编码：0004333

课程名称：模拟电子技术

英文名称：Analog Electronic Technology

课程类型：学科基础必修课

学分：3.5　　**学时：**56

面向对象：电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生

先修课程：高等数学（工）、大学物理Ⅰ、电路分析基础

考核形式：平时成绩+考试

撰写人：万培元

课程简介：

《模拟电子技术》是入门性质的技术基础课。模拟电路是多种电子产品、电子设备必不可少的基本组成单元，是物理量在转换成数字信号之前所必经的关键电路，该课程为培养自动化专业人才的电路分析与设计技能奠定基础，为提高其工程应用与创新能力做铺垫。课程主要内容：常用半导体器件原理、基本放大电路、场效管及放大电路、功率放大电路、模拟集成电路基础、反馈放大电路、信号产生电路、直流稳压电源等。重点是各类放大电路的原理分析和计算，难点是负反馈放大器、集成运算放大器等。为较好的掌握本课程，应在理解各类器件的工作原理基础上，熟练掌握晶体管三种基本放大器的分析与计算，继而掌握其它的放大器或模拟电子电路。

推荐教材或主要参考书：

[1] 孙景琪，雷飞，闫慧兰. 模拟电子技术基础. 高等教育出版社，2016 年 7 月

[2] 华成英. 模拟电子技术基础（第五版）. 高等教育出版社，2015 年 7 月

[3] 桑森（Willy M.C.Sansen）著，陈莹梅译. 模拟集成电路设计精粹（电子信息前沿技术丛书）. 清华大学出版社，2020 年 12 月

[4] 康华光. 电子技术基础（模拟部分）. 高等教育出版社，2006 年

[5] Robert L. Boylestad, Louis Nashelsky. Electronic Devices and Circuit Theory(Ninth Edition). 电子工业出版社，2010 年

0004333 Analog Electronic Technology

Course Number: 0004333

Course Title: Analog Electronic Technology

Course Type: Basic compulsory course

Credit: 3.5 **Total Credit Hours:** 56

Students: Undergraduate students majoring in Automation, Robotic Engineering, Electronic Science and Technology, and Microelectronics Science and Engineering

Prerequisites: Advanced mathematics、General Physics、Circuit analysis element

Evaluation Method: Course participation + written exams

Writer: Wan Peiyuan

Course Description:

Analog electronic technology is a basic technical course for beginners. Analog circuit is an essential basic unit of a variety of electronic products and electronic equipment. It is the key circuit that physical quantities must pass before they are converted into digital signals. This course lays the foundation for cultivating circuit analysis and design skills of automation professionals, and paves the way for improving their engineering application and innovation ability. Main contents of the course: principles of common semiconductor devices, basic amplifying circuit, FET and amplifying circuit, power amplifying circuit, analog integrated circuit foundation, feedback amplifying circuit, signal generating circuit, DC regulated power supply, etc. The key point is the principle analysis and calculation of all kinds of amplifier circuits, and the difficulty is the negative feedback amplifier, integrated operational amplifier, etc. In order to master this course, we should be familiar with the analysis and calculation of three basic amplifiers of transistors on the basis of understanding the working principles of various devices, and then master other amplifiers or analog electronic circuits.

Recommended Textbooks/References:

1. Sun Jingqi，Lei fei，Yan Huilan, Analog Electronic Technolog, Higher Education Press, 7-2016

2.Hua Chengying, Analog Electronic Technolog（Fifth Edition）, Higher Education Press, 7-2015

3. Willy M.C.Sansen Written, Chen Yingmei Translated, The essence of analog integrated circuit design（Electronic information frontier technology series）, Beijing: Tsinghua University Press, 12-2020

4. Kang Huaguang, Electronic Technology（Part of Analog）, Higher Education Press, 2006

5. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory(Ninth Edition), Electronic Industry Press, 2010

0008127 数字电子技术

课程编码：0008127

课程名称：数字电子技术

英文名称：Digital Electronic Technology

课程类型：学科基础必修课

学分： 3.5 **总学时：** 56

面向对象：自动化、机器人工程、电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生

先修课程：大学物理Ⅰ、电路分析基础-1、电路分析基础-2

考核形式：平时成绩+期末考试

撰写人：袁海英

课程简介：

《数字电子技术课程》是电子、通信、计算机、自动化等专业领域的入门性质基础课程，该课程教学过程充分体现理论联系实际的综合学习能力与实践动手训练。本课程的目标是使学生能够将专业知识、基础理论和基本技能熟练应用于数字电路与系统的推演、分析和设计中，有效解决数字电路领域中的复杂工程问题。课程的主要内容包括组合逻辑电路分析与设计、时序逻辑电路分析与设计、触发器、大规模数字集成电路应用等。

推荐教材或主要参考书：

[1] 江捷，马志成. 数字电子技术基础. 北京工业大学出版社，2009 年 10 月

[2] 阎石. 数字电子技术基础（第六版）. 高等教育出版社，2016 年 4 月

[3] John F. Wakerly. 数字设计原理与实践（第三版）. 高等教育出版社，2001.

0008127 Digital Electronic Technology

Course Number: 0008127

Course Title: Digital Electronic Technology

Course Type: Basic compulsory course

Credit: 3.5 **Total Credit Hours:** 56

Students: Undergraduate students majoring in Automation, Robotic Engineering, Electronic Science and Technology, and Microelectronics Science and Engineering

Prerequisites: College physics, Circuit Analysis Foundation -1、Circuit Analysis Foundation-2

Evaluation Method: Course participation + Final exam

Writer: Yuan Haiying

Course Description:

Digital electronic technology is one of the introductory foundational courses for undergraduate students Major in electronics, communication, computer science, automation. The teaching process of this course fully reflects the comprehensive learning ability of integrating theory with practice and practical hands-on training. The main target of this course is to clarify professional knowledge, basic theories, and basic skills to the deduction, analysis, and design of digital circuits and systems. This course is focus on effectively solving complex engineering problems in the field of digital circuits and system. The teaching contents are mainly covered by the following aspects: analysis and design of combinational logic circuits, analysis and design of sequential logic circuits, triggers, large-scale digital integrated circuit applications, etc.

Recommended Textbooks/References:

1.JIANG Jie, MA Zhicheng. Digital Electronic Technique Fundamentals. *Beijing University of Technology Press*, Oct-2009.

2.YAN Shi. Digital Electronic Technique Fundamentals (the 5th edition). *Higher Education Press*, May-2016.

3. John F. Wakerly. Principles and Practice of Digital Design (3rd Edition), Higher Education Press, 2001

0008120 计算机软件基础

课程编码：0008120

课程名称：计算机软件基础

英文名称：Fundamentals of Computer Software

课程类型：学科基础必修课

学分： 2.5 **总学时：** 40

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：高级语言程序设计，高级语言程序设计课设

考核形式：平时成绩+实验+考试

撰写人： 张小玲

课程简介：

《计算机软件基础》是信息学部为电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生开设的学科基础必修课程类型。本课程的任务是讲授计算机软件领域中涉及的相关基础知识，包括计算机软件基本概念、软件工程、数据结构与算法、操作系统等内容，通过本课程学习应使学生了解和掌握计算机软件技术的基本理论和数据处理方法，为今后开发应用软件打下必要的基础。教学内容重点：线性数据结构、非线性数据结构、排序和查找、资源管理技术、软件工程技术。教学内容的难点：数据结构的存储实现，不同存储结构上的算法实现，查找和排序算法的实现及性能分析。

推荐教材或主要参考书：

教 材： 汪友生等，计算机软件基础，清华大学出版社，2016.12

参 考 书： [1]. 李淑芬，计算机软件技术基础，机械工业出版社，2009.8

[2]. 孟彩霞，计算机软件基础，西安电子科技大学出版社，2003.8

[3]. 李 金，计算机软件技术基础，机械工业出版社，2010.1

[4]. 夏清国，计算机软件技术基础，西北工业大学出版社，2010.1

[5]. 杨建军，计算机软件技术基础，机械工业出版社，2011.9

[6]. 严蔚敏，数据结构（C 语言版），清华大学出版社，2007

[7]. 牟 艳等，计算机软件技术基础，机械工业出版社，2011.12

[8]. 徐士良等，计算机软件技术基础，清华大学出版社，2010

0008120 Fundamentals of Computer Software

Course Number: 0008120

Course Title: Fundamentals of Computer Software

Course Type: Basic Compulsory Course

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: C programming, Programming practice training, etc.

Evaluation Method: Course participation +experiment+ written exams

Writer: Zhang Xiaoling

Course Description:

Fundamentals of Computer Software is one of the basic compulsory courses for undergraduate students Major in Electronic Science and technology. The main target of this course is to clarify data structure, software engineering and operating system. This course is focus on the knowledge related with software. The teaching contents are mainly covered by the following aspects: the basic concept and the algorithm of linear data structure & non-linear data structure, types and algorithms of searching and sorting, the concepts of software engineering and operating system. The difficulties of teaching contents are described as followings: data storage structures, algorithm of linear data structure & non-linear data structure, performance analysis of the algorithm.

Recommended Textbooks/References:

Textbooks: Wang You-sheng etc., fundamentals of computer software，*Tsinghua university press*，Dec-2016

References:

1.LI Shu-fen, fundamentals of computer software, *Mechanical Industry Press*, Aug-2009

2.MENG Cai-xia, fundamentals of computer software, *Xidian University Press*，Aug-2003

3.LI Jin, fundamentals of computer software, *Mechanical Industry Press*, Jan-2010

4.XIA Qin-guo, fundamentals of computer software, *Northwest University of Technology Press*, Jan-2010

5.YANG Jian-jun, fundamentals of computer software, *Mechanical Industry Press*, Sep-2011

6.YAN Wei-min, Data structure (C language version), *Tsinghua university press*，2007

7.MU Yan,， fundamentals of computer software, *Mechanical Industry Press*, Dec-2011

8.XU Shi-liang etc., fundamentals of computer software，*Tsinghua university press*，2010

0008134 微机原理与应用Ⅰ

课程编号：0008134

课程名称：微机原理与应用Ⅰ

英文名称：Computer Principles and Applications Ⅰ

课程类型：学科基础必修课

学分：3.5　**学时：**56

面向对象：电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生

先修课程：数字电子技术、模拟电子技术、高级语言程序设计

考核形式：平时成绩+实验成绩+考试

撰写人：邓军

课程简介：（200-300 字）

《微机原理与应用I》是信息学部为电子科学与技术专业本科生开设的的基础课程。本课程的任务是通过本课程的学习，使本科生掌握计算机的硬件组成、工作原理和汇编语言程序设计的相关知识。教学内容重点包括计算机系统的构成和工作原理;微处理器的指令系统、内部结构和工作原理；汇编程序设计；存储器设计；计算机接口的概念与数据交换、智能接口电路的设计与编程。教学内容的难点是指令系统与汇编，存储器组织与接口电路的设计与编程。

推荐教材或主要参考书：（含主编，教材名，出版社，出版日期）

[1]余春暄，左国玉等，80x86/Pentium 微机原理及接口技术(第 3 版)，机械工业出版社，2015 年 6 月。

[2]左国玉，余春暄，韩德强等，80x86/Pentium 微机原理及接口技术-习题解答与实验指导（第 2 版），机械工业出版社，2018 年 1 月。

[3]彭虎，周佩玲等，微机原理及接口技术(第 4 版)，电子工业出版社，2016。

0008134 Computer Principles and Applications

Course Number: 0008134

Course Title: Computer Principles and Applications

Course Type: Basic Compulsory Course

Credit: 3.5 **Total Credit Hours:** 56

Students: Undergraduate students Major in Electronic Science and Technology & Microelectronics Science and Engineering

Prerequisites: Digital Electronics, Analog Electronics, C Programming

Evaluation Method: Course participation + Experiment exams + Written exams

Writer: Deng Jun

Course Description:

Computer Principles and Applications I is one of the fundamental course for the undergraduate students Major in Electronic Science and Technology. This course is focus on the knowledge of computer hardware as well as assembler language design, computer principles by means of learning the computer internal structure and working principles. The teaching contents are mainly covered by the following aspects: the basic principles and components of computer, the structure and working principles of the microprocessor, the instruction set, the assembler language design, the memory and its interface circuit design, the concept of computer interface, data transmission, and some basic intelligent interface circuit design and software programming. The difficulties of teaching contents are described as followings: instruction system and assembly programming, memory organization and interface circuit design and programming.

Recommended Textbooks/References:

1. YU Chunxuan, ZUO Guoyu etc,80X86/Pentium Microcomputer Principle and Interface Technology (Third Edition). Machinery Industry Press, 2015.6

2. ZUO Guoyu, YU Chunxuan, Han deqiang etc,80X86/Pentium Microcomputer Principle and Interface Technology- Exercises solving and experiment guidance (Third Edition). Machinery Industry Press, 2018.1

3. Peng hu, Zhou Peiling etc, Microcomputer Principle and Interface Technology (Four Edition). Electronic Industry Press, 2016

0004925 信号与系统Ⅳ

课程编码：0004925

课程名称：信号与系统 IV

英文名称：Signals and Systems IV

课程类型：学科基础必修课

学分： 2.5 **总学时：** 40

面向对象：微电子科学与工程专业本科生

先修课程：高等数学，线性代数，复变函数与积分变换，电路分析基础

考核形式： 平时成绩+考试

撰写人：张菁

课程简介：

信号与系统是信息学部为微电子科学与工程专业本科生开设的学科基础必修课程类型。

本课程的任务主要讨论信号的分析方法以及线性时不变系统对信号的各种求解方法，通过一定的实例分析，向学生介绍一些实际工程应用中非常重要的概念、理论和方法，可以为学生学习后续课程如数字信号处理、集成电路分析等打下坚实的理论基础，有帮助于提高学生实际分析问题、解决问题的能力。教学内容的重点：基本的信号分析的基本理论和方法，线性时不变系统的各种描述方法，线性时不变系统的时域和频域分析方法以及有关系统的稳定性、频响、因果性等工程应用中的一些重要结论。教学内容的难点：线性时不变系统的频域分析方法。

推荐教材或主要参考书：

[1] 郑君里，应启珩，杨为理. 信号与系统引论. 高等教育出版社，2009 年 3 月

[2] 郑君里，应启珩，杨为理. 信号与系统（第 3 版）. 高等教育出版社，2011 年 3 月

[3] 吴大正，杨林耀，张永瑞 等. 信号与线性系统分析（第 5 版）. 高等教育出版社，2019 年 3 月

[4] 张延华，刘鹏宇. 信号与系统（第 2 版）. 机械工业出版社，2017 年 9 月

[5] 奥本海姆，刘树棠译. 信号与系统（第 2 版）. 电子工业出版社，2014 年 1 月

0004925 Signals and SystemsⅣ

Course Number: 0004925

Course Title: Signals and Systems IV

Course Type: Discipline Requirements

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students majoring in microelectronics science and engineering

Prerequisites: Calculus, Linear Algebra, Complex Variables and Integral Transforms, Circuit Analysis

Evaluation Method: Course participation + Written exams

Writer： Zhang Jing

Course Description:

Signals and systems are a basic disciplinary course for undergraduate students major in microelectronics science and engineering. The main target of this course is to clarify the signal analysis methods and various signal solving methods of time-invariant systems by analyzing some instances, to introduce students to some very important concepts in practical engineering applications, theories and methods. This course is focused on laying a solid foundation for students to learn subsequent courses such as digital signal processing and integrated circuit analysis and helping to improve students' abilities of practical analysis and solving problems. The teaching contents are mainly covered by the following aspects: basic theory and method of signal analysis, various description methods of linear time-invariant system, time-domain and frequency-domain analysis methods of linear time-invariant system, and some important conclusions in engineering application of stability, frequency response, causality and so on. The difficulties of teaching contents are described as followings: frequency-domain analysis of linear time-invariant systems.

Recommended Textbooks/References:

1. Zheng Junli, Ying Qiheng, Yang Weili, Introduction to signals and systems, *Higher Education Press*, March-2009
2. Zheng Junli, Ying Qiheng, Yang Weili, Signals and systems (3rd edition), *Higher Education Press*, March-2011
3. Wu Dazheng, Yang Linyao, Zhang Yongrui et al, Analysis of signals and linear systems (5th edition), *Higher Education Press*, March-2019
4. Zhang Yanhua, Liu Pengyu, Signals and systems (2nd edition), *China Machine Press*, September-2017
5. Oppenheim, Trans. Liu Shutang, Signals and systems (2nd edition). *Electronic Industry Press*, January-2014

1600054 电磁场与电磁波

课程编码：1600054

课程名称：电磁场与电磁波

英文名称：Electromagnetic Field and Wave

课程类型：学科基础必修课

学分： 2.0 **总学时：** 32

面向对象：微电子科学与工程（实验班）专业本科生

先修课程：高等数学（工）、大学物理Ⅰ

考核形式： 平时成绩+考试

撰写人：李冲

课程简介：

电磁场与电磁波是信息学部为微电子科学与工程（实验班）专业本科生开设的学科基础必修课。本课程的任务是阐述宏观电磁场的基本性质、基本规律和基本分析计算方法，培养学生运用场的观点对工程电磁场问题进行初步分析与计算；掌握电磁场的场量、参数、特性的基本测量方法，并为后续专业课奠定基础。教学内容重点：散度、旋度、梯度在直角坐标系中的计算，静电场、恒定磁场、直角坐标中用分离变量法解拉普拉斯方程的方法、麦克斯韦方程、波动方程、动态矢量位和标量位。

教学内容的难点：散度、旋度、梯度的定义；有关磁感应强度和电场强度的矢量积分公式；介质中静电场的基本方程、极化电荷、静电场的能量及静电力；位移电流、动态矢量位和标量位。**推荐教材或主要参考书：**

[1] 谢处方 饶克谨著,《电磁场与电磁波》， 高等教育出版社， 2006 年 1 月

[2] David K. Cheng ，何业军 桂良启译 《电磁场与电磁波》 清华大学出版社 2013 年 2 月

[3] 张洪欣 沈远茂 韩宇南 著 《电磁场与电磁波》 清华大学出版社 2013 年 1 月

1600054 Electromagnetic Field and Wave

Course Number: 1600054

Course Title: Electromagnetic Field and Wave

Course Type: Basic Compulsory Course

Credit: 2 **Total Credit Hours:** 31

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Advanced Mathematics, College physics

Evaluation Method: Course participation + written exams

Writer： Li Chong

Course Description:

Electromagnetic Field and Wave is one of the compulsory courses for undergraduate students Major in Microelectronics Science and Engineering. The main target of this course is to clarify electromagnetic model. This course is focus on electromagnetic. The teaching contents are mainly covered by the following aspects: static electric fields, static magnetic fields, time-varying fields, Maxwell's equations, Helmholtz's theorem Coulomb's law and Gauss's law, Relations in materials media, the concept of equivalent charge distributions of polarized dielectrics.. The difficulties of teaching contents are described as followings: divergence, rotation, and gradient; vector integration formulas for magnetic induction and electric field strength; basic equations of electrostatic fields in media, polarized charges, energy and electrostatic forces of electrostatic fields; displacement current, dynamic vector and scalar.

Recommended Textbooks/References:

1.Chufang Xie, Keqin Rao, Electromagnetic Field and Wave, *Higher Education Press*, Jan.-2006

2.David K. Cheng, Field and Wave Electromagnetic, *Tsinghua University Pres*s, Feb.-2013

3.Hongxin Zhang, Yuanmao Shen, Nanyu Han, Electromagnetic Field and Wave, *Tsinghua University Pres*s, Jan.-2013

0010685 微电子学物理基础

课程编码：0010685

课程名称：微电子学物理基础

英文名称：Physical foundations of microelectronics

课程类型：学科基础必修课

学分： 2 **总学时：**32

面向对象：微电子科学与工程专业本科生

先修课程：高等数学、大学物理

考核形式： 平时成绩+考试

撰写人：赵艳军

课程简介：

微电子学物理基础是电子科学与技术学院为微电子科学与工程专业本科生开设的公共基础必修课程类型。本课程的任务是培养学生掌握量子力学的基本概念和基本原理，以及量子力学基本的解题技巧。要求学生能够应用量子力学的基本原理解决一些初等的量子力学问题。教学内容重点：德布罗意假设及其实验验证，薛定谔方程，一维无限深势阱，一维线性谐振子，力学量的平均值，厄米算符本征函数的正交归一性和完全性，氢原子哈密顿算符的本征值和本征函数，非简并定态微扰理论，全同粒子体系波函数的性质。教学内容的难点：黑体辐射、氢原子光谱，波函数及其统计解释，态叠加原理，动量的平均值和算符，厄米算符本征函数的正交归一性和完全性，量子跃迁，自旋算符与自旋波函数。

推荐教材或主要参考书：

[1] 周世勋. 量子力学教程. 高等教育出版社, 2009

[2] 苏汝铿. 量子力学. 高等教育出版社，2002

[3] 曾谨言. 量子力学导论.北京大学出版社,1998

[4] 顾莱纳. 量子力学导论.北京大学出版社,2001

[5] Ramamurti Shankar.Principles of Quantum Mechanics.Plenum Press,1994

[6] P. A. M. Dirac. The Principles of Quantum Mechanics. Clarendon Press,1958

0010685 Physical foundations of microelectronics

Course Number: 0010685

Course Title: Physical foundations of microelectronics

Course Type: Discipline Requirements

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students majoring in science and engineering of microelectronics

Prerequisites: Advanced maths, College physics

Evaluation Method: Course participation + written exams

Writer: Zhao Yanjun

Course Description:

Physical foundations of microelectronics is one of the compulsory course of public foundations for undergraduate students Major in physical foundations of microelectronics. The main target of this course is to teach basic concepts and basic principles of quantum mechanics, as well as the basic problem-solving techniques of quantum mechanics. Students are required to apply the basic principles of quantum mechanics to solve some primary quantum mechanics problems. The teaching contents are mainly covered by the following aspects: de Broglie hypothesis and its experimental verification, Schrödinger equation, one-dimensional infinite depth trap, one-dimensional linear resonator, average of mechanical quantity, orthogonality and completeness of the eigen functions of the Hermitian operators, the eigen values and functions of the hydrogen atomic Hamiltonian, nondegenerate perturbative theory for stationary states, the properties of the wave functions of the identical particle system. The difficulties of teaching contents are described as followings: black-body radiation, hydrogen atomic optical spectrum, wave function and its statistical interpretation, state superposition principle, momentum average and operator, orthogonality and completeness of the eigen functions of the Hermitian operators, quantum transitions, spin operators and spin wave functions.

Recommended Textbooks/References:

6. Shi-Xun Zhou, Couse of quantum mechanics, *Higher Education Press*, 2009
7. Ru-Qiang Su, Quantum mechanics, *Higher Education Press,* 2002
8. Jin-Yan Zeng, Introduction to quantum mechanics, *Beijing University Press*, 1998
9. Lai-Na Gu, Introduction to quantum mechanics, *Beijing University Press*, 2001
10. Ramamurti Shankar, Principles of Quantum Mechanics, *Plenum Press*,1994
11. P. A. M. Dirac, The Principles of Quantum Mechanics, *Clarendon Press*,1958

0008110 半导体物理学

课程编码：0008110

课程名称：半导体物理学

英文名称：Semiconductors Physics

课程类型：学科基础必修课

学分： 3.0 **总学时：** 48

面向对象：微电子科学与工程（实验班）本科生

先修课程：大学物理Ⅰ，微电子学物理基础,

考核形式： 平时成绩+考试

撰写人：张亚民

课程简介：

半导体物理是半导体芯片制备技术中材料特性、基础核心器件元素物理机理的学科基础课程，起源于上个世纪五十年代。课程主要学习半导体晶体的主要特性，导电粒子（电子和空穴）在晶体中运动规律、特性，以及不同导电类型半导体材料形成 PN 结、MOS 结构等最基本器件单元的物理机理。本课程是学习以半导体芯片为核心的微电子技术、半导体光电子技术和集成电路的重要学科基础课程之一。尽管各种新型功能器件不断涌现，但其中最为基本、核心元素的物理机理一直支持着新型器件物理。本课程对后续的器件物理、集成电路技术、功率器件、射频器件等课程和技术领域构成重要的理论支持

推荐教材或主要参考书：

1. 刘恩科、朱秉升、罗晋生,《半导体物理学》，电子工业出版社，2017 年第 7 版。

2. 顾祖毅、田立林、富力文,《半导体物理学》，电子工业出版社，1995 年第一版。

3. [美]施敏、伍国珏著，耿莉、张瑞智译,《半导体器件物理》，西安交通大学出版社，2008 年。

4.美 Donald A.Neamen 著，赵毅强等译,《半导体物理与器件》，电子工业出版社，2013 年

0008110 Semiconductors Theory

Course Number： 0008110

Course Title: Semiconductors Physics

Course Type: Basic Compulsory Course

Credit: 3.0 **Total Credit Hours:** 48

Students: Undergraduate students majoring in microelectronics science and engineering

Prerequisites: College physics, Fundamentals of microelectron physics

Evaluation Method: Course participation + written exams

Writer： Zhang Yamin

Course Description:

The Semiconductor Physics is one of the basic compulsory courses for undergraduate students Major in electronic science and technology. The main target of this course is to clarify the basic concepts, analytical methods and theory of semiconductor materials and devices. The teaching contents are mainly covered by the following aspects: the characteristics of semiconductor crystal, the motion characteristics of carrier (electron and hole), and the physics mechanism of basic devices such as PN junction, MOS structure and MS contact. Although various new functional devices are constantly emerging, the most basic and core physics mechanism included in the course still support the new devices. This course provides important theoretical support for subsequent courses, such as device physics, integrated circuit technology, power devices, and RF devices.

Recommended Textbooks/References:

1. Liu Enke, Zhu Bingsheng, Luo Jinsheng, Semiconductor Physics, Electronic Industry Press, 7th edition, 2017.

2. Gu Zuyi, Tian Lilin, Fu Liwen, Semiconductor Physics, Electronic Industry Press, 1st edition, 1995.

3. S. M. SZE, KWOK K. NG, Physics of Semiconductor Devices, Geng Li, Zhang Ruizhi, trans., Xi'an: Xi'an JiaoTong University Press, 2008.

4. Donald A.Neamen, Semiconductor Physics and devices, Zhao Yiqiang et al., trans., Electronic Industry Press, 2013.

0010681 微电子器件

课程编码：0010681

课程名称：微电子器件

英文名称：Microelectronic Devices

课程类型：学科基础必修课

学分： 2.5 **总学时：** 40

面向对象：微电子科学与工程（实验班）专业本科生

先修课程：半导体物理学

考核形式：平时成绩+考试

撰写人：吴郁

课程简介：

微电子器件是信息学部为微电子科学与工程（实验班）专业本科生开设的学科基础必修课。本课程的任务是结合集成电路中的应用，详细讲述若干典型微电子器件的基础知识，使学生建立起清晰紧凑的与半导体器件物理机制和工作原理相关的知识框架，认识和把握理论知识与生产实践之间的结合点，为未来从事的电路、系统级 IC 设计或器件级研发工作奠定坚实的知识和技术基础。教学内容重点：主要典型器件（二极管、MOSFET 和 BJT）的基本结构、内在机理和外端特性，以及它们之间的关联；尺寸不断缩小的 MOS 技术新进展介绍（应变硅、金属栅、hi-k 和 low-k 介质、超薄体区 SOI-MOS、多栅/围栅 MOS 如 FinFET、器件三维集成等）。教学内容的难点：对器件物理本质理解，新技术带来的新知识的拓展及其与原有知识的融会贯通。

推荐教材或主要参考书：

[1]Chenming Calvin Hu (胡正明), *Modern Semiconductor Devices for Integrated Circuits*, Pearson Higher Education, 2010. 影印版:《集成电路中的现代半导体器件（英文版）》，科学出版社，2012. 中译本：王燕等译,《现代集成电路半导体器件》，电子工业出版社 2012.

[2]Jesús A. del Alamo, *Integrated Microelectronic Devices: Physics and Modeling*, Pearson Education, Inc., 2018. 影印版:《集成微电子器件（英文版）》，电子工业出版社，2019.

[3]陈星弼等编著,《微电子器件（第 4 版）》，电子工业出版社，2018.

[4] B. G. Streetman, S. K. Banerjee, *Solid State Electronic Devices (7th Ed.)*, Pearson Education, 2015. 中译本：杨建红等译,《固态电子器件（第七版）》，电子工业出版社，2018.

0010681 Microelectronic Devices

Course Number: 0010681

Course Title: Microelectronic Devices

Course Type: Basic Compulsory Course

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students majoring in Microelectronic Science and Engineering

Prerequisites: Semiconductor Physics

Evaluation Method: Course participation + written exams

Writer： Wu Yu

Course Description:

Microelectronic Devices is one of the discipline requirement courses for undergraduate students Major in Microelectronic Science and Engineering. The main target of this course is to introduce the basic knowledge of several typical microelectronic devices in detail, so that students can establish a clear and compact knowledge framework related to the physical mechanism and operating principle of semiconductor devices, understand and grasp the combination point between theoretical knowledge and engineering practice, and lay a solid knowledge and technical foundation for future circuit, system level IC design or device level R&D work. This course is focus on basic structure, internal mechanism and external characteristics of main typical devices (diodes, MOSFETs and BJTs), and the relationship between them; introduction of new development of MOS technology with scaling sizes (strained silicon, metal gate, hi-k and low-k media, ultra-thin SOI-MOS, multi gate/enclosed gate MOS such as FinFET, and 3D device integration, etc.). The difficulty of teaching contents is described as followings: understanding the essence of device physics, the expansion of new knowledge brought by new technology and the integration with the original knowledge.

Recommended Textbooks/References:

1.Chenming Calvin Hu, Modern Semiconductor Devices for Integrated Circuits, *Pearson Higher Education*, 2010.

2.Jesús A. del Alamo, Integrated Microelectronic Devices: Physics and Modeling, *Pearson Education, Inc.*, 2018.

3.CHEN Xingbi, et al, Microelectronic Device, 4th edition， in Chinese, *Publishing House of Electronics Industry*, 2018.

4.B. G. Streetman, S. K. Banerjee, Solid State Electronic Devices (7th Ed.), Pearson Education, 2015.

0010110 集成电路制造技术

课程编码：0010110

课程名称：集成电路制造技术

英文名称：Integrated Circuit Manufacturing Technology

课程性质：学科基础必修课

学分：2.0　　**总学时：**32

面向对象：微电子科学与工程专业类本科生

先修课程：新生研讨课，半导体物理学，固体物理学

考核形式：平时成绩+考试

撰写人：申栗繁

课程简介：

半导体制造工艺是半导体行业人员，包括从事半导体器件设计、集成电路设计和半导体器件与集成电路制造等，必需掌握的相关知识。本课程讲授集成电路制造的基本工艺原理，芯片制作的各种常用方法、设备及检测手段和现代半导体制作中的典型工艺流程。要求学生理解表征薄膜生长速率的 GROVE 模型，费克扩散方程等基本工艺原理，掌握半导体工艺虚拟仿真技术和数据分析方法，掌握半导体制作工艺中不同材料的生长方法和技术，包括半导体材料生长技术（衬底制备、外延生长）、介质薄膜和金属薄膜制备技术，掌握半导体制作工艺中材料处理、检测和技术（掺杂、光刻、刻蚀、金属化和 IC 互联技术），掌握双极晶体管、MOS 晶体管、CMOS 反相器和大规模集成电路的制备流程。

推荐教材或主要参考书：

1. 王蔚，田丽，任明远，集成电路制造技术—原理与工艺（第二版），电子工业出版社，2016 年 4 月

2.关旭东，硅集成电路工艺基础（第二版），北京大学出版社，2014 年 5 月

3. Peter Van Zant 著，韩郑生译，芯片制造—半导体工艺制程实用教程 (第六版)，电子工业出版社，2015 年 1 月

4. 张亚非，段力，集成电路制造技术，上海交通大学出版社，2018 年 10 月

5. Stephen A. Campbell 著，曾莹、严利人等译，微电子制造科学原理与工程技术（第二版），北京：电子工业出版社，2005 年 8 月

6. James D. Plummer，硅超大规模集成电路工艺技术：理论、实践和模型 (英文版)，电子工业出版社，2006 年 9 月

0010110 Integrated Circuit Manufacturing Technology

Course Number: 0010110

Course Title: Integrated Circuit Manufacturing Technology

Course Type: Discipline Requirements

Credit: 2.0 **Total Credit Hours:** 32

Students： Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Freshman Seminar, Semiconductor Physics, Solid-State Physics

Evaluation Method: Course participation + written exams

Writer： Shen Lifan

Course Description:

Semiconductor manufacturing technology is the key knowledge for semiconductor industry practitioners, including people engaged in semiconductor device design, integrated circuit design and semiconductor device and integrated circuit manufacturing and so on. This course teaches the basic process principles of integrated circuit manufacture, the various common methods, equipment and detection methods of chips making, as well as the typical processes in modern semiconductor manufacturing. Students are required to understand the basic process principles in semiconductor process, such as the GROVE model characterizing the growth rate of the film, the Fick's diffusion equation and so on. Students are required to master the virtual simulation technology and the data analysis methods of semiconductor technology. Students are required to master the growth methods and techniques of different materials in semiconductor manufacturing processes, including: growth technology of semiconductor materials (substrate preparation, epitaxial growth), and preparation technology of dielectric films and metal films. Familiar with the preparation process of bipolar transistors, MOS transistor, CMOS inverters and large-scale integrated circuits.

Recommended Textbooks/References:

1.Wang Wei, Tian Li, Ren Mingyuan, Integrated Circuit Manufacturing Technology: Principles and Processes (2nd Edition), Electronic Industry Press, April-2016.

2. Guan Xudong, Integrated Circuit Technology Basis (2nd Edition), Peking University Press, May-2014.

3. Peter Van Zant, Han Zhengsheng, Microchip Fabrication: A Practical Guide to Semiconductor Processing (Sixth Edition), Electronic Industry Press, January-2015.

4.Zhang Yafei, Duan Li, Integrated Circuit Manufacturing Technology, Shanghai Jiaotong

University Press, October-2018.
5. Stephen A. Campbell, Zeng Ying, Yan Liren etc., Microelectronics Manufacturing Science Principles and Engineering Technology (2nd Edition), Electronic Industry Press, August-2005.
6. James D. Plummer, Silicon VLSI Technology: Fundamentals, Practice and Modeling, Electronic Industry Press, September-2006.

0008640 集成电路原理与设计

课程编码：0008640

课程名称：集成电路原理与设计

英文名称：Integrated Circuit Principle and Design

课程类型：学科基础必修课

学分：4　　总学时：64

面向对象：微电子科学与工程专业本科生

先修课程：电路分析基础、数字电子技术、模拟电子技术、半导体物理学等

考核形式：考试+平时成绩

撰写人：刘素娟

课程简介：（250-300 字）

集成电路原理与设计是信息学部为微电子科学与工程专业本科生开设的学科基础必修课。本课程的课程目标是使学生掌握模拟和数字集成电路原理与设计方法，培养学生的系统和工程思想，关注集成电路设计技术的最新进展，为学生从事与集成电路相关的研发和设计打下坚实的基础。本课程教学内容重点是针对 CMOS 集成电路的原理和设计，包括工艺和器件（制作工艺和器件模型）、数字集成电路部分（数字集成电路的基本单元电路、集成电路基本模块、集成电路的 I/O 设计、存储器）、模拟集成电路部分（单级放大器、差分放大器、电流镜、集成电路的设计方法和版图设计）三大模块。教学内容的难点是模拟集成电路的小信号分析以及它们在单级放大器、差分放大器、电流镜设计中的应用。

推荐教材或主要参考书：

1.毕查德·拉扎维，模拟 CMOS 集成电路设计，西安交通大学出版社，2018 年 12 月

2.甘学温等，集成电路原理与设计，北京大学出版社，2006 年 2 月

3.康松默(美国),CMOS 数字集成电路——分析与设计（第四版）（英文版）， 电子工业出版社，2015 年 01 月

4.艾伦等(美国)、冯军等译，CMOS 模拟集成电路设计，电子工业出版社，2005 年 3 月

5. PaulR.Gray，模拟集成电路的分析与设计（第 4 版）,高等教育出版社，2003 年 10 月

0008640 Integrated circuit analysis and design

Course Number: 0008640

Course Title: Integrated circuit Principle and design

Credit: 4 **Total Credit Hours:** 64

Students: Undergraduate students major in Microelectronics Science and Engineering

Prerequisites: Analog Circuits, Pulse and Digital Circuits, Semiconductor Technology, Semiconductor Devices

Evaluation Method: Exam + usual score

Writer： Liu Sujuan

Course Description:

The principle and design of integrated circuit is a compulsory course for the undergraduates majoring in microelectronics science and engineering established by Information Faculty. The main target of this course is to enable students to master the principles and design methods of analog and digital integrated circuits, train students' system and engineering ideas, pay attention to the latest development of integrated circuit design technology, and lay a solid foundation for students to engage in research and development and design related to integrated circuits. This course focuses on the principle and design of CMOS integrated circuit, including process and device (manufacturing process and device model), digital integrated circuit (basic unit circuit of digital integrated circuit, basic module of integrated circuit, I/O design of integrated circuit, memory), analog integrated circuit (single-stage amplifier, differential amplifier, current mirror, integration Circuit design method and layout design). The difficulties of teaching contents are described as followings: the small signal analysis of basic unit circuit and analog integrated circuit and their application in the design of single-stage amplifier, differential amplifier and current mirror.

Recommended Textbooks/References:

1.Behzad Razavi, Analog CMOS IC design, Xi'an Jiaotong University Press, Dec. 2018

2.Gan Xuewen et al, Principles and design of integrated circuits, Peking University Press, February 2006

3. Sung-Mo Kang，CMOS Digital Integrated Circuits: Analysis and Design, (4th Edition), electronic industry press, Jan. 2015

4. Allen P.E. et al. (USA), Translated by Feng Jun et al., CMOS analog integrated circuit design, electronic industry press, March 2005

5. Paul R. gray, Analysis and design of analog integrated circuits (4th Edition), higher education press, October 2003

0008114 电子技术实验-1

课程编码：0008114

课程名称：电子技术实验-1

英文名称：The Electronic Technology Experiment-1

课程类型：实践环节必修课

学分： 1.0 **总学时：** 32

面向对象：电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生

先修课程：模拟电子技术, 数字电子技术

考核形式：平时成绩+考试

撰写人：周新田

课程简介：（250-300 字）

《电子技术实验-1》是信息学部为电子科学与技术专业本科生开设的实践环节必修课程。本课程的任务是通过电子实验知识、概念的学习，实验操作能力的培养，使学生加深对相关理论知识的理解，初步具备进行电子技术实验的能力。教学内容重点：学生能够学会电子元器件、集成电路的识别、测试和使用知识，掌握常用电子设备和工具的使用方法，在完成几个单元实验的过程中，加深对理论知识的理解，建立实验的概念，为今后进行综合性设计和专业实验奠定坚实的基础。教学内容的难点：对实验中出现或可能出现的故障的分析和排除，培养学生分析问题、分解问题和解决问题的方法。

推荐教材或主要参考书：

[1] 江捷，马志成，赵影，数字电子技术，北京工业大学出版社，2009 年 10 月

[2] 孙景琪，雷飞，闫慧兰，模拟电子技术，高等教育出版社，2016 年 7 月

0008114 The Electronic Technology Experiment-1

Course Number: 0008114

Course Title: The Electronic Technology Experiment-1

Course Type: Practice compulsory course

Credit: 1.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Automation, Robotic Engineering, Electronic Science and Technology, and Microelectronics Science and Engineering

Prerequisites: Analog Electronics, Digital Electronics

Evaluation Method: Course participation + written exams

Writer: Zhou Xintian

Course Description:

The Electronic Technology Experiment-1 is one of the practical requirement courses for undergraduate students Major in electronic science and technology. The main target of this course is to make the students better understand the relevant theoretical knowledge and gain the ability to carry out the experiments individually through the study of electronic experimental knowledge and concepts, and the cultivation of experiment operational capability. The teaching contents are mainly covered by the following aspects: the students could learn the recognition, testing and using of the electron devices and ICs. They could master the ways of how to use the electronic instruments and tools. After completing several experiments, the students could acquire a better understanding of the theoretical knowledge, which would be a basis of subsequent integrated design and specialized experiments. The difficulties of teaching contents are described as followings: cultivate the capability of the students on how to analyze, split and solve the problems or troubles which may occur during the experiments.

Recommended Textbooks/References:

1. J. Jiang, Z. Ma, Y. Zhao, Digital Electronic Technique, Beijing University of Technology Press, Oct. 2009.

2. J. Sun, F. Lei, H. Yan, Analog Electronic Technique, Higher Education Press, Jul. 2016.

0010081 电子技术实验-2

课程编码：0010081

课程名称：电子技术实验-2

英文名称：The Electronic Technology Experiment-2

课程类型：实践环节必修课

学分： 1.0 **总学时：** 32

面向对象：电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生

先修课程：模拟电子技术, 数字电子技术

考核形式：平时成绩+考试

课程简介：（250-300 字）

电子技术实验-2 是信息学部为电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生开设的实践环节必修课。本课程的任务是通过讲课和实验，使学生进一步熟悉电子原材料的知识和电子仪器的使用方法，熟练掌握电子技术实验的方法，在设计实现综合型模块化题目的过程中，学会测量、记录、分析和调试，提高学生解决实际问题的能力，获得感知，积累经验。

教学内容重点：分别完成一个基于数字电子技术和模拟电子技术的课题设计。

教学内容的难点：学生综合运用电子技术知识解决工程问题的综合能力。

推荐教材或主要参考书：

[1] 华成英，模拟电子技术基本教程，清华大学出版社，2018 年 7 月；

[2] 林涛、林彬、杨照辉，数字电子技术基础，清华大学出版社，2018 年 1 月；

[1] 姚福安，徐向华，电子技术实验，清华大学出版社，2015 年 8 月；

0010081 The Electronic Technology Experiment-2

Course Number: 0010081

Course Title: The Electronic Technology Experiment-2

Course Type: Practice compulsory course

Credit: 1.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and Technology, and Microelectronics Science and Engineering

Prerequisites: Analog Electronics, Digital Electronics

Evaluation Method: Course participation + written exams

Course Description:

Electronic Technology Experiment-2 is a practice compulsory course of information department for undergraduates majoring in Electronic Science and Technology, and Microelectronics Science and Engineering. The goal of this course is to make students further familiar with knowledge of electronic raw materials, the use of electronic instruments and master the method of electronic technology experiment through lectures and experiment. In the process of designing and implementing integrated modular topics, students learn how to measure, record, analyze and debug, improve the ability of solving practical problems, gain perception and accumulate experience.

Teaching content focus: Course design based on digital electronic technology and analog electronic technology.

Difficulties in teaching content: The comprehensive ability of students to solve engineering problems using electronic technical knowledge.

Recommended Textbooks/References:

1.Chengying Hua, Fundamentals of Analog Electronics, *Tsinghua University Press*, 07-2018

2.Tao Lin, Bin Lin, Zhaohui Yang, Fundamentals of Digital Electronics, *Tsinghua University Press*, 01-2018

3.Fuan Yao, Xianghua Xu, The Electronic Technology Experiment, *Tsinghua University Press*, 08-2015

0010075 电子工程设计

课程编码：0010075

课程名称：电子工程设计

英文名称：Electronic Engineering Training

课程类型：实践环节必修课

学分： 2.5 **总学时：** 75

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：模拟电子技术、数字电子技术、微机原理与接口技术、单片机应用技术、C 语言程序设计

考核形式： 作品评价+实操考试+平时表现+工作报告

撰写人：崔宁

课程简介：

《电子工程设计》是电子信息工程、通信工程、自动化、电子科学与技术等多专业本科生必修的实践类课程。课程的具体目标是让学生了解产品研发的一般过程和基本方法；培养工程实现的基本技能；培养运用所学知识分析、解决实际工程问题的能力；培养自主学习，独立思考能力。

电子工程设计课程内容选择“小型温度控制系统”作为具体设计题目。在实验过程中，使学生了解项目、产品研发的一般过程，包括：需求分析、方案设计、细节设计、设计实现、功能测试等环节，掌握产品设计的基本方法，积累初步的实际工作经验，为从工科大学生向工程师的角色转换做好准备。

推荐教材或主要参考书：

[1] 高新、施远征、张岩艳、司农，嵌入式项目开发实践教程，首都经济贸易大学出版社，2023 年 8 月。

0010075 Electronic Engineering Training

Course Number: 0010075

Course Title: Electronic Engineering Training

Course Type: Project compulsory course

Credit: 2.5 **Total Credit Hours:** 75

Students: Undergraduate students majoring in Electronics Science and Technology, Microelectronics Science and Engineering

Prerequisites: Analog Electronics Technique, Digital Electronics Technique, Microcomputer principle and interface technology, Application technology of single chip microcomputer, C language programming

Evaluation Method: Work evaluation + practical test + usual performance + course report

Writer: Cui Ning

Course Description:

"Electronic Engineering Design" is a compulsory experimental course for undergraduate students in electronic information engineering, communication engineering, automation, electronic science and technology, etc. The main target of this course is to provide general process and basic methods of product development for students. The students are expected to develop basic skills in complete engineering tasks, analyze and solve practical engineering problems, independent learning and independent thinking skills.

This course is focus on "design of small temperature control system". In this engineering experimental, students can understand the general process of project and product development, which including demand analysis, scheme design, detailed design, design implementation, functional testing, etc. Students will learn the basic methods of product design and work experience. Then prepare for the role change from engineering students to engineers.

Recommended Textbooks/References:

1. Xin Gao, Yuanzheng Shi, Yanyan Zang, Nong Si, Hands-on tutorials for embedded project development, The Name of the Textbook, Capital University of Economics and Business Press, 08-2023.

0008641 微电子工艺实习

课程编码：0008641

课程名称：半导体工艺实习 II

英文名称：Semiconductor Technical Field Work

课程类型：实践环节必修课

学分： 1.5 **总学时：** 45

面向对象：微电子科学与工程（实验班）专业

先修课程：模拟电路，半导体制造环境与安全规范

考核形式： 完成单管和振荡器工艺流程，得到单管输出特性

撰写人：丁广玉

课程简介：（250-300 字）

《微电子工艺实习》是信息学部（部）为电子科学与技术专业本科生开设的实践环节必修课程类型。本课程的任务是通过以清洗、氧化、扩散、光刻、磁控溅射和真空镀膜为主要步骤的半导体工艺流程制备具有输出特性的 NPN 单管，并进一步制备集成无源器件和振荡器。教学内容重点：确定工艺方案，制备靠得足够近并形成耦合的背靠背 PN 结。结合无源器件和金属互连制备振荡器。兼顾工艺约束、分散性等因素的影响，满足安全和环保要求，并通过测试电性能加以验证。总之工艺实习强调实践动手能力和工程伦理意识的培养。教学内容的难点：扩散工艺的控制精度，光刻对版的速度和准确，有源器件之间的匹配，有源器件和无源器件的匹配。

推荐教材或主要参考书：

[1] 张渊，半导体制造工艺，机械工业出版社，2018 年 7 月

[2] [美] Peter Z，芯片制造（第六版），电子工业出版社，2019 年 3 月

[3] 郭澎，张福海，刘永，晶体管原理（第二版），国防工业出版社，2016 年 4 月

[4] [美]Alan H，张为译，模拟电路版图的艺术（第二版），电子工业出版社，2011 年 9 月

[5] 童诗白主编，模拟电子技术基础（第五版），高等教育出版社，2015 年 7 月

0008641 Microelectronics Process Field Work

Course Number: 0008641

Course Title: Microelectronics Process Field Work

Course Type: Project compulsory course

Credit: 1.5 **Total Credit Hours:** 45

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Analog Circuit, Semiconductor Manufacturing Environment and Safety Specification Experiment

Evaluation Method: Finish fabrication process of bipolar device and oscillator

Writer: Ding Guangyu

Course Description:

Microelectronics Process Field Work is one of the Faculty of Information Technology courses in required practice for undergraduate students Major in Electronic Science and Technology. The main target of this course is to clarify the fabrication of NPN transistor that having output characteristic curve and oscillator further through semiconductor process that taking clean, oxide, diffusion, photoetching, magnetron sputtering and vacuum coating as major steps. This course is focus on the training of practical ability and engineering ethical consciousness. The teaching contents are mainly covered by the following aspects: determining the process scheme, fabrication of back to back PN junction that so close to coupling, fabrication of oscillator combined with passive devices and metal interconnect, taking account of process constrains and dispersion, meeting the challenge of safety and environment and verifying by electrical characteristics measure. The difficulties of teaching contents are described as followings: control accuracy of diffusion, speed and accurate of lithography alignment, matching between active devices, matching between active and passive devices.

Recommended Textbooks/References:

1. Yuan Zhang, Semiconductor Fabrication Process, *China Machine Press*, 4-2016

2. Peter Z, Microchip Fabrication(Sixth Edition), *Publishing House of Electronics Industry*, 3-2019

3. Peng G, Fuhai Z, Yong Z, Transistor Principle(Second Edition), *National Defense Industry Press*, 4-2016

4. Alan H, The Art of Analog Layout(Second Edition), *Publishing House of Electronics Industry*, 9-2011

5. Shibai T, The Foundation of Analog Electronic Technology, *High Education Press*，7-2015

0008642 FPGA 设计实验

课程编码：0008642

课程名称：FPGA 设计实验

英文名称：FPGA Design Experiment

课程类型：实践环节必修课

学分： 1.5 **总学时：** 48

面向对象：微电子科学与工程专业本科生

先修课程：电路分析基础、模拟电子技术、数字电子技术

考核形式： 完成设计+上机操作

撰写人：胡小玲

课程简介：

《FPGA 设计实验》在电子科学与技术专业本科生实践能力培养中起着非常重要的作用。本课程的目标是以设计实例的形式，引导学生完成从设计任务的编程到硬件功能实现的 FPGA 设计全过程，培养学生建立系统设计和按照设计流程进行设计的思想。提高在设计中提出问题，发现问题，解决问题的能力，以此达到理论与实际相结合、进一步加深对 EDA 技术的理解和全面提高学生的创造及开发能力。课程的主要内容包括：掌握 FPGA 设计方法及流程，熟悉硬件描述语言；熟悉软硬件平台及时序设计的方法和要点；通过相应规模的实验进一步提高设计能力；自主实验设计，由学生提出设计方案并实施，培养独立进行系统设计的能力。教学内容的难点：电路设计。

推荐教材或主要参考书：

[1] 张峰著， 嵌入式高速串行总线技术——基于 FPGA 实现与应用，电子工业出版社，2017 年 1 月

[2] 彭皮·楚著，李艳志，孟伟，刘军等译，用 Verilog 设计 FPGA 样机实例解析，机械工业出版社，2016 年 11 月

[3] Pong P·Chu 著，金明录，门宏志译，基于 Nios II 的嵌入式 SoPC 系统设计与 Verilog 开发实例，电子工业出版社，2015 年 5 月

[4] 吴厚航，深入浅出玩转 FPGA，北京航空航天大学出版社，2013 年 7 月

[5] 周润景，苏良碧， 基于 Quartus Ⅱ 的 FPGA/CPLD 数字系统设计实例，电子工业出版社，2013 年 1 月

[6] FPGA 设计实验指导书，自编

0008642 FPGA Design Experiment

Course Number: 0008642

Course Title: FPGA Design Experiment

Course Type: Required Courses in Practice

Credit: 1.5 **Total Credit Hours:** 48

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Basis of Circuit Analysis， Analog Electronics Technique， Digital Electronic Technique

Evaluation Method: Complete design + Practice exams

Writer: Hu Xiaoling

Course Description:

FPGA Design Experiment is one of the Faculty of Information Technology courses for undergraduate students Major in Electronic Science and Technology. The main target of this course is to clarify the students to complete the whole process of FPGA design, that is, from programming based on design requirements to realizing the hardware function, in the form of design examples. It cultivates students to establish the idea of system design method and complete design task in accordance with the design process. It can make the theory more combination with practice, make students master EDA technology and improve their ability of creation and innovation. This course is focus on cultivating students' ability to discover and solve problems in engineering practice. The teaching contents are mainly covered by the following aspects: master FPGA design methods and processes, learn the hardware description language; master timing design methods and familiar with software and hardware platform; improve the design capabilities through former experiments; own design experiment, require students to design and implement themselves project, cultivate their ability of system design independently. The difficulties of teaching contents are described as followings: circuit design and analysis.

Recommended Textbooks/References:

12. Zhang Feng, Embedded High-speed Serial Bus Technology--Implementation and Application based on FPGA，*Publishing House of Electronics Industry*，Jan-2017
13. Ping D.CHU, FPGA Prototyping by Veriog Examples，China Machine Press，Nov-2016
14. Pong P・Chu, Jin Minglu, Men Hongzhi 译，Embedded SoPC Design with Nios II Processor and Verilog Examples, *Publishing House of Electronics Industry*, May-2015
15. Wu Houhang, Study the FPGA in a Simple Way，*Beihang University Press*，July-2013
16. Zhou Runjing，Su Liangbi, Design Example of FPGA/CPLD Digital System Based on Quartus Ⅱ，*Publishing House of Electronics Industry*, Jan-2013

0008109 半导体实验

课程编码：0008109

课程名称：半导体实验

英文名称：Experiments of Semiconductor

课程类型：实验环节必修课

学分： 1.0 **总学时：** 32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业

先修课程：半导体物理, 半导体器件原理

考核形式： 平时成绩+考试

撰写人：武利

课程简介：

集成电路产业对国计民生有重大影响，半导体物理的理论知识是集成电路行业的基础。使学生熟悉半导体物理的基础理论和半导体的主要性质，以适应后续专业课程的学习和将来工作的需要。《半导体实验》是信息学部电子科学与技术学院微电子专业本科生开设的专业基础与专业综合的本科生独立设课实验。本课程的任务是通过实验，加深同学对半导体物理课程理论的认识；理解相关测量系统的工作原理、测量技术；掌握数据采集、误差分析及撰写报告的能力。教学内容重点：测量参数、数据处理。教学内容的难点：数据处理。

推荐教材或主要参考书：

[1] 刘恩科、朱秉升、罗晋生 《半导体物理学》电子工业出版社 2011 年第 7 版。

[2]顾祖毅、田立林、富力文 《半导体物理学》电子工业出版社，1995 年第一版。

[3]《半导体实验》，北京工业大学 2016 年。

0008109 Experiments of Semiconductor

Course Number：0008109

Course Title: Experiments of Semiconductor

Course Type: Project compulsory course

Credit: 1.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Semiconductor Physics, Principles of Semiconductor Devices

Evaluation Method: Course participation + written exams

Writer: Wu Li

Course Description:

The integrated circuit industry has a significant impact on the national economy and the people's livelihood. The theoretical knowledge of semiconductor physics is the foundation of the integrated circuit industry. Students are familiar with the basic theory of semiconductor physics and the main properties of semiconductors to meet the needs of subsequent professional courses and future work. Semiconductor experiments It is an independent undergraduate experiment of professional foundation and comprehensive undergraduate courses offered by undergraduates majoring in microelectronics in the School of Electronic Science and Technology of the Department of Informatics. The task of this course is to deepen students' understanding of the theory of semiconductor physics through experiments; to understand related measurement systems Working principle and measurement technology; master the ability of data collection, error analysis and report writing. Focus of teaching content: measurement parameters, data processing. Difficulties of teaching content: data processing.

Recommended Textbooks/References:

1. Liu Enke, Zhu Bingsheng, Luo Jinsheng "Semiconductor Physics" Electronic Industry Press, 7th edition, 2011.

2. Gu Zuyi, Tian Lilin, R & F. "Semiconductor Physics" Electronic Industry Press, 1995 first edition.

3. "Semiconductor Experiment", Beijing University of Technology, 2016.

0008644 集成电路综合设计实训

课程编码：0008644

课程名称：集成电路综合实训

英文名称：Integrated Circuits Comprehensive Design Training

课程类型：实践环节必修课

学分： 2.0 **总学时：** 60

面向对象：微电子科学与工程（实验班）专业本科生

先修课程：模拟电子技术, 数字电子技术, 集成电路原理与设计

考核形式： 平时成绩+实习报告（含小组口头答辩）

撰写人：王文思

课程简介：（250-300 字）

集成电路综合实训是信息学部电子科学与技术学院为微电子科学与工程（实验班）专业本科生开设的实验类课程。本课程的任务是探讨集成电路发展的主要技术，阐明模拟和数字集成电路的基本设计思路，引导学生动手操作使用先进 EDA 仿真工具进行实践设计。教学内容重点：通过实践教学使学生基本掌握基础的模拟类集成电路的设计方法，通过对基于运算放大器的模拟集成电路的实践设计操作，在课堂上设计出一个可流片的模拟集成电路。同时通过对 FPGA 和 MCU 编译的学习，在实践中了解 RTL 设计的概念，实现基于标准数字集成电路进行初步设计和操作的课程目标。教学内容的难点：学生对模拟集成电路中小信号模型的理解，对器件开关速度与系统稳定性设计的理解。

该课程以模拟与数字类集成电路的实际操作入手，教授学生这两类主流集成电路的设计方法以及如何使用相关 EDA 软件等内容。目前的课程体系安排如下，但在本项目建设过程中，将对现有的课程内容进行调整，使其更加适用于创新创业课程体系建设。

第一专题：模拟集成电路入门专题；第二专题：高增益运算放大器专题；第三专题：模拟集成电路版图与仿真专题；第四专题：模拟集成电路基准电压源设计；第五专题：混合集成电路 DAC 设计专题；第六专题：数字 ASIC 设计专题；第七专题：嵌入式系统设计专题；第八专题：FPGA 数字图像处理与识别专题。

推荐教材或主要参考书：

[1] 毕查德.拉扎维，模拟 CMOS 集成电路设计，西安交通大学出版社，2003 年 2 月

0008644 Integrated Circuits Comprehensive Design Training

Course Number: 0008644

Course Title: Integrated Circuits Comprehensive Design Training

Course Type: Experiment Course

Credit: 2 **Total Credit Hours:** 60

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Analog circuit design, Digital circuit design, Integrated circuit Principle and design

Evaluation Method: Course Participant + final report (including oral defense)

Writer： Wang Wensi

Course Description:

Integrated Circuit Integrated Training is an experimental course offered by the School of Electronic Science and Technology of the Department of Informatics for undergraduates majoring in e Microelectronics Science and Engineering. The task of this course is to explore the main technologies for the development of integrated circuits, to clarify the basic design ideas of analog and digital integrated circuits, and to guide students in hands-on operation using advanced EDA simulation tools for practical design. Focus of teaching content: Through practical teaching, students can master the basic analog integrated circuit design method. Through the practical design operation of analog integrated circuits based on operational amplifiers, an complete analog integrated circuit is designed in the classroom. At the same time, through the learning of FPGA and MCU compilation, understand the concept of RTL design in practice, and realize the course goal of preliminary design and operation based on standard digital integrated circuits. Difficult points of teaching content: Students' understanding of small signal models in analog integrated circuits, and understanding of device switching speed and system stability design.

Recommended Textbooks/References:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, Xi`an Jiaotong University Press, Feb-2003

0008643 集成电路版图及设计

课程编码：0008643

课程名称：集成电路版图及设计

英文名称：Integrated Circuit Layout and Design

课程类型：实践环节必修课

学分： 2.5 **总学时：** 75

面向对象：微电子科学与工程专业本科生

先修课程：半导体器件原理，微电子工艺，数字电子技术，FPGA 设计实验

考核形式： 完成设计要求

撰写人：袁颖

课程简介：

《集成电路版图及设计》在微电子科学与工程专业本科生实践能力培养中起着非常重要的作用。本课程的目标是培养学生集成电路设计方法与流程方面的能力，掌握微电子技术人员所需的基本理论和技能，为学生进一步学习硕士有关专业课程和日后从事集成电路设计工作打下基础。课程的主要内容包括：培养学生的集成电路 EDA 工具使用能力、电路分析能力、版图识别能力、集成电路版图设计与验证分析能力等，掌握系统集成设计方法，进而掌握系统设计→电路设计→版图设计→版图验证等整个系统集成设计过程。教学内容的难点：引导学生确立设计架构，掌握设计方法，完成功能设计与仿真，进而完成电路设计与版图设计。

推荐教材或主要参考书：

1. 刘雯，ASIC 设计理论与实践-RTL 验证、综合与版图设计，人民邮电出版社，2019 年 4 月

2. Sridhar Gangdharan，Sanjay Churiwala，综合与时序分析的设计约束，机械工业出版社，2018 年 2 月

3. 韩雁，韩晓霞，丁扣宝，集成电路设计 CAD/EDA 工具实用教程，机械工业出版社，2010 年 9 月

4. Dan Clein，邓红辉，王晓蕾，耿罗锋等译，CMOS 集成电路版图——概念、方法与工具，电子工业出版社，2006 年 3 月

5. Phillio E. Allen，Douglas R. Holberg，冯军，李智群译，CMOS 模拟集成电路设计，电子工业出版社，2005 年 3 月

6. Christopher Saint，Judy Saint. IC Mask Design-Essential Layout Techniques，清华大学出版社，2004 年 1 月

7. 集成电路版图及设计实验指导书，自编

0008643Integrated Circuit Layout and Design

Course Number: 0008643

Course Title: Integrated Circuit Layout and Design

Course Type: Project compulsory course

Credit: 2.5 **Total Credit Hours:** 75

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Principles of Semiconductor Devices, Microelectronics Process, Digital Electronic Technique，FPGA Design Experiments

Evaluation Method: Practice Design

Writer: Yuan Ying

Course Description:

Integrated circuit design plays a very important role in cultivating practical abilities of undergraduate students majoring in microelectronics science and engineering. The main target of this course is to clarify the ability of students in the digital design and to develop students' ability in integrated circuit design methods and processes, to master the basic theories and skills required by microelectronics technicians, and to lay the foundation for students to further study master-related professional courses and engage in integrated circuit design work in the future. This course is focus on cultivating students' ability to use integrated circuit EDA tools, circuit analysis ability, layout recognition ability, integrated circuit layout design and verification analysis ability, etc. The teaching contents are mainly covered by the following aspects: a digital integrated circuit design projects based Synopsys tools must be completed by students, familiar with CMOS manufacturing processes and layout design rules, through the step-by-step process of basic unit design to circuit design, finally master the integrated circuit layout design method. The difficulties of teaching contents are described as followings: Guide the students to establish the design framework, master the design method of integrated circuit, complete the functional design and simulation, and then complete the circuit design and layout design.

Recommended Textbooks/References:

1. Liu Wen, ASIC design theory and practice - RTL verification, synthesis and layout design, Post & Telecom Press, Apr-2019

2. Li Guangjun, Guo Zhiyong,et al, Digital integrated circuit and system design, Publishing House of Electronics Industry, Oct-2015

3. Han Yan, Han Xiaoxia, Ding Koubao, Integrated circuit design CAD / EDA tools practical course, China Machine Press, Sept-2010

4. Dan Clein, CMOS IC Layout concepts, Methodologies, and Tools, Publishing House of Electronics Industry, Mar-2006

5. Phillio E. Allen, Douglas R. Holberg, CMOS Analog Circuit Design, Publishing House of Electronics Industry, Mar-2005

6. Christopher Saint, Judy Saint. IC Mask Design-Essential Layout Techniques, Tsinghua University Press, Jan-2004

7. Integrated Circuit Layout and Design Experiment Guide, Self-Edited textbook

0007256 工作实习

课程编码：0007256

课程名称：工作实习

英文名称：Professional Practice

课程类型：实践环节必修课

学分：4.0　　**总学时：**120

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：微电子工艺，半导体物理，集成电路原理与设计

考核形式：企业考核+个人评价+学校考核

撰写人：崔碧峰

课程简介：

工作实习是微电子学院为电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生开设的必修实习课程类型。本课程的任务是通过深入企业的学习与培养，熟悉电子科学与技术相关的器件、电路开发设计、性能测试、批量生产、销售服务等环节，增强人际交往、团队协作能力及社会责任感，锻炼不怕吃苦，敢于挑战困难的精神。企业实训使学生了解将知识化为生产力的过程，学会如何运用知识解决实际问题的能力。本次实践课程使学生得到多方面的训练，掌握适应社会发展需求的各种技能，熟悉电子技术（含微电子技术）领域对人才知识构架的需求，为将来更好地适应社会和工作奠定基础。教学内容重点：学会如何运用知识解决实际问题。教学内容的难点：建立团队协作，探索创新的能力。

推荐教材或主要参考书：

无

0007256 Professional Practice

Course Number: 0007256

Course Title: Professional Practice

Course Type: Project compulsory course

Credit: 4.0 **Total Credit Hours:** 120

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Microelectronic Fabrication Technology, The physics of Semiconductors, Principle and Design of Integrated Circuit

Evaluation Method: Enterprise assessment + Self-Evaluation + School evaluation

Writer: Cui Bifeng

Course Description:

Professional practice is one of the practice compulsory courses for undergraduate students major in electrical science and technology. The main target of this course is to make students know well in the devise and circuit design, manufacture, measurement, and sale. By throughout learning in enterprises, students will understand that knowledge is becoming the key factor of productivity and learn how to use the knowledge to solve the practical problems. The capability of applying specialized knowledge to solve engineering problem in Microelectronic field can be enhanced. This training in enterprise helps students establish good interpersonal relationships, team cooperation, and social responsibility. This Professional practice has various training on students, making them know the talent requirement in Microelectronic field.

The teaching content is mainly covered by applying specialized knowledge to solve engineering problem in Microelectronic field. The difficulty of teaching contents is to establish good interpersonal relationships, team cooperation, and social responsibility.

Recommended Textbooks/References:

None

0008111 毕业设计

课程编码：0008111

课程名称：毕业设计

英文名称：Graduation Thesis

课程类型：实践环节必修课

学分：8.0　　**总学时：**480

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：微电子工艺，半导体物理，集成电路原理与设计

考核形式： 课题设计+论文内容+报告考核

撰写人：崔碧峰

课程简介：

毕业论文是微电子学院为电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生开设的实践环节必修课。毕业设计是本科教育阶段最后、但也是最重要的环节之一，学生通过适当的课题研究为背景，完成调研、实施、总结、汇报等工作，是培养学生综合运用所学知识的技能，分析和解决实际问题，进一步培养学生的分析问题、分解问题、和解决问题的能力，也是培养学生独立思考、团队协作、问题抽象、建模、分析等能力的重要环节，使学生受到工程设计和实现的综合训练。最终通过毕业论文的撰写，使学生掌握科技论文撰写规范，强化学生归纳、总结与文字表达的能力。教学内容重点：培养学生的分析问题、分解问题、和解决问题的能力。教学内容的难点：建立科学研究的思维模式。

推荐教材或主要参考书：

无

0008111 Graduation Thesis

Course Number: 0008111

Course Title: Graduation Thesis

Course Type: Project compulsory course

Credit: 8.0 **Total Credit Hours:** 480

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Microelectronic Fabrication Technology, The physics of Semiconductors, Principle and Design of Integrated Circuit

Evaluation Method: Subject design + Thesis content + Report

Writer: Cui Bifeng

Course Description:

Graduation thesis is one of the practice compulsory courses for undergraduate students major in electrical science and technology. The main target of this course is to cultivate the capability of analysis, decomposing, and solve problem. Students need to accomplish a series of work including the investigation, implement, summary, and report. Students can understand the process of academic research by writing graduation thesis. This is very important for them to achieve the connect between the engineering design and accomplishment.

The teaching content is mainly covered by investigation, implement, summary, and report of the subject. The difficulty of teaching contents is to understand the mode of thinking the scientific research.

Recommended Textbooks/References:

None

0003213 自动控制原理Ⅱ

课程编码：0003213

课程名称：自动控制原理Ⅱ

英文名称：Automatic Control Theory

课程类型：学科基础选修课、专业选修课

学分：2.0　　**总学时：**32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：信号与系统、电路分析基础、复变函数与积分变换，模拟电子技术、数字电子技术

考核形式：平时成绩+考试

撰写人：

课程简介：

自动控制原理是为电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生开设的学科基础选修课。课程的任务是通过讲述自动控制系统数学建模、时域分析、频率分析及校正方法，向学生传授自动控制原理理论知识，使学生掌握电子科学与技术领域控制系统的建模与分析、校正（设计）方法。教学内容重点包括：闭环控制的基本概念；典型系统的传递函数及动态结构图建立；时域中系统稳定性、稳态误差以及动态性能的分析方法；频域稳定性判据以及基于开环频率特性的系统性能分析；超前、滞后以及参考模型的控制系统校正方法。教学内容难点包括：掌握反馈控制思想；建立一般物理系统的传递函数；理解高阶线性定常系统的分析方法及思路；掌握时域和频域的对应关系；理解控制系统的固有特性、校正装置特性。

推荐教材或主要参考书：

[1] 孙亮，《自动控制原理》第三版，高等教育出版社，2011 年 6 月

[2]胡寿松，《自动控制原理》第七版，科学出版社，2019 年 1 月

[3] Richard C., Robert H. Modern Control Systems 13th, Prentice Hall,2018 年 7 月

0003213 Automatic Control Theory Ⅱ

Course Number:0003213

Course Title: Automatic Control Theory II

Course Type: Discipline Elective & Elective

Credit:2.0 **Total Credit Hours:**32

Students: Undergraduate students majoring in Electronics Science and Technology & Microelectronics Science and Engineering

Prerequisites: Signals and systems, Circuit theory, Complex functions, Integral transformation, Electronics

Evaluation Method: Course participation + written exams

Writer:

Course Description:

Automatic Control Theory is one of the discipline-based optional courses for undergraduate students majoring in Electronics Science and Technology, Microelectronics science and engineering. The main target of this course is to clarify the knowledge of automatic control theory by the discussion of mathematical modeling, time-domain analysis, frequency-domain analysis, and design of automatic control system, such that the students are able to solve engineering problem. This course focuses on the basic concepts of closed-loop control system, transfer function and dynamic structure diagram of typical systems, stability analysis, analysis of steady-state error and dynamicproperty in the time-domain, analysis of stability and open-loop frequency characteristic in the frequency domain, control system correction with leading and lag network as well as reference model. The difficulties of teaching contents are as follows: feedback control idea, modeling the general physical systems, analysis of high-order linear time-invariant systems, the relationship between time- and frequency-domains, the characteristics of inherent system and correction device.

Recommended Textbooks/References:

1.Sun Liang, Automatic Control Theory 3th, *Beijing: Higher Education Press*, June-2011

2.Hu Shousong, The Principles of Automatic Control 7th. *Beijing: Science Press*, January-2019

3.Richard C, Robert H.Modern Control Systems 13th,*Prentice Hall*, July-2018

0005701 嵌入式系统Ⅰ

课程编码： 0005701

课程名称：嵌入式系统 I

英文名称：Embedded System I

课程类型：专业选修课

学分： 2.0 **总学时：** 32

面向对象：电子科学与技术（实验班）专业，微电子科学与工程（实验班）专业本科生

先修课程：模拟电子技术，数字电子技术，微机原理与应用，C 程序设计基础，单片机应用技术

考核形式： 平时成绩+实验+考试

撰写人：耿淑琴

课程简介：

嵌入式系统技术是当今迅猛发展的前沿技术，SoC 技术的发展，使得嵌入式处理器全面进入 32 位时代。嵌入式系统产品正在广泛的应用在通信、航空航天、医疗仪器、工业控制和信息家电等领域，并将逐步渗透到人们生活的各个方面。本课程的目标是通过本课程的学习，使本科生了解当今嵌入式系统发展的前沿技术，拓宽专业知识面，掌握嵌入式系统的软硬件设计方法，能够完成一定的系统设计任务。课程的主要内容包括嵌入式系统的基本概念、组成、特点、处理器的架构、寄存器的配置、接口电路的设计、嵌入式系统硬件电路的设计、指令等内容。方法主要有软硬件协同设计，面向当今的主流芯片技术，充分考虑电子科学与技术、微电子专业的特点，从处理器设计的角度和功能应用实现的角度将理论与实践紧密相结合等方法。

推荐教材或主要参考书：

1.［美］ 塔米•诺尔加德，嵌入式系统：硬件、软件及软硬件协同（原书第 2 版），机械工业出版社，2018 年 02 月

2. Edward Ashford Lee，Sanjit Arunkumar Seshia，嵌入式系统导论：CPS 方法（原书第 2 版加州大学伯克利分校名著），机械工业出版社，2018 年 09 月

3. Alexander G. Dean，嵌入式系统原理——基于 Arm Cortex-M 微控制器体系，人民邮电出版社，2019 年 09 月

0005701 Embedded System Ⅰ

Course Number: 0005701

Course Title: Embedded System Ⅰ

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students in Electronic Science and Engineering & Microelectronic Science and Engineering

Prerequisites: Analog electronic, Digital electronic, Microcomputer principle and application, C programming, MCU application

Evaluation Method: Course participation + experiment+ written exams

Writer: Geng Shuqin

Course Description:

Embedded System I is one of the limit courses for undergraduate students Major in electronic science and technology and Microelectronics Science and Engineering. Embedded system is the cutting-edge technology of rapid development. The embedded processor enters the 32-bit era. Embedded system products are widely used in communication, aerospace, medical instruments, industrial control, information appliances and other fields, and will gradually penetrate into all aspects of people's lives. This course is focus on understanding the cutting-edge technology of embedded system development, broaden undergraduate students professional knowledge, master the software and hardware design methods of embedded system, and complete system design tasks. The teaching contents are mainly covered by the following aspects: the basic concept, composition, characteristics, processor architecture, register configuration, interface circuit design, embedded system hardware circuit design, instructions, and other contents of embedded systems. The main methods include software and hardware collaborative design, facing the mainstream chip technology today, fully considering the characteristics of electronic science and technology, microelectronics, and combining theory and practice closely from the perspective of processor design and functional application implementation.

Recommended Textbooks/References:

1. [US] Tammy norgard, Embedded system: hardware, software and software hardware collaboration (the second edition of the original book), Machinery industry press, February- 2018

2. Edward Ashford Lee, Sanjit Arunkumar seshia, Introduction to embedded systems: CPS method (the second edition of the original book, a masterpiece of the University of California, Berkeley), Mechanical industry press, September-2018

3. Alexander g. Dean, Embedded system principle - based on arm Cortex-M microcontroller system, People's Posts and Telecommunications Press, September-2019

0008646 数字信号处理

课程编码：0008646

课程名称：数字信号处理

英文名称：Digital Signal Processing

课程类型：专业选修课

学分： 2.5 **总学时：** 40

面向对象：微电子科学与工程（实验班）专业本科生

先修课程：信号与系统Ⅳ、高等数学（工）、复变函数与积分变换

考核形式：平时成绩+考试

课程简介：

《数字信号处理》是信息学部微电子学院为微电子科学与工程（实验班）专业本科生开设的专业选修课类型。本课程的任务是通过教学，让学生掌握离散时间信号分析与离散时间系统设计的基本概念、理论、手段和方法，为深入学习本专业相关课程以及今后从事专业打下良好的基础。教学内容重点包括：离散时间信号分析、离散傅立叶变换（DFT）、快速傅立叶变换（FFT）、数字滤波器的实现结构、无限长单位冲激响应数字滤波器设计、有限长单位冲激响应数字滤波器设计等。教学内容的难点包括：采样定理、DFT 变换及性质、DFT 应用中存在的问题、线性相位 FIR 数字滤波器设计等。

推荐教材或主要参考书：

[1] 程佩青. 数字信号处理教程（第四版）简明版. 清华大学出版社，2013

[2] 胡广书. 数字信号处理导论. 清华大学出版社，2005

[3] 丁玉美. 数字信号处理. 西安电子科技大学出版社，2006

0008646 Digital Signal Processing

Course Number: 0008646

Course Title: Digital Signal Processing

Course Type: Electives

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Signals and Systems, Advanced Mathematics, Complex Function

Evaluation Method: Course participation + written exams

Course Description:

Digital Signal Processing is one of the Electives courses for undergraduate students Major in Microelectronics Science and Engineering. The main target of this course is to clarify the basic concepts, theories, means and methods of Discrete Time Signal analysis and Discrete Time System design. This course is focus on helping undergraduates to gain a basic insight into the connotation and essence of digital signal processing. It will lay a good foundation for the further study of the related courses of this major and the future professional work. The teaching contents are mainly covered by the following aspects: Discrete Fime Signal analysis, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Basic structure of digital filter, Design of Infinite Impulse Response digital filter, Design of Finite Impulse Response digital filter. The difficulties of teaching contents are described as followings: Sampling theorem, DFT definition and properties, problems in DFT application, design of linear phase FIR digital filter.

Recommended Textbooks/References:

1.CHENG Peiqing. Digital Signal Processing Course (Fourth Edition), Concise Edition. Tsinghua University Press, 2013

2.HU Guangshu. An Introduction to Digital Signal Processing. Tsinghua University Press, 2005

3.DING Yumei. Digital Signal Processing. Xidian University Press, 2006

0007277 电子材料与器件（双语）

课程编码：0007277

课程名称：电子材料与器件（双语）

英文名称：Electronic materials and devices

课程类型：专业选修课

学分：2.0　　**总学时：**32

面向对象：电子科学与技术（实验班）专业，微电子科学与工程（实验班）专业本科生

先修课程：高等数学（工）、大学物理Ⅰ、固体物理学、半导体物理/半导体物理学

考核形式：笔试

撰写人：朱慧

课程简介：

《电子材料与器件（双语）》课程是电子科学与技术专业以及微电子科学与工程专业选修课。通过本课程的教学，应使学生理解与掌握电子材料与器件的概念、原理与应用基础，了解不同功能的电子元器件及发展趋势，培养学生对电子材料功能特性的应用能力，拓宽知识面，获得必要的专业常识和认识不同的专业方向，激发学生的学习兴趣和构建合理的知识结构，为今后的工作打下良好的基础。具体知识包括电子材料的发展与应用，各种电功能材料包括导电材料、电介质材料（包括电容器介质材料、铁电材料、压电材料、热释电材料）、半导体材料以及电功能材料在相关方面的应用。

推荐教材或主要参考书：（含主编，教材名，出版社，出版日期）

[1] S.O.Kasap，Principles of Electronic Materials and Devices(Third Edition，影印版)，清华大学出版社，2007

[2] 李言荣、恽正中，电子材料导论，清华大学出版社，2001

0007277 Electronic materials and devices

Course Number: 0007277

Course Title: Electronic materials and devices

Course Type: Electives

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students in Electronic Science and Engineering & Microelectronic Science and Engineering

Prerequisites: Calculus, Physics, Solid State Physics, Semiconductor Physics

Evaluation Method: Written exam

Writer: Zhu Hui

Course Description:

"Electronic materials and devices" is an elective course for the Undergraduate students. The students are expected to understand the concepts and theories of electronic materials and acquaint themselves with the functions of different electronic devices. The basic topics include: conductors, dielectric materials (ferroelectric materials, piezoelectric materials, pyroelectric materials), semiconductors and the related devices.

Recommended Textbooks/References:

1. S. O. Kasap, Principles of Electronic Materials and Devices (Third Edition)，Tsinghua University Press, 2007

2. Y. R. Li, Z. Z. Yun, Introduction of Electronic Materials, Tsinghua University Press, 2001

0005213 单片机应用技术

课程编码：0005213

课程名称：单片机应用技术

英文名称：Application technique of Single-chip Microcomputer

课程类型：专业选修课

学分： 2.0 **总学时：**32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）本科生

先修课程：模拟电子技术， 数字电子技术， 电路分析基础， 微机原理与应用， 高级语言程序设计，高级语言程序设计训练

考核形式：平时成绩+实验成绩+考试

撰写人：金冬月

课程简介：

《单片机应用技术》是面向电子科学与技术专业和微电子科学与工程专业开设的专业选修课。本课程学习对于培养学生科学原理和科学方法掌握能力、现代工程工具和信息技术工具使用能力、工程问题解决能力等方面具有重要意义。本课程的目标是理解单片机系统结构及单片机的结构原理和工作原理；掌握 MCS-51 单片机原理和软硬件开发技术；培养系统能力和面向系统构建的交流和团队协作能力。课程的主要内容包括单片机系统结构、存储器、指令系统、中断系统、定时器/计数器与串行通信口，以及汇编语言程序设计及 Silicon IDE 集成开发环境的程序调试方法。

推荐教材或主要参考书：

1. 孙育才，孙华芳，MCS-51 系列单片机及其应用（第 6 版），东南大学出版社，2019 年 1 月
2. 王彰云，凌艺春，MCS-51 系列单片机及汇编编程（第 3 版），中国铁道出版社，2019 年 2 月
3. 张毅刚，刘旺，邓立宝，单片机原理及接口技术（C51 编程）（第 2 版），人民邮电出版社，2016 年 6 月

0005213 Application technique of Single-chip Microcomputer

Course Number: 0005213

Course Title: Application technique of Single-chip Microcomputer

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and Technology & Microelectronic Science and Engineering

Prerequisites: Analog Electronic Technology, Digital Electronic Technology, Circuit Analysis Fundamentals, Computer Principles and Applications, Practical Training of Program Design, Fundamentals of C Language Program Design

Evaluation Method: Course participation + experiment achievement + written exams

Writer: Jin Dongyue

Course Description:

Application technique of Single-chip Microcomputer is one of the selective courses for undergraduate students major in electronic science and technology and microelectronics science and engineering. The main target of this course is to clarify Application technique of Single-chip Microcomputer. This course is focus on the ability to master scientific principles and methods, the ability to use modern engineering tools and information technology tools, and the ability to solve engineering problems. The goal of this course is to understand the structure of single-chip microcomputer system and the structure principle and working principle of single-chip microcomputer. The principle of MCS-51 single-chip microcomputer and software and hardware development technology should be mastered. At the same time, communication and teamwork ability for system construction should be mastered. The teaching contents are mainly covered by the following aspects: the structure of single-chip microcomputer system, memory, instruction system, interrupt system, timer / counter and serial communication port, as well as assembly language program design and program debugging method of Silicon IDE integrated development environment.

Recommended Textbooks/References:

1.Sun Yucai, Sun Huafang, MCS-51 SCM and the applications (Version 6), *Southeast University Press*, 1-2019

2.Wang Zhangyun, Lin Yichun, MCS-51 SCM and assemble programming (Version 3), *Chinese Railway Press*, 2-2019

3.Zhang Yigang, Liu Wang, Deng Libao, Principle of SCM and the interface technique (Version 2), *Posts and Telecommunications Press*, 6-2016

0007280 射频集成电路分析与设计

课程编码：0007280

课程名称：射频集成电路分析与设计

英文名称：Analysis and Design of RF Integrated Circuits

课程类型：专业选修课

学分： 2 **总学时：** 32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）本科生

先修课程：模拟电子技术、数字电子技术、电路分析基础、电磁场理论

考核形式：平时成绩+考试

撰写人：金冬月

课程简介：

《射频集成电路分析与设计》是面向电子科学与技术专业和微电子科学与工程专业开设的专业选修课。本课程侧重于应用技术理论和实践的结合，对于重点培养学生科学的思维方式以及认识新技术和应用新技术的能力具有重要意义。本课程的目标是掌握传输线基本概念及阻抗匹配问题的描述和解决方法；理解 Smith 圆图并熟练掌握 ADS 射频集成电路仿真软件的使用；增强理论结合实际能力，获得开发射频晶体管放大器的设计经验；培养系统能力和面向系统构建的交流和团队协作能力。课程的主要内容包括采用微波等效电路法即以低频电路理论为基础结合高频电压、电流波动特征的方法来分析和设计射频、微波系统，涵盖传输线、匹配网络、放大器等主要射频微波系统单元的理论分析和设计问题及电路分析工具。

推荐教材或主要参考书：

1. Reinhold Ludwig，Pavel Bretchko 著，王子宇，王心悦等译，射频电路设计-理论与应用（第 2 版），电子工业出版社，2013 年 8 月

2. Hooman Darabi 著，吴建辉，陈超译，射频集成电路及系统设计，机械工业出版社，2019 年 6 月

3. 李智群，王志功，射频集成电路与系统设计，科学出版社，2018 年 12 月

4. Matthew M. Radmanesh 著，顾继慧，李鸣译，射频与微波电子学，电子工业出版社，2012 年 1 月

0007280 Analysis and Design of RF Integrated Circuits

Course Number: 0007280

Course Title: Analysis and Design of RF Integrated Circuits

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and Technology & Microelectronic Science and Engineering

Prerequisites: Analog Electronic Technology, Digital Electronic Technology, Circuit Analysis Fundamentals, Electromagnetic Field Theory

Evaluation Method: Course participation + written exams

Writer: Jin Dongyue

Course Description:

Analysis and Design of RF Integrated Circuits is one of the selective courses for undergraduate students major in electronic science and technology and microelectronics science and engineering. The main target of this course is to clarify Analysis and Design of RF Integrated Circuits. This course is focus on the combination of theory and practice of applied technology, which is of great significance for cultivating students' scientific thinking mode and the ability to understand new technology and apply new technology. The basic principle of transmission lines and the description and solution of impedance matching problems should be mastered. Both Smith chart and ADS RF integrated circuit simulation software should be mastered to enhance the combination of theory and practical ability and obtain the development of RF transistor amplifier design experience. At the same time, communication and teamwork ability for system construction should be mastered. The teaching contents are mainly covered by the following aspects: the microwave equivalent circuit method is used to analyze and design the RF and microwave systems based on the low frequency circuit theory combined with the high frequency voltage and current fluctuation characteristics. At the same time, the theoretical analysis and design problems and circuit analysis tools of the main RF microwave system units such as transmission lines, matching networks, and amplifiers should be mastered.

Recommended Textbooks/References:

1.Reinhold Ludwig, Pavel Bretchko, RFIC Design- Theory and Applications (Version 2)，*Electronic Industry Press*, 8-2013

2.Hooman Darabi, RFIC and System Design, *Mechanical Industry Press*, 6-2019

3.Li Zhiqun, Wang Zhigong, RFIC and System Design, *Science Press*, 12-2018

4.Matthew M. Radmanesh, RF and Microwave Electronics, *Electronic Industry Press*, 1-2012

0010098 混合信号集成电路设计

课程编码：0010098

课程名称：混合信号集成电路设计

英文名称：Mixed-Signal Integrated Circuit Design

课程性质：专业选修课

学分：3.0　　**学时：**48

面向对象：微电子科学与工程专业本科生

先修课程：模拟电子技术, 数字电子技术, 信号与系统IV，集成电路原理与设计

考核形式：笔试

撰写人：张蒙

课程简介：

本课程是微电子技术与工程专业的专业选修课。本课程旨在使学生理解模数混合信号电路的基本概念，熟悉混合信号电路的基本结构，掌握混合信号电路的基本分析方法。理解混合信号电路中噪声、失配和非线性误差等重要参数的概念；了解反馈的电学概念和物理描述，熟悉反馈电路的结构，掌握反馈电路的分析方法；了解开关电容电路工作机理，基于开关电容电路结构，熟悉奈奎斯特模数转换器和数模转换器的电学参数和评价指标，了解模数转换器和数模转换器的基本架构。使学生掌握混合信号的基本概念与混合信号电路的分析方法，培养学生混合信号电路的分析能力，培养混合信号集成电路的设计能力。

推荐教材或主要参考书：

[1]David Johns, Ken Martin, Analog integrated circuit design, John Wiley & Sons，New York，1997

[2]李晓潮，邢建立，林海军，混合信号模数转换 CMOS 集成电路设计，清华大学出版社，2015

[3]Paul Gray，《模拟集成电路的分析与设计》（英文影印版），高等教育出版社，2003

[4]Behzad Razavi, 陈贵灿（译），程军（译），张瑞智（译），《模拟 CMOS 集成电路设计》，西安交通大学出版社，2003

0010098 Mixed-Signal Integrated Circuit Design

Course Number: 0010098

Course Title: Mixed-Signal Integrated Circuit Design

Course Type: Professional elective course

Credit: 3 **Total Credit Hours:** 48

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Analog Electronic Technology，Digital Electronic Technology, Signals and Systems IV, Principles and Design of Integrated Circuits

Evaluation Method: Written exam

Writer: Zhang Meng

Course Description:

This course is an elective course for students majoring in microelectronics technology and engineering. This course aims to enable students to understand the basic concepts of analog digital mixed signal circuits, to become familiar with the basic structure of mixed signal circuits and master the basic analysis methods of mixed signal circuits, to understand the concepts of important parameters such as noise, mismatch and nonlinear error in mixed signal circuits, to understand the electrical concepts and physical descriptions of feedback, to be familiar with the structure of feedback circuits and master the analysis methods of feedback circuits, to understand the working mechanism of switch capacitor circuits based on the structure of switch capacitor circuits, to be familiar with the electrical parameters and evaluation indicators of Nyquist analog-to-digital converters and analog-to-digital converters, to understand the basic architecture of analog-to-digital converters and analog-to-digital converters. to enable students to master the basic concepts of mixed signals and the analysis methods of mixed signal circuits, to cultivate students' analysis ability of mixed signal circuits and cultivate their design ability of mixed signal integrated circuits.

Recommended Textbooks/References:

[1]David Johns, Ken Martin, Analog integrated circuit design, John Wiley & Sons，New York，1997

[2] Li Xiaochao, Xing Jianli, Lin Haijun, Hybrid Signal Analog to Digital Conversion CMOS Integrated Circuit Design, Tsinghua University Press, 2015

[3] Paul Gray, "Analysis and Design of Analog Integrated Circuits" (English Photocopy Edition), Higher Education Press, 2003

[4] Behzad Razavi, Chen Guican, Cheng Jun, Zhang Ruizhi, "Analog CMOS Integrated Circuit Design", Xi'an Jiaotong University Press, 2003

0008142 专业英语

课程编码：0008142

课程名称：专业英语

英文名称：Professional English

课程类型：专业选修课

学分： 2.0 **总学时：** 32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：半导体物理，半导体器件原理，微电子工艺

考核形式： 期末笔试+平时成绩

撰写人：贾云鹏

课程简介：

能够阅读专业相关的外文资料，是大学生毕业能力要求的重要方面。专业英语为通过大量电子科学与技术（实验班）专业相关的英文文献的阅读与翻译，使学生了解并掌握电子科学与技术（实验班）专业常用专业术语（英语术语）对应的汉语表达，以及常规专业术语的英文表达，逐步提高学生的阅读、理解和翻译电子技术专业书刊资料的能力，使学生获得阅读专业文献并正确解读的能力，为将来从事专业相关的工作奠定良好的外语基础。

为了保证学生接触的专业词汇足够丰富，课程内容涉及电子元器件、集成电路、基本放大电路、数字电路等方面的基本知识。课程根据学生特点，以理解全文为主导，采用关键术语直接翻译、有重点地强调记忆，典型句式分层分析、引导学生进行翻译，整个段落理解为主，前后衔接的教学方式。

推荐教材或主要参考书：

1.吕红亮，“微电子专业英语（第一版）”，电子工业出版社，2012 年 9 月

2. 张红,“微电子专业英语”,机械工业出版社，2010 年 8 月朱

3. Jan M.Rabaey et al, Digital Integrated Circuits-A design Perspective (second Edition，影印版),清华大学出版社，2003 年

4.Donald A.Neamen, Semiconductor Physics and Devices-Basic Principles (Third Edition,影印本)，清华大学出版社，2003 年

5.James D. Plummer et al, Silicon VLSI Technology - Fundamentals, Practice and Modeling, 电子工业出版社，2003 年

0008142 Professional English

Course Number: 0008142

Course Title: Professional English

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and Technology & Microelectronic Science and Engineering

Prerequisites: Semiconductor physics, Principle of Semiconductor Devices, Micoroelectronic Technology

Evaluation Method: Written Exam + homework

Writer: Jia Yunpeng

Course Description:

The ability of reading professional relevant foreign language literature is one of the most important requirements for college students to graduate. The Professional English course enables students to understand the common professional terms and corresponding to the Chinese expressions of electronic science and technology. The students' ability will gradually improve on reading, understanding, translating and correctly interpreting electronic technology books, which will be beneficial to related future work.

In order to ensure that professional vocabulary fully contacted by students, this course content involves basic knowledge of electronic components, integrated circuits, basic amplifier circuits, digital circuits and so on. According to the characteristics of the students, the teaching method employed in this course is based on understanding the full text, using key terms to translate directly, emphasizing memory, analyzing and guiding students to translate typical sentences, understanding whole paragraph.

Recommended Textbooks/References:

1. Liu Hongliang. "English for Microelectronic (first Edition)". Publishing House of Electronics Industry，2012;

2. Zhang Hong, "English for Microelectronic", china machine press, 2010

3. Jan M.Rabaey et al, Digital Integrated Circuits-A design Perspective (second Edition),2003;

4.Donald A.Neamen, Semiconductor Physics and Devices-Basic Principles (Third Edition)， 2003;

5.James D. Plummer et al, Silicon VLSI Technology - Fundamentals, Practice and Modeling, Publishing House of Electronics Industry，2003;

0010147 深度学习技术与应用导论

课程编码：0010147

课程名称：深度学习技术与应用导论

英文名称：Introduction to Deep Learning Techniques and Its Applications

课程类型：专业选修课

学分： 2.0 **总学时：** 32

面向对象：微电子科学与工程专业本科生

先修课程：线性代数、概率论与数理统计、微积分、信号与系统、程序设计基础

考核形式：平时成绩+考试

撰写人：徐雪远

课程简介：（250-300 字）

深度学习技术与应用导论是信息学部为微电子科学与工程专业本科生开设的专业选修课。本课程的任务是介绍机器学习基本理论基础，基于神经网络的深度学习技术的基本概念，主要模型结构，核心训练方法和典型应用。通过课程的学习，使学生巩固基础数学及机器学习的基本概念和方法，掌握神经网络的基本概念，掌握深度学习中的主要网络结构和相关算法，了解具体应用领域的背景知识，能应用相关的深度学习技术，并了解 Transformer 和强化学习等新兴技术。教学内容重点：（1）机器学习和神经网络的基本概念；（2）深度学习的主流结构、激活函数、正则化技术；（3）计算机视觉技术原理与应用。教学内容的难点：机器学习模型优化、BP 算法、网络可视化与理解、Transformer。

推荐教材或主要参考书：

1、 伊恩 古德费洛等著，赵申剑等译. 深度学习. 人民邮电出版社，2017 年 10 月

2、 李航. 统计学习方法（第 2 版）. 清华大学出版社，2019 年 5 月

0010147 Introduction to Deep Learning Techniques and Its Applications

Course Number: 0010147

Course Title: Introduction to Deep Learning Techniques and Its Applications

Course Type: specialized optional courses

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Microelectronics Science and Engineering

Prerequisites: Linear Algebra, Probability Theory and Mathematical Statistics, Calculus, Signals and Systems, Programming Foundation

Evaluation Method: Course participation + written exams

Course Description:

Introduction to Deep Learning Technology and Its Application is one of the specialized optional courses for undergraduate students Major in Microelectronics Science and Engineering. The main target of this course is to clarify the theoretical foundation of machine learning, as well as the basic concepts, main model structures, core training methods, and typical applications of deep learning techniques. This course is focus on enabling students to consolidate basic concepts and methods related to mathematics and machine learning, master the basic concepts of neural networks, master the main network structures and related algorithms in deep learning, understand the background knowledge of specific applications, be able to apply related deep learning technologies, and understand emerging technologies such as Generative Adversarial Networks (GANs). The teaching contents are mainly covered by the following aspects: (1) the basic concepts of machine learning and neural networks; (2) the mainstream structure, activation function, and regularization technology of deep learning; (3) the principles and applications of computer vision technology; (4) emerging technologies including Transformer and reinforcement learning. The difficulties of teaching contents are described as followings: model optimization for machine learning, BP algorithm, network visualization and understanding, and `Transformer`.

Recommended Textbooks/References:

1. Ian Goodfellow *et al.*, Deep Learning, *Posts & Telecom Press*, October-2017. (in Chinese)

2. Hang Li, Statistical Learning Methods (2nd edition), *Tsinghua University Press*, May-2019. (in Chinese)

0009027-数字图像处理

课程编码：0009027

课程名称：数字图像处理

英文名称：Digital Image Processing

课程类型：学科选修课

学分： 2.0 **总学时：**32

面向对象：电子科学与技术本科生

先修课程：信号与系统等课程

考核形式： 平时成绩+笔试

撰写人：李嘉锋

课程简介：

数字图像处理是信息学部为电子科学与技术专业本科生开设的学科选修课程。本课程的任务是讲授计算机视觉与图像处理领域中涉及的相关基础知识。主要内容包括人类视觉感知系统、图像获取与数字化、数字图像基本运算、图像变换、图像增强、图像复原、图像压缩编码、图像分割、图像表示与描述等原理和技术方法。针对数字图像处理课程概念多、内容抽象、入门较难的特点，本课程以实践为导向，以实际工程中的具体应用为目标，逐层递进讲解数字图像处理技术基础理论及算法原理。教学内容难点是图像变换的原理与应用、图像增强与恢复原理、图像编码。

推荐教材或主要参考书：

1. 张弘等，数字图像处理与分析，机械工业出版社,2017.06;
2. 冈萨雷斯，数字图像处理，电子工业出版社,2017.05;

0009027- Digital Image Processing

Course Number: 0009027

Course Title: Digital Image Processing

Course Type: Optional Course

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in electronic science and technology

Prerequisites: Signals and Systems, etc

Evaluation Method: Course participation + written exams

Writer： Li Jiafeng

Course Description:

Digital Image Processing is one of the optional course courses for undergraduate students Major in Electronic Science and technology. The main target of this course is about basic knowledge of image processing and computer vision. The main contents include the principles and technical methods of human visual perception system, image acquisition and digitization, image basic operation, image transformation, image enhancement, image restoration, image compression coding, image segmentation, image representation and description, etc. Aiming at the characteristics of digital image processing courses with many concepts, abstract content, and difficult to get started, this course introduces the basic theory and algorithm principle of digital image processing technology step by step. The difficulty of teaching content is the principle and application of image transformation, the principle of image enhancement and restoration, and image coding.

Recommended Textbooks/References:

1.Hong Zhang, etc; Digital Image Processing and Analysis， Mechanical Industry Press,2017.06;

2.González, etc; Digital Image Processing， Publishing House of Electronics Industry,2017.05;

0007275 半导体理论

课程编码：0007275

课程名称：半导体理论

英文名称：Semiconductor theory

课程类型：专业选修课

学分：2.0　　**总学时：**32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：固体物理学

考核形式：考试

撰写人：郭春生

课程简介：（250-300 字）

《半导体理论》课程是电子科学与技术专业的专业选修课，是面向电子科学与技术及微电子科学与工程专业方向本科生所开设的专业基础与专业综合课程，是培养方案中的理论教学环节之一。开设的目的是使学生熟悉半导体物理的基础理论和半导体的主要性质，以适应后续专业课程的学习和将来工作的需要。半导体理论是在量子力学和固体物理的基础上，关于半导体基本性质、基本理论和实验方法的一门科学，本课程主要介绍固体晶格理论、半导体性质、载流子输运过程、半导体中非平衡过剩载流子、PN 结、金半接触、半导体 MOS 结构等。

推荐教材或主要参考书：（含主编，教材名，出版社，出版日期）

1.刘恩科，半导体物理，国防工业出版社，2011 年。

2. Sheng S. Li, Semiconductor Physical Electronics, 科学出版社，2007.

0007275 Semiconductor theory

Course Number: 0007275

Course Title: Semiconductor theory

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Solid state physics

Evaluation Method: Test

Writer: Guo Chunsheng

Course Description:

The course 'Semiconductor Theory' is a professional elective course for undergraduate students majoring in 'Electronic science and technology' and 'Microelectronics Science and Engineering'. It is a professional foundation and comprehensive course for undergraduate students majoring in electronic science and technology and microelectronics science and engineering. It is one of the theoretical teaching links in the training plan.

The purpose of the course is to familiarize students with the basic theories of semiconductor physics and the main properties of semiconductors, in order to meet the needs of subsequent professional courses and future work.

Semiconductor theory is a science based on quantum mechanics and solid-state physics, which deals with the basic properties, theories, and experimental methods of semiconductors. This course mainly introduces solid-state lattice theory, semiconductor properties, carrier transport processes, non equilibrium excess carriers in semiconductors, PN junctions, gold semi contacts, semiconductor MOS structures, etc.

Recommended Textbooks/References:

1. Liu Enke, Semiconductor physics, National Defense Industry Press,2011.

2. Sheng S. Li, Semiconductor Physical Electronics, Science press，2007.

0008652 电子封装技术与材料

课程编码：0008652

课程名称：电子封装技术与材料

英文名称：Electronic Packaging Technology and Materials

课程性质：专业限选课

学分： 2.0 **总学时：** 32

面向对象：微电子科学与工程类本科生

先修课程：半导体物理学，集成电路设计，半导体工艺

考核形式： 平时成绩+考试

撰写人：关宝璐

课程简介：（250-300 字）

电子封装技术在集成电路知识链中具有重要的地位，特别在后摩尔时代的集成电路产业链中扮演着桥梁和推动者的角色”。课程除要求学生掌握相关基本概念、理论外，系统且全面地阐述封装材料及封装技术，使学生理解封装技术的基本概念和主要功能，掌握常用的集成电路封装技术。对芯片键合、元器件组装和塑封技术等关键材料和 BGA、SiP、CSP 等技术手段进行较为详细介绍，使其应用渗透到微电子集成电路各个领域，进而掌握如何进行集成电路封装材料和技术的开发和制备工艺，从而为学生学习后续专业课程和工作打下基础。

推荐教材或主要参考书：

[1] 李可为. 集成电路芯片封装技术（第 2 版）. 电子工业出版社，2018 年 11 月

[2] 毕克允. 微电子封装技术. 中国科学技术大学出版社，2017 年 7 月

[3] 胡永达、李元勋、杨邦朝. 微电子封装技术. 科学出版社，2018 年 7 月

0008652 Electronic Packaging Technology and Materials

Course Number: 0008652

Course Title: Electronic Packaging Technology and Materials

Course Type: Limited Choose

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Microelectronics science and Engineering

Prerequisites: Semiconductor Physics, Integrated circuit design, Semiconductor lithographic

Evaluation Method: Course participation + written exams + Experiment

Writer： Guan Baolu

Course Description:

The electronic packaging technology plays an important role in the knowledge chain of integrated circuits, especially in the post-Moore era of the integrated circuit industry, where it acts as a bridge and promoter". In addition to requiring students to master the relevant basic concepts and theories, the course systematically and comprehensively elaborates on packaging materials and packaging technology, enabling students to understand the basic concepts and main functions of packaging technology, and to master commonly used integrated circuit packaging technologies. The provides detailed introductions to key materials such as chip bonding, component assembly, and encapsulation technology, as well as techniques such as BGA, SiP, and CSP, allowing their applications to permeate various fields of microelectronic integrated circuits. This enables students to understand the development and manufacturing processes of integrated circuit packaging materials and technologies, laying a foundation for their study of subsequent professional courses and work.

Recommended Textbooks/References:

1. Li Kewei, Integrated circuit chip packaging technology (Second), *Electronic industry Press*, 11-2018

2. Bi Keyun, Microelectronics packaging technology, University of *Science and technology of china Press,* 7-2017

3. Hu Yongda, Li Yuanxun, Yang Bangchao, Microelectronics packaging technology, *Science Press*, 7-2018

0008649 基于 FPGA 的可编程系统设计

课程编码：0008649

课程名称：基于 FPGA 的可编程系统设计

英文名称：Reconfigurable Systems Design Using FPGA

课程类型：专业选修课

学分： 2 **总学时：** 32

面向对象：微电子科学与工程专业本科生

先修课程：数字电路设计，C 语言程序设计

考核形式： 课程报告+考试

撰写人：宋惠远

课程简介：（250-300 字）

“基于 FPGA 的可编程系统设计”是信息学部为微电子科学与工程专业本科生开设的专业选修课程。基于 FPGA 的可编程系统是现代数字集成电路的前沿技术，在低功耗计算，通信，人工智能计算领域有着广泛的应用。本课程在熟练掌握数字电路设计原理的基础上，初步学习 Veilog 硬件设计语言，重点讲授 FPGA 可编程系统的架构及 EDA 设计流程，包括高层次综合，逻辑综合，工艺影射，布局布线及时序分析模块，将探讨 FPGA 可编程芯片在搭建异构计算系统中的作用，以及 FPGA 系统在人工智能计算中的应用。本课程的难点将集中于针对 FPGA 专有架构进行的设计优化。

推荐教材或主要参考书：

[1] 深亚微米 FPGA 结构与 CAD 设计，王伶俐，杨萌，周学功 译， 电子工业出版社，2008

[2] Verilog HDL 高级数字设计，张雅绮 等译，电子工业出版社，2005

0008649 Reconfigurable Systems Design Using FPGA

Course Number: 0008649

Course Title: Reconfigurable Systems Design Using FPGA

Course Type: Major Elective Course

Credit: 2 **Total Credit Hours:** 32

Students: Undergraduate students majoring in XXX

Prerequisites: Digital Integrated Circuit Design, C Programming Language

Evaluation Method: Course presentation + written exams

Writer： Song Huiyuan

Course Description:

"Reconfigurable Systems Design Using FPGA" is one of the Major Elective courses for undergraduate students Major in Microelectronics Science and Technology. The main target of this course is to understand the design and analysis of the reconfigurable systems with FPGA. This course is focus on the FPGA architecture, FPGA hardware and software systems. The teaching contents are mainly covered by the following aspects: Verilog HDL, FPGA Logic Synthesis, FPGA placement and routing, FPGA timing and power analysis. The difficulties of teaching contents are described as followings: architecture dependent optimization for FPGA systems.

Recommended Textbooks/References:

1. **Architecture and CAD for Deep-Submicron FPGAs**, V. Betz, J. Rose, andA. Marquardt, Kluwer Academic Publishers, February 1999.

2. Advanced Digital Design with the Verilog HDL, Michael D. Ciletti, Pearson Education, 2011

0004959 ASIC 设计与应用（自学）

课程编码：0004959

课程名称：ASIC 设计与应用（自学）

英文名称：ASIC Design and Application (Self-study)

课程类型：专业选修课

学分：2.5　　**总学时：**40

面向对象：电子科学与技术（实验班）专业及微电子科学与工程（实验班）专业本科生

先修课程：数字电子技术 集成电路分析与设计

考核形式：考查

撰写人：刘素娟

课程简介：（250-300 字）

《ASIC 设计与应用(自学)》是信息学部为电子科学与技术专业及微电子科学与工程专业本科生开设的专业限选课。本课程的课程目标是使学生理解专用集成电路(ASIC)的概念，初步掌握 ASIC 的设计方法和设计流程，培养学生的系统和工程思想，关注 ASIC 设计技术的最新进展，为学生从事与集成电路相关的工作奠定良好的基础。本课程教学内容重点是结合先进的技术和设计方法，以 Veilog HDL 为工具，针对 ASIC 设计的重要内容和工程设计技术进行了全面深入的讨论。教学内容的难点是培养学生的“工程设计”能力，着重讲述了使用 Verilog 进行数字系统的设计、验证及综合，使培养学生初步掌握 RTL 级数字电路模块和系统描述、设计、验证的基本流程和工程设计方法。

推荐教材或主要参考书：（含主编，教材名，出版社，出版日期）

1. 虞希清，专用集成电路设计实用教程，浙江大学出版社，2007
2. Michael John Sebastian Smith 著，虞惠华 等译,专用集成电路,电子工业出版社,2007
3. Sanir Palnitkar 著，夏宇闻 等译,Verilog HDL 数字设计与综合(第 2 版)，电子工业出版社，2009
4. 来新泉，专用集成电路设计基础教程，西安电子科技大学出版社，2008
5. 何宾,EDA 原理及 Verilog 实现,清华大学出版社,2010

0004959 ASIC Design and Application (Self-study)

Course Number: 0004959

Course Title: ASIC Design and Application (Self-study)

Course Type: Electives

Credit: 2.5 **Total Credit Hours:** 40

Students: Undergraduate students major in Electronic Science and technology and Microelectronics Science and Engineering

Prerequisites: Digital electronic technology; Integrated circuit analysis and design

Evaluation Method: Research project report

Writer: Liu Sujuan

Course Description:

ASIC Design and Application (Self-study) is a limited elective course for undergraduates majoring in Electronic Science and technology and microelectronics science and engineering established by Information Faculty. The main target of this course is to clarify the concept of application specific integrated circuit (ASIC), ASIC design methodology and design process, cultivate the ideas of the system and project , concern the latest developments in ASIC design technology, prepare for students who will be engaged with IC related work. This course focus on the advanced technology and design methods to Veilog HDL and discusses the important content for ASIC design and engineering technology. The difficulties of teaching contents are described as followings: cultivate students' engineering ability, especially using Verilog design digital system, verification and synthesis. The students will grasp the method and design flow of the modern ASIC.

Recommended Textbooks/References:

1. Yu Xiqing. ASIC design and practical tutorial，Zhejiang University Press,，2007

2. Michael John Sebastian Smith Application specific integrated circuit Electronic Industry Press,2007

3. Sanir Palnitkar. Verilog HDL A guide to digital design and synthesis (3rd Edition). Electronic Industry Press,2009

4. Lai Xinquan，ASIC Design Essentials，Xidian University Press，2008

5. He Bin. EDA principle and Verilog implementation, Tsinghua University Press,2010

0010129 片上系统集成（双语）

课程编码：0010129

课程名称：片上系统集成（双语）

英文名称：System on a Chip

课程类型：专业选修课

学分： 2.0 **总学时：** 32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）本科生

先修课程：半导体器件原理、微电子工艺、集成电路分析与设计、电路分析基础、模拟电子技术、数字电子技术

考核形式： 平时成绩+考试

撰写人：谢雪松

课程简介：

《片上系统集成 (双语)》是信息学部为电子科学与技术（实验班）专业本科生开设的专业限选课程类型。本课程的任务是使学生跟踪集成电路发展新方向、掌握片上系统集成的设计方法学和设计环境等，提高学生对新技术的适应能力，为今后从事集成电路设计相关工作打下良好基础。

SOC (System on Chip,片上系统)是 ASIC(Application Specific Integrated Circuits)设计方法学中的新技术，是指以嵌入式系统为核心，以 IP 复用技术为基础，集软、硬件于一体，并追求系统最大兼容的集成芯片。

SOC 设计方法学主要研究总线架构技术、IP 核可复用技术、软硬件协同设计技术、SOC 设计验证技术、芯片综合/时序分析技术、可测性/可调试性设计技术、低功耗设计技术等，此外还要做操作系统或嵌入式软件移植、开发研究，是一门跨学科的新兴课程。

推荐教材或主要参考书：

1.郭炜[等] 编著，《SoC 设计方法与实现（第三版）》，电子工业出版社，2017，ISBN：978-7-121-32254-9。

2.梅雪松.《SoC FPGA 嵌入式设计和开发教程》.北京航空航天大学出版社.2019.ISBN：9787512422391

3.Jan M.Rabeay.《数字集成电路 电路、系统与设计（第二版）》 [Digital Integrated Circuits: A Design Perspective].电子工业出版社.2017.ISBN：9787121305054

4.[美] Sung-Mo Kang，[美] Yusuf Leblebici，[韩] Chulwoo Kim 著.《CMOS 数字集成电路：分析与设计（第 4 版 英文版）》 [CMOS Digital Integrated Circuits Analysis and Design, Fourth Edition] .电子工业出版社.2015.ISBN：9787121248047

5. [美]Chris Rowen.《复杂 SoC 设计(英文版)》.机械工业出版社.2005.ISBN:9787111171935

6. 罗萍.《集成电路设计导论（第 2 版）》.清华大学出版社.2015.ISBN：9787302404545

7. 陆启帅，陆彦婷，王地.《Xilinx Zynq SoC 与嵌入式 Linux 设计实战指南 兼容 ARM Cortex-A9 的设计方法》.清华大学出版社.201.ISBN：9787302373445
8. 李兰英等.《Nios Ⅱ嵌入式软核 SOPC 设计原理及应用》.北京航空航天大学出版社.2006 .ISBN：9787810779005

0010129 System on a Chip

Course Number: 0010129

Course Title: System on a Chip

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students in Electronic Science and Engineering & Microelectronic Science and Engineering

Prerequisites: Principles of semiconductor devices, microelectronics technology, integrated circuit analysis and design, basis of circuit analysis, analog circuit technology, digital circuit technology

Evaluation Method: Course participation + written exams

Writer: Xie Xuesong

Course Description:

System on chip integration (SOC) (Bilingual) is a kind of specialized direction course for undergraduates majoring in Electronic Science and technology. The task of this course is to help students to track the new trend of IC development, and master the design methodology and design environment of system on chip, improve students' adaptability to new technologies, and lay a good foundation for future work related to IC design.

SOC (system on chip) is a new technology in ASIC (application specific integrated circuits) design methodology. It involves to an integrated chip which takes embedded system as the core and IP reuse technology as the basis, integrates software and hardware, and pursues the maximum system flexibility.

SOC design methodology mainly studies bus architecture technology, IP core reusability technology, software and hardware co-design technology, SOC verification technology, chip synthesis / timing analysis technology, testability / debuggability design technology, low-power design technology, etc. in addition, it is a new interdisciplinary course includes transplant and develop operating system or embedded software.

Teaching content focus: the design and implementation of SOC. Course difficulty: the theory and practice of IP reuse.

Recommended Textbooks/References:

1.GuoWei ,《SoCdesign and implementation(third edition)》，Publishing House of Electronic Industry，2017，ISBN：978-7-121-32254-9。

2. Mei Xuesong.《SoC FPGA Embedded design and development tutorial》.BeiHang University Press. 2019.ISBN：9787512422391

3. Jan M.Rabeay.Digital Integrated Circuits: A Design Perspective.Publishing House of Electronic Industry.2017.ISBN：9787121305054

4. Sung-Mo Kang，Yusuf Leblebici，Chulwoo Kim [CMOS Digital Integrated Circuits Analysis and Design, Fourth Edition] .Publishing House of Electronic Industry.2015.ISBN：9787121248047

5. Chris Rowen. Engineering the Complex SOC.China Machine Press.2005.ISBN: 9787111171935

6. Luo Ping.Introduction of IC Design[2nd edition]. Tsinghua University Press.2015.ISBN：9787302404545

7. Lu Qishuai. Xilinx Zynq SoC andEmbedded Linux design practice guide. Tsinghua University Press. 201.ISBN：9787302373445

8. Li Lanying. Design principle and application of Nios II embedded soft core SOPC. BeiHang University Press. 2006 .ISBN：9787810779005

0010069 低功耗集成电路设计

课程编码：0010069

课程名称：低功耗集成电路设计

英文名称：Design of Low Power IC

课程类型：专业选修课

学分： 2.0 **总学时：** 32

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：模拟电子技术、数字电子技术、电路分析基础、电磁场理论

考核形式：平时成绩+实验成绩+考试

撰写人：崔碧峰

课程简介：

低功耗集成电路设计是一门电子科学与技术的专业技术课，本课程从工艺器件方面，探究低功耗电子学的历史、深亚微米体硅 SOI 技术的进展、CMOS 纳米工艺中的漏电、纳米电子学与未来发展趋势、以及光互连技术；从低功耗电路方面，探究深亚微米设计建模、低功耗标准单元、高速低功耗动态逻辑与运算电路、以及在结构、电路、器件的各个层面上的低功耗设计技术。

推荐教材或主要参考书：

1. ［美］ 简·拉贝艾（Jan Rabaey） 著，蒲宇，赵文峰，哈亚军，杨胜齐 译 《低功耗设计精解 [Low Power Design Essentials]》 机械工业出版社 2020
2. ［瑞士］ Christian Piguet，译者：夏晓娟，张洪俞，吉新村，杨淼 编 《低功耗处理器及片上系统设计(集成电路设计)》 科学出版社，2012
3. 《低功耗 CMOS 电路设计》，陈力颖编，科学出版社，2011
4. 《低功耗集成电路原理与应用》，盛法生编，浙江大学出版社，2011
5. 《低压低功耗 CMOS/BiCMOS 超大规模集成电路》，Kiat-Seng Yeo,Samir S.Rofail,Wang-Ling Goh 著， 周元兴译，浙江大学出版社，2011

0010069 Design of Low Power Integrated Circuits

Course Number: 0010069

Course Title: Design of Low Power Integrated Circuits

Course Type: Electives

Credit: 2.0 **Total Credit Hours:** 32

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Analog Electronic Technology, Digital Electronic Technology, Circuit Analysis Fundamentals, Electromagnetic Field Theory

Evaluation Method: Course participation + written exams

Writer： Cui Bifeng

Course Description:

Low power integrated circuit design is a professional course of Electronic Science and technology. From the aspect of process devices, this course explores the history of low-power electronics, the progress of deep submicron bulk silicon SOI technology, leakage in CMOS nano process, Nano Electronics and future development trend, and optical interconnection technology; from the aspect of low-power circuit, it explores deep submicron design modeling and low-power consumption Standard cell, high-speed and low-power dynamic logic and operation circuit, and low-power design technology at all levels of structure, circuit and device.

Recommended Textbooks/References:

1. Jan Rabaey, translated by Pu Yu, Zhao Wenfeng, ha Yajun, Yang Shengqi, Low Power Design Essentials, China Machine Press 2020

2. Translated by Xia Xiaojuan, Zhang Hongyu, Ji Xincun, Yang Miao Low Power Processor and Pystem On Chip, , Science Press, 2012

3. Chen Liying,Low power CMOS circuit design, Science Press, 2011

4. Sheng Fasheng,Principles and applications of low power integrated circuits, Zhejiang University Press, 2011

5. Translated by Zhou Yuanxing, Low voltage and low power CMOS / BiCMOS VLSI, Zhejiang University Press, 2011

0009394 新生研讨课

课程编码：0009394

课程名称：新生研讨课

英文名称：Freshman Seminar

课程类型：自主课程

学分： 1.0 **总学时：**16

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：无

考核形式： 平时成绩+小组研讨与陈述

撰写人：崔碧峰

课程简介：（250-300 字）

新生研讨课是信息学部为电子科学与技术（实验班）、微电子科学与工程（实验班）专业本科生开设的自主课程。本课程的任务是经过专业导航、经历认知和体会研究的讨论，使新生认知所学专业，激发其求知欲、好奇心和研究兴趣，培养其积极思考、讨论和探究式学习的习惯，逐步形成创新思维能力。

推荐教材或主要参考书：

互联网络，相关调研资料，及辅助教学工具。

0009394 Freshman Seminar

Course Number: 0009394

Course Title: Freshman Seminar

Course Type: Major Required Course

Credit: 1.0 **Total Credit Hours:** 16

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: none

Evaluation Method: Course participation + Group discussion and presentation

Writer： Cui Bifeng

Course Description:

Freshman Seminar is one of the Major Required Courses for undergraduate students Major in Electronic Science and Technology. The main target of this course is to to have a discussion on professional navigation, experience cognition and experience research, so that freshmen can recognize their majors, stimulate their thirst for knowledge, curiosity and research interest, cultivate their habits of positive thinking, discussion and inquiry learning, and gradually form their innovative thinking ability.

Recommended Textbooks/References:

1. Something in Internet or relevant research data

0010120 离散数学

课程编码：0010120

课程名称：离散数学

英文名称：Discrete Mathematics

课程类型：自主课程

学分： 2.0 **总学时：** 36

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：高等数学, 线性代数

考核形式： 平时成绩+考试

撰写人：李晓光

课程简介：

《离散数学》是信息学部电子科学与技术学院为电子科学与技术（实验班）专业、微电子科学与工程(实验班)专业本科生开设的专业选修课。本课程的任务是通过本课程的学习，使学生掌握集合论、图论和逻辑推理的基本理论，具有一定的抽象思维和逻辑推理的能力；完成逻辑推导、公式证明，培养理论联系实际的能力，可以利用理论知识解决实际问题；通过了解离散数学在后续相关领域中的应用，培养学生工程意识和终身学习意识。教学内容重点：集合论、图论和数理逻辑的基本理论。教学内容的难点：集合的运算性质、二元关系和函数的计数、欧拉图与哈密顿图和推理理论。

推荐教材或主要参考书：

1. 邓米克，邵学才，编著.离散数学，清华大学出版社，2015年5月.

2. 屈婉玲、耿素云、张立昂，离散数学（第2版），高等教育出版社，2015年3月.

3. Kenneth H. Rosen，Discrete Mathematics and Its Applications（英文精编版.第8版），机械工业出版社, 2020年1月.

0010120 Discrete Mathematics

Course Number: 0010121

Course Title: Discrete Mathematics

Course Type: Major Required Course

Credit: 2.0 **Total Credit Hours:** 36

Students: Undergraduate students majoring in Electronic Science technology & Microelectronics Science and Engineering

Prerequisites: Calculus, Linear algebra

Evaluation Method: Course participation + written exams

Writer: Li Xiaoguang

Course Description:

Discrete Mathematics is one of the elective courses for undergraduate students Major in Electronic Science technology, and Microelectronics. The main target of this course is to clarify the basic theories of set theory, graph theory and logical reasoning. Through this course, students will have certain abstract thinking and logical reasoning abilities; complete logical deductions and formula proofs, cultivate the ability to integrate theory with practice, and use theoretical knowledge in applications to solve practical problems; cultivate students' sense of engineering and lifelong learning by understanding the application of discrete mathematics in the follow-up related fields. The teaching contents are mainly covered by the follows: basic theories of set theory, graph theory and logic and proofs. The difficulties of teaching contents are described as followings: operational properties of sets, counting of binary relations and functions, Euler and Hamiltonian diagrams, and reasoning theory.

Recommended Textbooks/References:

1 Mike Deng, Xuecai Shao. Discrete Mathematics, *Tsinghua Press*, May-2015. (In Chinese)

2 Wanling Qu, Suyun Geng, and Liang Zhang， Discrete Mathematics (2nd Edition), *Higher Education Press*, March-2015 (In Chinese)

3 Kenneth H. Rosen，Discrete Mathematics and Its Applications (Eighth Edition), *China Machine Press*, Jan.-2020

0007260 认识实习

课程编码：0007260

课程名称：认识实习

英文名称：Cognitive Practice

课程类型：自主课程

学分：1　　总学时：30

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：大学物理Ⅰ，模拟电子技术，数字电子技术

考核形式：出勤考核+参观学习考核+报告考核

撰写人：崔碧峰

课程简介：

认识实习是微电子学院为电子科学与技术（实验班）、微电子科室与工程（实验班）专业本科生开设的必修实习课程类型。本课程的任务是学生感知专业相关行业特色，及对专业知识的需求，了解专业相关的公司企业的工作内涵、市场情况及其与国内外同类企业的竞争能力。初步认识电子科学与技术（实验班）、微电子科学与工程（实验班）专业相关的器件、电路开发设计、性能测试、批量生产、销售服务等环节，增强学生对专业前景的感知。与企业对接，使学生了解本专业的前沿技术与挑战，培养学生的社会责任感与国际化视野，激发学生勇于探索和创新的精神。教学内容重点：初步认识电子科学与技术相关的器件、电路开发设计、性能测试、批量生产、销售服务等环节。教学内容的难点：了解电子科学与技术（实验班）、微电子科学与工程（实验班）专业相关的工作内容与需求等。

推荐教材或主要参考书：

无

0007260 Cognitive Practice

Course Number: 0007260

Course Title: Cognitive Practice

Course Type: Major Required Course

Credit: 1 **Total Credit Hours:** 1 week

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: College Physics, Analog Electronics Technique, Digital Electronics Technique

Evaluation Method: Attendance + Enterprise assessment + Report

Writer： Cui Bifeng

Course Description:

Cognitive practice is one of the practice compulsory courses for undergraduate students major in electrical science and technology. The main target of this course is to make students perceive the major feature and industry requirement. Students will know the working environment, market situation, and the competition among similar enterprises. This is also a good way to help students preliminarily understand the devise and circuit design, manufacture, measurement, and sale. All these processes cultivate the social responsibility and international view of students, and motivate their exploration sprit and innovation capability.

The teaching content for students is to preliminary understand the devise and circuit design, manufacture, measurement, and sale. The difficulty of teaching contents is how to solve practical engineering problem.

Recommended Textbooks/References:

None

0010719 学术前沿课程

课程编码：0010719

课程名称：学术前沿课程

英文名称：Lectures on the Frontiers of Science

课程类型：自主课程

学分： 1.0 **总学时：** 16

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：半导体器件物理，集成电路原理与设计

考核形式： 平时成绩+报告

撰写人：黄帅

课程简介：

《学术前沿课程》为学生的学术成长和职业生涯发展打下坚实的基础，具有重要的学习和发展价值。课程旨在引导学生关注本学科的发展前沿，了解相关科学技术的热点问题、新兴技术和未来发展趋势，拓宽学术视野，更新知识储备，促进学术交流，同时培养创新性思维和探索精神，提高逻辑分析能力和解决问题的能力。本课程主要讲述电子科学与技术领域的相关研究热点与技术发展重点，包括集成电路新兴光刻工艺、钙钛矿基光电器件、MOSFET性能提升技术、先进功率半导体器件、人工智能芯片、集成电路发展及模数转换技术、低功耗医疗电子与微能量采集芯片设计等内容。

推荐教材或主要参考书：

[1] [美] B. Jayant Baliga 著， 于坤山，金锐，杨霏，赵志斌，齐磊 译. 《先进的高压大功率器件—原理、特性和应用》. 机械工业出版社. 2015

[2] [美] Behzad Razavi 著，池保勇 编译. 《模拟 CMOS 集成电路设计》. 清华大学出版社. 2017

0010719 Lectures on the Frontiers of Science

Course Number: 0010719

Course Title: Lectures on the Frontiers of Science

Course Type: Major Required Course

Credit: 1.0 **Total Credit Hours:** 16

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Semiconductor Physics, the Principle and Design of Integrated Circuits

Evaluation Method: Course participation + Reports

Writer： Huang Shuai

Course Description:

The Lectures on the Frontiers of Science course is designed to provide a solid foundation for the academic growth and career development. It aims to guide students to focus on the discipline forefront, understand the hot issues, emerging technologies and future trends in related scientific and technological fields. Furthermore, it can broaden academic perspectives, update knowledge reserves, promote academic exchanges, cultivate innovative thinking/exploratory spirit, and improve logical analysis and problem-solving skills. This course mainly covers research hotspots and technological developments in the field of Electronic Science and Technology, including the emerging lithography processes for integrated circuits, perovskite-based optoelectronic devices, MOSFET performance enhancement techniques, advanced power semiconductor devices, artificial intelligence chips, integrated circuit development and analog-to-digital conversion techniques, low-power medical electronics, and microenergy harvesting chip design.

Recommended Textbooks/References:

1. B. Jayant Baliga, translated by Kunshan Yu, Rui Jin, Fei Yang, Zhibin Zhao, Lei Qi, Semiconductor Power Devices: Physics, Characteristics, Reliability, *China Machine Press*, 4-2013.

2. Behzad Razavi, translated by Baoyong Chi, Design of Analog CMOS Integrated Circuits, *Tsinghua University Press*, 1-2018.

0010082 电子设计 EDA

课程编码：0010082

课程名称：电子设计 EDA

英文名称： Electronic Design EDA

课程类型：自主课程

学分：1.0 **总学时：** 30

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：数字电子技术，模拟电子技术、电路分析基础

考核形式： 完成设计要求

撰写人：袁颖

课程简介：（250-300 字）

掌握电子设计中的主流 EDA 工具使用对于电子科学与技术专业与微电子科学与工程专业本科生来讲是一项非常重要的技能，本课程的目标是培养学生基于集成电路设计主流 EDA 工具进行设计和测试的能力，使学生掌握当今集成电路设计中常用的一些设计与测试 EDA 工具，掌握微电子技术人员所需的基本理论和技能，为进一步学习有关专业课程和日后从事集成电路设计工作打下基础。课程的主要内容包括：掌握基于 FPGA 的原型验证方法及相关的 Vivado 工具使用，掌握基于 PYNQ 的嵌入式系统设计方法及相关工具使用，掌握基于 Ni 的模拟集成电路测试方法及相关的 Labview 工具使用。教学内容的难点：设计与测试、设计与验证之间的关系及设计方法的理解与掌握。

推荐教材或主要参考书：

1. 邹雪诚 等，VLSI 设计方法与项目实施，科学出版社，2007 年 8 月

2. 韩雁，韩晓霞，丁扣宝，集成电路设计 CAD/EDA 工具实用教程，机械工业出版社，2010 年 9 月

3. 刘雯，ASIC 设计理论与实践-RTL 验证、综合与版图设计，人民邮电出版社，2019 年 4 月

4. 李广军，郭志勇等，数字集成电路与系统设计，电子工业出版社，2015 年 10 月

5. 廉玉欣，侯博雅等，Vivado 入门与 FPGA 设计实例，电子工业出版社，2018 年 9 月

0010082 Electronic Design EDA

Course Number： 0010082

Course Title: Electronic Design EDA

Course Type: courses in practice

Credit: 1.0 **Total Credit Hours:** 30

Students: Undergraduate students majoring in Electronic Science and technology & Microelectronics Science and Engineering

Prerequisites: Digital Electronic Technology, Analog Electronics, Fundamentals of circuit analysis

Evaluation Method: Practice Design

Writer： Yuan Ying

Course Description:

Mastering the use of mainstream EDA tools in electronic design is a crucial skill for undergraduate students Major in Electronic Science and Technology and Microelectronics Science and engineering. The main target of this course is to clarify the ability to design and test based on mainstream EDA tools of integrated circuit design. This course is focus on master some EDA tools commonly used in today's integrated circuit design, master the basic theories and skills required by microelectronics technicians. The teaching contents are mainly covered by the following aspects: The use of FPGA based prototype verification methods and Vivado tools; the use of PYNQ based embedded system design methods and tools; the use of Ni based analog IC testing methods and related Labview tools. The difficulties of teaching contents are described as followings: Understanding and mastering the relationship between design and testing, design and validation, and design methods.

Recommended Textbooks/References:

1. Zou Xuecheng, et al, VLSI Design Method and Project Implementation, *Science Press*, Oct-2007

2. Han Yan, Han Xiaoxia, Ding Koubao, Integrated circuit design CAD / EDA tools practical course, *China Machine Press*, Sept-2010

3. Liu Wen, ASIC design theory and practice - RTL verification, synthesis and layout design, *Post & Telecom Press*, Apr-2019

4. Li Guangjun, Guo Zhiyong,et al, Digital integrated circuit and system design, *Publishing House of Electronics Industry,*Oct-2015

5. Lian Yuxin, Hou Boya, et al, Introduction to Vivado and FPGA design examples, *Publishing House of Electronics Industry*, Sept-2018

0010060 半导体制造环境与安全规范实验

课程编码：0010060

课程名称：半导体制造环境与安全规范实验

英文名称：Semiconductor Manufacturing Environment and Safety Specification Experiment

课程类型：自主课程

学分： 0.5 **总学时：** 16

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：工程伦理

考核形式：平时成绩+考试

撰写人：刘莹

课程简介：

半导体制造环境与安全规范实验是信息学部为电子科学与技术（实验班）专业本科生开设的自主课程。本课程的任务是通过学习半导体制造环境和安全规范，参观半导体生产工艺线及安全演练，从直观上认识半导体制造环境并建立各工序之间的相互联系，获取直接经验知识及感性认识，为后续专业课程的学习奠定必要的实践知识，同时提高学生在日后工作和生活中的应急能力，防止和减少安全事故的发生。教学内容重点：半导体生产工艺线的介绍及进入工艺线前的安全教育；主要半导体制造设备的功能、特点以及使用注意事项；安全生产的一般常识，工艺线中各种废弃物的处理。教学内容的难点：各种有毒、有害气体、液体在工艺中的作用、使用方式及回收处理。

推荐教材或主要参考书：

1. [美] Peter Z，芯片制造（第六版），电子工业出版社，2019 年 3 月

2. 陈卫华，实验室安全风险控制与管理，化学工业出版社，2017 年 2 月。

0010060 Semiconductor Manufacturing Environment and Safety Specification Experiment

Course Number: 0010060

Course Title: Semiconductor Manufacturing Environment and Safety Specification Experiment

Course Type: Major Required Course

Credit: 0.5 **Total Credit Hours:** 16

Students: Undergraduate students majoring in Electronic Science and Technology, or Microelectronics Science and Engineering

Prerequisites: Engineering ethics

Evaluation Method: Course participation + written exams

Writer： Liu Ying

Course Description:

Semiconductor Manufacturing Environment and Safety Specification Experiment is one of the professional foundation and comprehensive for undergraduate students Major in Electronic Science and Technology. The main target of this course is to clarify the semiconductor manufacturing environment and safety specifications, visit the semiconductor production process line and safety drill, intuitively understand the semiconductor manufacturing environment, establish the relationship between various processes, obtain direct experience knowledge and perceptual knowledge, and accumulate the necessary practical knowledge for the study of subsequent professional courses. At the same time, improve students' emergency ability in future work and life, and prevent and reduce the occurrence of safety accidents. This course is focus on introduction of semiconductor production process line and safety education before entering the process line. The teaching contents are mainly covered by the following aspects: general knowledge of safety production and treatment of various wastes in the process line. The difficulties of teaching contents are described as followings: the function, use mode and recovery treatment of various toxic and harmful gases and liquids in the process.

Recommended Textbooks/References:

1. Peter Z, Microchip Fabrication(Sixth Edition), *Publishing House of Electronics Industry*, 3-2019.

2. Weihua Chen, Laboratory Safety Risk Control and Management, *Chemical Industry Press*, 2-2017.

0010663 学术写作课程

课程编码：0010663

课程名称：学术写作课程

英文名称：Academic Paper Writing

课程类型：自主课程

学分： 1.0 **总学时：** 16

面向对象：电子科学与技术（实验班）专业、微电子科学与工程（实验班）专业本科生

先修课程：新生研讨课

考核形式：平时成绩+小组研讨与陈述+论文写作

撰写人：杨峰

课程简介：（250-300 字）

掌握学术论文写作是大学本科教育阶段完成学业并取得学位应具备的基本能力和基本素质之一。本课程通过系统讲授电子科学与技术和微电子科学与工程（实验班）专业本科毕业论文的选题、开题、框架安排及写作思路，文献检索与资料搜集，以及如何开展基础性学术研究等相关知识，对学生进行科学研究方面基本知识的传授和基本技能的训练，以提高学生的科研素养和论文写作能力。要求学生了解学术论文写作的基本程序及规范，掌握学术论文写作的基本知识和技巧，为本科生毕业论文的撰写提供重要指导，也为其将来在国内外期刊上发表论文打下坚实基础。同时，这门课程在全面介绍学术研究和论文写作相关知识的基础上，培养学生对学术研究的兴趣以及学术创新的意识和能力。

推荐教材或主要参考书：

[1] 郭倩玲. 科技论文写作（第二版）. 化学工业出版社，2019 年 10 月

[2] 张孙玮、赵卫国、张迅. 科技论文写作入门（第五版）. 化学工业出版社，2019 年 11 月

[3] 周淑敏、周靖. 学术论文写作. 清华大学出版社，2018 年 1 月

[4] 周新年. 科学研究方法与学术论文写作（第二版）. 科学出版社，2019 年 1 月

[5] Stanley Chodorow. Writing a Successful Research Paper: A Simple Approach. Hackett Publishing Co, Inc, 2011 年 11 月

0010663 Academic Paper Writing

Course Number: 0010663

Course Title: Academic Paper Writing

Course Type: Major Required Course

Credit: 1.0 **Total Credit Hours:** 16

Students: Undergraduate students majoring in Electronic Science and Technology, or Microelectronics Science and Engineering

Prerequisites: Freshman Seminar

Evaluation Method: Course participation + Group discussion and presentation + written paper

Writer： Yang Feng

Course Description:

Academic paper writing is one of the basic skills that college students should have, to complete their studies and obtain the bachelor degrees during their education in the university. The course is for the students majored in Electronic Science and Technology, and Microelectronics Science and Engineering. It includes all kinds of skills for academic writing, such as how to find a research topic, starting and organizing it, literature searching and data collection for it, how to carry out basic academic research, enhancing their basic knowledge and skills of scientific research, and improving students' scientific research literacy and thesis writing ability. The course requires the students to understand the basic procedures and norms of academic paper writing, master the basic knowledge and skills, have a preview for the undergraduate graduation thesis writing, and learn how to publish papers in domestic and foreign journals in the future. At the same time, the course fosters students' interest in academic research, and academic consciousness and ability of innovation.

Recommended Textbooks/References:

1. Guo Qianling. Scientific paper writing (2nd Edition). Chemical Industry Press, October 2019

2. Zhang Sunwei, Zhao Weiguo, Zhang Xun, etc. Introduction to scientific paper writing (Fifth Edition). Chemical Industry Press. November 2019

3. Zhou Shumin, Zhou Jing. Academic paper writing. Tsinghua University Press, January 2018

4. Zhou Xinnian. Scientific research methods and academic paper writing (2nd Edition). Science Press, January 2019

5. Stanley Chodorow. Writing a Successful Research Paper: A Simple Approach. Hackett Publishing Co, Inc, November 2011