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

0000525 统计物理

课程编号：0000525

课程名称：统计物理

英文名称： Statistical Physics

课程类型：学科基础必修课

学分：2.0　　**总学时：** 32

面向对象：电子科学与技术（实验班）专业本科生

先修课程：大学物理Ⅰ、高等数学（工）

考试形势：平时成绩+笔试

撰写人：邢艳辉

课程简介：

《统计物理》是信息学部为电子科学与技术（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，使学生基本掌握热力学的基本理论，均匀物质的热力学性质，统计物理的基本概念及基本方法，经典粒子的玻尔兹曼统计及其应用， 量子性粒子的玻色统计和费米统计及其简单应用。而且能够运用这些理论解决典型问题，使学生理论学习能力，运用理论解决物理问题的能力得到培养和提高，为后面的专业课（固体物理、半导体物理、半导体器件原理等）学习打下理论基础。教学内容重点：热力学系统的基本概念原理，经典粒子和量子性粒子统计与分布。教学内容难点：熵增加原理应用，麦氏关系应用，玻尔兹曼分布，费米分布，玻色分布。

推荐教材或主要参考书：

[1].汪志诚《热力学 · 统计物理》高等教育出版社，2008

[2]. 王竹溪《统计物理学导论》 高等教育出版社 1965

[3]. 李卫《热力学与统计物理》北京理工大学出版社 1989

[4]. 林宗涵《热力学与统计物理学》北京大学出版社 2009

[5]. 苏汝铿《统计物理学》　复旦出版社　1990

0000525 Statistical Physics

Course Number: 0000525

Course Title: Statistical Physics

Course Type: Basic Compulsory Course

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

Students: Undergraduate students major in Department of Electronic Science and Technology

Prerequisites: General Physics, Advanced Mathematics s

Evaluation Method: Course participation + written exams

Writer: Xing Yanhui

Course Description:

Statistical Physics is one of the required foundation courses for undergraduate students Major in electronic science and technology. Through learning the course, the students could learn thermodynamics basic theory, classical particle's Boltzmann statistics and its applications, quantum particle's Bose statistics and Fermi statistics and its applications. And could Use these theories to solve the typical problems, training and improve students' theoretical learning ability, and the ability to use theory to solve physical problems, For the following specialized courses (Solid State Physics, Semiconductor Physics, Semiconductor device theory, et al) learning to lay a theoretical foundation.

Recommended Textbooks/References:

1. Wang Zhicheng. Thermodynamics · statistical physics.Higher Education Press.2008
2. Wang Zhuxi. Stats Physics Introduction. Higher Education Press. 1965
3. Li Wei. Thermodynamics and Statistical Physics. Beijing Institute of Technology Press. 1989
4. Lin Zonghan.Thermodynamics and Statistical Physics.Peking University Press. 2009
5. Su Rujian .Statistical physics. Fudan University Press . 1990

0002004 量子力学Ⅲ

课程编码：0002004

课程名称：量子力学Ⅲ

英文名称：Quantum Mechanics

课程类型：学科基础必修课

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：苏金宝

课程简介：（250-300 字）

《量子力学》是描述微观粒子运动规律的理论，是进入现代科学问题研究不可或缺的基础。课程要求学生掌握量子力学的基本概念、基本原理和基本的解题技巧，并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，培养学生理解系统的能力和对微电子复杂工程问题的解决方案进行分析、建模、进行推导和求解能力。内容包括德布罗意假设、波函数和态叠加原理等量子力学基本概念，在这些基础上引入薛定谔方程，并用薛定谔方程处理了一维势阱、线性谐振子和氢原子问题，最后讲述了算符的概念和性质、量子力学算符与力学量的关系，微扰及量子跃迁，自旋及全同粒子。

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 年 6 月

[2].苏汝铿，量子力学，高等教育出版社，2002 年 12 月

[3].曾谨言，量子力学导论，北京大学出版社，2001 年 12 月

0002004 Quantum Mechanics

Course Number: 0002004

Course Title: Quantum Mechanics

Course Type: Basic Compulsory Course

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Advanced Mathematics, General Physics

Evaluation Method: Course participation + written exams

Writer: Su Jinbao

Course Description:

Quantum Mechanics is a theory describing motion principles of microscopic particles and an indispensable base for studying the modern science. The students are expected to master the basic concepts, basic principles and basic problem-solving skills of quantum mechanics. The course requires the students to use the basic principles to solve elementary problems of quantum mechanics and also cultivates their ability to understand a system and analyze, model, derivate and solve the complicated engineering problems in micro-electronics. The teaching contents starts from the basic concepts including De Broglie hypothesis, wave function and the superposition principle to the introduction of the Schrödinger equation based on these bases. Then the Schrödinger equation is used to solve the problems including one-dimensional potential well, the linear harmonic oscillator and the hydrogen atom. Finally, the concept and nature of operators, the relationship between quantum mechanical operators and mechanical quantities, perturbation and quantum transitions, spin and isotopic particles are introduced.

Recommended Textbooks/References:

1.ZHOU Shixun, Quantum Mechanics Tutorial, Higher Education Press, June-2009.

2. SU Rukeng, Quantum Mechanics, Higher Education Press, December-2002

3. ZENG jinyan, Introduction to Quantum Mechanics, Peking University Press, December-2001

0000519 固体物理学

课程编码：0000519

课程名称：固体物理学

英文名称：Solid-State Physics

课程类型：学科基础必修课

学分： 2.0 **总学时：** 32

面向对象：电子科学与技术（实验班）专业本科生

先修课程：统计物理，量子力学

考核形式：平时成绩+考试

撰写人：李建军

课程简介：

《固体物理学》是固体材料和固体器件的基础学科，是固体新材料和新器件的生长点。本课程的任务是使学生掌握理论与实际相结合的研究方法，针对提出的实际问题，抓住主要矛盾，建立科学的物理模型进行解释，并加以分析总结。固体物理学是近代物理学的一个重要分支，是研究固体的结构及其组成粒子之间的相互作用与运动规律以阐明其性能与用途的学科，课程的教学内容重点：晶体结构，晶体的结合，晶格振动，能带理论，晶体中电子在电场中的运动，金属自由电子论，晶体中的缺陷。

推荐教材或主要参考书：

[1] 黄昆 原著，韩汝琦 改编，固体物理学，高等教育出版社，1988 年 10 月（教材）

[2] 方俊鑫编著，固体物理学，上海科学技术出版社，1980 年 12 月

[3] 吕世骥，固体物理基础， 北京大学出版社，1990 年 12 月

0000519 Solid-State Physics

Course Number: 0000519

Course Title: Solid-State Physics

Course Type: Basic Compulsory Course

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Statistic Physics, Quantum Mechanics

Evaluation Method: Course participation + written exams

Writer: Li Jianjun

Course Description:

Solid-State Physics is the basic discipline of solid materials and solid devices, and it is also a powerful growth point of new materials and devices. The principle objective of this course is to enable students to grasp the research methods combing theory with practice. For practical problems, they could grasp the principal contradiction and build a scientific physical model to solve the practice problem. Solid-State Physics is an important branch of modern physics. It is used for clarify the properties and applications of the solids based on the study of the crystal structures of solids and the interaction as well as the motion laws of the constituent particles. The teaching contents are mainly covered by the following aspects: crystal structure, crystal combination, crystal vibration, energy band theory, electron movement in electrical field, metal free electron theory, crystal defects.

Recommended Textbooks/References:

1. Hang Kun, Solid States Physics, *Higher Education Press*, 10-1988

2. Fang Junxing, Solid States Physics, *Shanghai Science and Technology Press*, 12-1980

3. Lv Shiji, Basics for Solid States Physics, *Beijing University press*, 12-1990

0010058 半导体物理

课程编码：0010058

课程名称：半导体物理

英文名称：Semiconductor Physics

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）专业本科生

先修课程：大学物理Ⅰ、固体物理学、量子力学、统计物理

考核形式： 平时成绩+考试

撰写人：周丽星

课程简介：

《半导体物理》是信息学部为电子科学与技术（实验班）专业本科生开设的学科基础必修课。该课程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

0010058 Semiconductor physics

Course Number：0010058

Course Title: Semiconductor physics

Course Type: Basic Compulsory Course

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

Students: Undergraduate students majoring in electronic science and technology

Prerequisites: College physics, solid state physics, quantum mechanics, statistical physics

Evaluation Method: Course participation + written exams

Writer: Zhou Lixing

Course Description:

Semiconductor physics is a required foundation course for undergraduates majoring in electronic science and technology, the Faculty of Information Technology. It focuses on the semiconductor material characteristics and the physical mechanism of elementary core devices in semiconductor chip fabrication. The course originated in the 1950s. It will give the senior undergraduates: the main characteristics of semiconductor crystals, characteristics of conductive particles (electrons and holes) in crystal, the physical mechanism of semiconductor PN junctions, MOS structures and other basic device units. This course is one of the chip-based subject and core courses for studying microelectronic technology, semiconductor optoelectronic technology and integrated circuits. Although a variety of new functional devices are constantly emerging, the most basic and core element physical mechanism has always supported the new device physics. This course provides important theoretical support for subsequent courses and technical fields such as device physics, integrated circuit technology, power devices, and radio frequency devices.

Recommended Textbooks/References:

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

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

3. [US] Shi Min and Wu Guozheng, Geng Li, Zhang Ruizhi translated "Semiconductor Device Physics", Xi'an Jiaotong University Press, 2008.

4. Donald A. Neamen, translated by Zhao Yiqiang, etc., Semiconductor Physics and Devices, Electronic Industry Press, 2013

0000516 电磁场理论

课程编码：0000516

课程名称：电磁场理论

英文名称：Electromagnetic Field Theory

课程类型：学科基础必修课

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：崔碧峰

课程简介：

《电磁场理论》是信息学部为电子科学与技术（实验班）专业本科生开设的学科基础必修课程类型。本课程的任务是通过本课程的学习，使学生掌握电磁场理论的基本知识及基本理论以及处理问题的基本方法，为后面的专业课（半导体物理、半导体器件原理、集成电路分析与设计等）学习打下理论基础。通过系统讲解，理论的分析，典型问题的运算和解决，使学生在学习抽象、复杂理论的能力，运用数学工具解决物理问题的能力得到培养和提高。知识包括：矢量分析与场论，电磁场基本实验定律－库伦力定律，安培力定律，法拉第电磁感应定律，位移电流假说，麦克斯韦方程组，静电场的基本规律，恒定电场的基本规律，恒定磁场的基本规律，电容、电导和电感，静态场的基本解法，时变电磁场的基本规律，时谐电磁场及传播规律，场能量等。

推荐教材或主要参考书：

[1] 谢处方 饶克谨等编著，《电磁场与电磁波》（第 5 版）高等教育出版社，2019 年 10 月

[2] 邹澎 周晓萍 马力编著 《电磁场与电磁波》（第 2 版）清华大学出版社，2016 年 2 月

[3] 马西奎 沈瑶 邹建龙等译 《电磁场与波-电磁材料及 MATLAB 计算》 机械工业出版社，2014 年 7 月

0000516 Engineering Electromagnetic Field Theory

Course Number: 0000516

Course Title: Electromagnetic Field Theory

Course Type: Basic Compulsory Course

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Higher Mathematics，College Physics

Evaluation Method: Course participation + written exams

Writer: Cui Bifeng

Course Description:

Electromagnetic Field Theory is one of the Compulsory courses for undergraduate students Major in Electronic Science and Technology. The main target of this course is to clarify grasping the basic knowledge, basic theory and basic methods of electromagnetic field，and then can support the later specialized course such as Physics of semiconductor; Physics of semiconductor devices; Integrated circuit analysis and design and so on. The students are expected to get solution of abstract and complex problem and improve the ability of solving physics problem using mathematics method.

This course is focus on Electromagnetic Field Theory. The teaching contents are mainly covered by the following aspects: vector analysis and field theory, basic experimental theory of electromagnetic field: Coulom's Law, Ampere Law and Faraday Law of electromagnetic induction; displacement current hypothesis; maxcell's equations; basic theory of electrostatic field，steady electric field and constant magnetic field; Solution for steady fields; basic theory of time-varying electromagnetic field; basic theory of time harmonic electromagnetic field.

Recommended Textbooks/References:

1. Xie Chufang, Rao Kejin, Electromagnetic field and electromagnetic wave (fifrth Edition). Higher Education Press, 10-2019

2. Zou Peng, Zhou XiaoPing, Ma Li, Electromagnetic field and electromagnetic wave(second edition), Tsinghua University Press, 02-16

3. Ma Xikui, Shen Yao, Zou Jianlong , Electromagnetic waves, Materials, and Computation with MATLAB, China Machine Press, 07-2014

0008119 集成电路分析与设计

课程编码：0008119

课程名称：集成电路分析与设计

英文名称：Integrated circuit analysis and design

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）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

考核形式：平时成绩+考试

撰写人：陈志杰

课程简介：

《集成电路分析与设计》是信息学部为电子科学与技术（实验班）专业本科生开设的学科基础必修课程类型。本课程的任务是以 CMOS 工艺为主，从电路的单元特性和工作原理出发，学习研究中大规模及 VLSI 的设计特点，熟悉并掌握版图设计流程和方法。通过本课程的学习，使学生能够深入了解和掌握反映 VLSI 发展的新技术、新器件、新电路，并熟练掌握集成电路设计的基本方法和技术。教学内容重点：超大规模集成电路发展规律，等比例缩小定律，典型的 CMOS 结构和工艺，长沟道 CMOS 器件模型及二级效应，CMOS 反相器，动态 CMOS 逻辑电路，组合逻辑电路，时序逻辑电路，CMOS 存储器的分类和结构。教学内容的难点：长沟道 CMOS 器件模型及二级效应，CMOS 反相器，动态 CMOS 逻辑电路，组合逻辑电路和时序逻辑电路。

推荐教材或主要参考书：

[1]甘学温等，集成电路原理与设计，北京大学出版社，2006 年 2 月

[2]叶以正，来逢昌，集成电路设计，清华大学出版社，2011 年 5 月

[3]夏宇闻，Verilog 数字系统设计教程，北京航空航天大学出版社，2003 年 7 月

[4]孙肖子,《专用集成电路设计基础》，西安电子科技大学出版社，2003 年 10 月

0008119 Integrated circuit analysis and design

Course Number: 0008119

Course Title: Integrated Circuit Analysis and Design

Course Type: Basic Compulsory Course

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

Students: Undergraduate Students Majoring in Electronic Science and Technology

Prerequisites: Fundamentals of Circuit Analysis, Digital Electronic Technique, Analog Electronics Technique, Semiconductor Physics

Evaluation Method: Course participation + written exams

Writer: Chen Zhijie

Course Description:

Integrated circuit analysis and design is one of the basis of compulsory subjects courses for undergraduate students Major in Electronic Science and Technology. The main target of this course is to clarify the issue of designing integrated circuits. This course is focus on integrated circuit design based on CMOS technology, starting from the unit features and working principle of circuit. Get the mass and VLSI design features in the research of learning, familiar with and master landscape design processes and methods through the study of this course. The students can deeply understand and grasp the new technology of the development of the VLSI and new device circuit, and master the basic method of integrated circuit design and technology. The teaching contents are mainly covered by the following aspects: Development Law of VLSI, Law of Scale-down, Typical CMOS Structure and Process, Long-channel CMOS device model and Secondary Effect, CMOS Inverter, Dynamic CMOS Logic Circuit, Combination Logic Circuit, Sequential Logic Circuit, Classification and Structure of CMOS Memory. The difficulties of teaching contents are described as followings: Long-channel CMOS device model and Secondary Effect, CMOS Inverter, Dynamic CMOS Logic Circuit, Combination Logic Circuit, Sequential Logic Circuit.

Recommended Textbooks/References:

1.Gan Xuewen, *et al*. Integrated Circuit Principle and Design. Beijing University Press. February 2006.

2.Yizheng Ye, Fengchang Lai, Integrated Circuit Design, Tsinghua University Press, May 2011.

3.Yuwen Xia, Design Course of Verilog Digital System, Beijing University of Aeronautics and Astronautics press, July 2003.

4.Sun Xiaozi. The Basis of ASIC Design. Xi'an University of Electronic Science and Technology Press. Oct. 2003

0008108 半导体器件原理

课程编码：0008108

课程名称：半导体器件原理

英文名称：Physics of Semiconductor Devices

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）专业本科生

先修课程：半导体物理，微电子工艺

考核形式：平时成绩+考试

撰写人：郭伟玲

课程简介：

《半导体器件原理》是信息学部为电子科学与技术专业本科生开设的专业必修课程类型。本课程是链接半导体物理和集成电路的纽带，是研究集成电路设计和微电子技术的基础课程。课程任务是探索半导体器件的内在物理机理与外部特性的关系， 进而理解器件的材料参数、几何结构参数与器件的特性参数之间的关系，掌握如何通过材料、结构参数设计来提高器件的特性。主要内容包括： PN 结的基本原理和特性、金属半导体接触、双极型晶体管（BJT 和 HBT）、MOS 和结型场效应晶体管等相关器件的特性。为学习后续的集成电路原理、CMOS 模拟集成电路设计等课程，以及为从事与本专业有关的器件和集成电路设计、制造等工作打下一定的基础。

推荐教材或主要参考书：

[1] 曹培栋,《微电子技术基础（双极、场效应晶体管原理）》电子工业出版社，2001

[2] 陈星弼,《晶体管原理与设计》，电子工业出版社 2007 年

[3] 傅兴华、丁召，陈军宁，杨健,《半导体器件原理简明教程》科学出版社，2018

[4] 黄均鼎，汤庭鳌，胡光喜,《半导体器件原理》复旦大学出版社，2020

0008108 Physics of Semiconductor Devices

Course Number: 0008108

Course Title: Physics of Semiconductor Devices

Course Type: Basic Compulsory Course

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

Students: Undergraduate students majoring in electronics science and technology

Prerequisites: The physic of semiconductor, fabrication process of microelectronics devices

Evaluation Method: Course participation + written exams

Writer: Guo Weiling

Course Description:

Principles of Semiconductor Devices is one of the Professional compulsory courses for undergraduate students Major in Electronic Science and Technology. This course is a link between semiconductor physics and integrated circuits, and is a fundamental course for studying integrated circuit design and microelectronics technology. The main target of this course is to clarify the relationship between the internal physical mechanisms and external characteristics of semiconductor devices, thereby understanding the relationship between the material parameters, geometric structure parameters, and device characteristic parameters, and mastering how to improve device characteristics through material and structural parameter design. This course is focus on the relationship between the internal structure and external characteristics of semiconductor devices. The teaching contents are mainly covered by the following aspects: the basic principles and characteristics of PN junctions, the characteristics of metal semiconductor contacts, bipolar transistors (BJT and HBT), MOS and junction field-effect transistors, and other related devices.

Recommended Textbooks/References:

1. Cao Peidong, Fundamentals of Microelectronics Technology (Principles of Bipolar and Field Effect Transistors), The Name of the Textbook, Electronic Industry Press,2001

2. Chen Xingbi, Principles and Design of Transistors, Electronic Industry Press,2007

3. Fu Xinghua, Ding Zhao, Chen Junning, Yang Jian, A Brief Tutorial on the Principles of Semiconductor Devices, Science Press,2018

4. Huang Junding, Tang Ting'ao, Hu Guangxi, Principles of Semiconductor Devices, Fudan University Press, 2020

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.

0004349 半导体工艺实习Ⅱ

课程编码：0004349

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：电子科学与技术（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）

《半导体工艺实习 II》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

0004349 Semiconductor Technical Field Work Ⅱ

Course Number: 0004349

Course Title: Semiconductor Technical Field Work Ⅱ

Course Type: Project compulsory course

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

Students: Undergraduate students majoring in Electronic Science and Technology

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:

Semiconductor Technical 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

0008106 FPGA 设计实验

课程编码：0008106

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：电子科学与技术专业本科生

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

0008106 FPGA Design Experiment

Course Number: 0008106

Course Title: FPGA Design Experiment

Course Type: Required Courses in Practice

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

Students: Undergraduate students majoring in Electronic Science and Technology

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:

1. Zhang Feng, Embedded High-speed Serial Bus Technology--Implementation and Application based on FPGA，*Publishing House of Electronics Industry*，Jan-2017
2. Ping D.CHU, FPGA Prototyping by Veriog Examples，China Machine Press，Nov-2016
3. 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
4. Wu Houhang, Study the FPGA in a Simple Way，*Beihang University Press*，July-2013
5. 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.

0010684 微电子器件设计与实验

课程编码：0010684

课程名称：微电子器件设计与实验

英文名称：Design & Experiments of Microelectronic devices

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）专业本科生

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：

《微电子器件设计与实验》是面向电子科学与技术方向本科生所开设的微电子技术的专业基础与专业综合的本科生独立设课实验。

通过晶体管设计、理论验算、样品测试、报告的实现，培养学生建立系统设计和流程设计的思想。要求掌握有关理论、方法和技术。提高在设计中提出问题，发现问题，解决问题的能力。理解（f；Po；Kp；Vcc；η；）几个设计参数的含义和它们与器件参数之间的关系，完成包括全部横、纵向参数设计、光刻版图设计、封装设计、工艺设计、测试条件及典型测量设计，设计验算全部过程。

推荐教材或主要参考书：

[1]微电子器件设计与实验指导书..北京工业大学.

[2]曹培栋. 晶体管原理：电子工业出版社.2007

[3]宋南辛、徐义刚. 晶体管原理.北京：国防工业出版社.2000

[4]曹培栋. 微电子技术基础.北京：电子工业出版社.2007

[5]谢红云. 半导体工艺实习实验指导书. 2009

0010684 Design & Experiments of Semiconductor Device

Course Number：0010684

Course Title：Design & Experiments of Semiconductor Device

Course Type：Project compulsory course

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

Students: Undergraduate students majoring in Microelectronics

Prerequisites: Semiconductor Physics, Principles of Semiconductor Devices

Evaluation Method: Course participation + written exams

Writer: Wu Li

Course Description:

The course of " Design & Experiments of Semiconductor Device " is the specialized required course of electronic science and technology. The course is oriented to electronic science and technology undergraduate, and is an opened microelectronic technology foundation for the professional and comprehensive independent course experiments.

Through the experiments, including the design of a transistor, sample design, theoretical calculation and design report are achieved. The course can deepen students' understanding of the theory of semiconductor device, and deepen understanding of correlated working principle about measuring system. The students are expected to establish philosophy based on system design and process design .And the students are expected to understand the basic concepts, theories, methods, and techniques of formal languages and automata and the related problem solving methods, through which their abstraction and modeling abilities will be improved. The design parameters（f；Po；Kp；Vcc；η）and device parameters will be understood, and design scheme is submitted. The detail design include: longitudinal and transverse parameter design; layout design; package design; test condition; checking computations.

Recommended Textbooks/References:

1.Experiment guide book of electronic science and technology, Beijing University of Technology Press.

2.Cao Peidong, Microelectronics technology, Publishing house of Electronics Industry,2001.

3.Song Nanxin. Theory of Transistor. Beijing：National Defence Industry Press.2000

4.Cao Peidong. Theory of Microelectronics. Beijing：Publishing House of Electronics Industry.2007

5.Xie Hongyun. Practice of Semiconductor process. 2009

0007261 数字集成电路设计

课程编码：0007261

课程名称：数字集成电路设计

英文名称：Digital Integrated Circuit Design

课程类型：实践环节必修课

学分：1.5　**总学时：** 45

面向对象：电子科学与技术（实验班）专业（实验班）本科生

先修课程：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：

《数字集成电路设计》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。本课程的目标是培养学生数字集成电路设计工程能力，在熟悉集成电路制造技术、硬件描述语言及 EDA 工具的基础上，掌握系统设计→电路设计→版图设计的数字集成电路设计方法与流程。课程的主要内容包括：学生独立完成一个基于 Synopsys 的数字集成电路设计项目，即首先选择合适难度的题目，然后对项目工作原理进行分析，模块划分，最终使用硬件描述语言完成所选题目的功能设计与仿真，利用 Synopsys DC 工具完成设计综合，利用 Synopsys ICC 工具完成自动布局布线。教学内容的难点：引导学生确立设计架构，快速掌握硬件描述语言的设计方法，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] 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] 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

[6] 数字集成电路设计课设指导书，自编

0007261 Digital Integrated Circuit Design

Course Number: 0007261

Course Title: Digital Integrated Circuit Design

Course Type: Project compulsory course

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Microelectronics Process，Digital Electronic Technique，FPGA Design Experiments

Evaluation Method: Practice Design

Writer: Yuan Ying

Course Description:

Digital Integrated Circuit Design plays a very important role in cultivating practical abilities of undergraduate students majoring in Electronic Science and Technology. The main target of this course is to clarify the ability of students in the digital IC design that is based on familiar with the IC manufacturing technology, hardware description language and advanced digital integrated circuit design software. This course is focus on master digital integrated circuit design methods and HDL programming skills. The teaching contents are mainly covered by the following aspects: a digital integrated circuit design projects based Synopsys tools must be completed by students, include to select subject, analyze, module division, HDL (hardware description language) design, function simulation, logic synthesis based on Synopsys Design Compiler and physical synthesis based on Synopsys IC Compiler and so on. The difficulties of teaching contents are described as followings: Guide the students to establish the design framework, master the design method of hardware description language, complete the functional design and simulation, and then complete the circuit design and layout design.

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. Sridhar Gangdharan, Sanjay Churiwala，Constraining Designs for Synthesis and Timing Analysis, *China Machine Press*, Feb-2018

6. Course instruction of Digital Integrated Circuit Design, Self

0007258 集成电路版图设计

课程编码：0007258

课程名称：集成电路版图设计

英文名称：Integrated Circuit Layout Design

课程类型：实践环节必修课

学分： 1.5 **总学时：** 45

面向对象：电子科学与技术类本科生

先修课程：半导体器件原理，集成电路分析与设计，微电子工艺，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：袁颖

课程简介：

《集成电路版图设计》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。本课程的目标是使学生把从集成电路原理与设计、半导体器件原理、微电子工艺、集成电路 CAD 等相关课程中学到的理论知识全面综合地加以利用，从而使这些知识得到进一步巩固、深化和发展。课程从集成电路设计流程入手，在熟悉 CMOS 制造工艺和版图设计规则的基础上，通过基本单元设计再到电路设计的循序渐进地过程，最终掌握集成电路版图设计方法。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，为学生将来就业或进一步深造奠定坚实的基础。教学内容的难点：电路设计及分析。

推荐教材或主要参考书：

[1] 刘峰，CMOS 集成电路后端设计与实战，机械工业出版社，2018 年 5 月

[2] 尹飞飞，陈铖颖，范军，王鑫，CMOS 模拟集成电路版图设计与验证，电子工业出版社，2016 年 9 月

[3] 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

[4] 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

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

[6] 集成电路版图设计实验指导书，自编

0007258 Integrated Circuit Layout Design

Course Number: 0007258

Course Title: Integrated Circuit Layout Design

Course Type: Project compulsory course

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Principles of Semiconductor Devices, Integrated circuit analysis and design, Microelectronics Process, Analog Electronics Technique，Digital Electronic Technique

Evaluation Method: Complete design + Practice exams

Writer: Yuan Ying

Course Description:

Integrated Circuit Layout Design 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 theoretical knowledge learned from related courses such as the principles and design of integrated circuits, the principles of semiconductor devices, microelectronics processes, and computer aided design in integrated circuit, so as to enable students to further consolidate, deepen and master these knowledge. 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. This course provides students with a solid foundation for future employment or further studies. The teaching contents are mainly covered by the following aspects: the course starts with the integrated circuit design process. On the basis of being 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: CMOS circuit design and analysis.

Recommended Textbooks/References:

1. Liu Feng, CMOS IC Back-end Design and Actual Combat, *China Machine Press*, May-2018

2. Yin Feifei, Chen Chengying, Fan Jun, Wang Xin, CMOS Analog Integrated Circuit Layout Design and Verification, *Publishing House of Electronics Industry*, Sept-2016

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

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

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

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

0010111 集成电路综合设计实训

课程编码：0010111

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：电子科学与技术（实验班）专业本科生

先修课程：模拟电子技术、数字电子技术、集成电路分析与设计

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电子科学与技术（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

0010111 Integrated Circuits Comprehensive Design Training

Course Number: 0010111

Course Title: Integrated Circuits Comprehensive Design Training

Course Type: Experiment Course

Credit: 2.0 **Total Credit Hours:** 60

Students: Undergraduate students majoring in electronics science and technology

Prerequisites: Analog circuit design, digital circuit design, Integrated circuit analysis 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 electronic science and technology. 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

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

0004924 信号与系统III

课程编码：0004924

课程名称：信号与系统 III

英文名称：Signals and Systems III

课程类型：学科基础选修课

学分：2.0　**总学时：**32

面向对象：电子科学与技术（实验班）专业本科生

先修课程：高等数学（工），线性代数（工），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：张辉

课程简介：

《信号与系统 III》是信息学部为电子科学与技术业本科生开设的学科基础选修课类型。本课程集中研究确定信号经线性时不变系统进行传输、处理的基本理论、基本分析方法和工程应用。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，并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，有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（第 3 版），高等教育出版社，2011 年 3 月

[2] 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

[3] 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

[4] 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

[5] 吴大正，杨林耀，张永瑞，信号与线性系统分析（第 4 版），高等教育出版社，2005 年 8 月

0004924 Signals and Systems Ⅲ

Course Number: 0004924

Course Title: Signals and Systems III

Course Type: Electives

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

Students: Undergraduate students majoring in electronic science and technology

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

Evaluation Method: Course participation + Written exams

Writer: Zhang Hui

Course Description:

Signals and systems III is one of the basic discipline elective courses for undergraduate students Major in electronic science and technology. The main target of this course is to clarify the basic theory, basic analysis method and engineering application of signal transmission and processing through linear time invariant system. This course is focus on the signal analysis methods and various signal solving methods of time-invariant systems. The course introduces some very important concepts, theories and methods in practical engineering applications to students through certain example analysis, and finally enhances students' ability to analyze and solve practical 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, Signals and systems (3rd edition), *Higher Education Press*, March-2011

2.Zhang Yanhua, Liu Pengyu, Signals and systems (2nd edition), *China Machine Press*, September-2017

3.Zheng Junli, Ying Qiheng, Yang Weili, Introduction to signals and systems, *Higher Education Press*, March-2009

4.Oppenheim, Trans. Liu Shutang, Signals and systems (2nd edition). *Electronic Industry Press*, January-2014

5.Wu Dazheng, Yang Linyao, Zhang Yongrui, Analysis of signals and linear systems (4th edition), *Higher Education Press*, August-2005

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

0004644 微电子工艺

课程编码：0004644

课程名称：微电子工艺

英文名称：Microelectronic Fabrication Technology

课程类型：学科基础选修课

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：谢红云

课程简介：

微电子工艺是信息学部电子科学与技术学院为电子科学与技术专业本科生开设的基础选修课程。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。本课程的任务是为半导体芯片行业培养合格的掌握芯片制造技术的人才。本课程讲授半导体制造的基本工艺原理，芯片制作的各种常用方法、设备以及检测手段和现代半导体制作中的典型工艺流程。教学内容的重点是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。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）。半导体工艺虚拟仿真技术和数据分析方法。教学内容难点是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，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. 关旭东. 硅集成电路工艺基础 （第二版）. 北京大学出版社，2014

2. 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

3. 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

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， 微电子制造科学原理与工程技术 (英文版) ，电子工业出版社，2003

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

0004644 Microelectronic Fabrication Technology

Course Number: 0004644

Course Title: Microelectronic Fabrication Technology

Course Type: Electives

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

Students: Undergraduate students major in Semiconductor science and technology

Prerequisites: Freshman Semina, Physics of Semiconductor, Physics of solid state

Evaluation Method: Course participation + written exams

Writer: Xie Hongyun

Course Description:

Microelectronic Fabrication Technology is one of the basic elective courses for undergraduate students Major in semiconductor science and technology. The main target of this course is to provide excellent person with the skill to fabricate a semiconductor chip . This course is focus on semiconductor fabrication technology. The teaching contents are mainly covered by the following aspects: the common fabrication technology: substrate fabrication, material grown methods, films fabrication, doping technology, Lithography, etching and packaging methods common technologies, devices and testing methods for a chip fabrication. The difficulties of teaching contents are described as followings: basic theories of semiconductor fabrication process, such as Groove model and Fick diffusion equation, and several typical semiconductor fabrication processes, such as the bipolar transistor fabrication process, the CMOS transistor fabrication process.

Recommended Textbooks/References:

1.Guan Xudong. Basic process of Si integrated circuit, the second edition, Peking University Publisher. May, 2014

2.Peter Van Zant, Han Zhengsheng. Chip fabrication-Semiconductor fabrication process. Publishing House of Electronics industry. January, 2015

3.Wang Wei et al. Integrated circuit manufacturing technology, principles and methodology. Publishing House of Electronics industry. April, 2016

4.Zhang Yafei et al. Integrated circuit manufacturing technology, Shanhai Jiaotong University Publisher. Octorber, 2018

5.Stephen A Campbel. The science and engineering of microelectronic fabrication. Publishing House of Electronics industry. 2003

6.James D. Plummer.Silicon VLSI Technology Fundamentals, Practice and Modeling. Publishing House of Electronics industry. 2006

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

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

0007278 光电子技术基础（双语）

课程编码：0007278

课程名称：光电子技术基础（双语）

英文名称：Optoelectronics Technique

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）专业本科生

先修课程：高等数学（工）、大学物理Ⅰ、半导体物理、固体物理学

考核形式：平时成绩+随堂测试+口头报告

撰写人：马啸尘

课程简介：

《光电子技术基础（双语）》是电子科学与技术专业选修课，本课程的目标是通过讲述近年来国内外电子科学与技术的发展与应用，将材料与器件相结合，通过双语教学，培养学生英语听说读写的能力，使学生掌握光电子器件和材料的相关知识；了解不同功能的光电子元器件，藉此培养学生对光电子器件功能特性的应用能力；了解光电子技术基础领域的国内和国际发展趋势研究热点，了解中国在光电子技术基础领域的发展和贡献。课程的主要内容包括光电子学概论、光电子技术物理基础、光电子探测技术、半导体照明与显示技术、半导体激光器原理、前沿专题技术。

推荐教材或主要参考书：

1. S. O. Kasap. 《Optoelectronics and Photonics Principles and Practices》(Second Edition，影印版). 电子工业出版社，2007

2. 张永林. 《光电子技术》. 高等教育出版社，2005

3. 肖奇.《纳米半导体材料与器件》.化学工业出版社，2013

0007278 Optoelectronics Technique

Course Number: 0007278

Course Title: Optoelectronics Technique

Course Type: Electives

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

Students: Undergraduate students majoring in Electronic Science and technology

Prerequisites: Advanced Mathematics (Engineering), Advanced Physics, Semiconductor Physics, Solid State Physics

Evaluation Method: Course participation + in class tests + oral reports

Writer: Ma Xiaochen

Course Description:

Optoelectronics Technique is electronic science and technology professional elective courses. The goal of this course is to combine the development and application of electronic science and technology at home and abroad in recent years, combine materials and devices, and cultivate students' English, speaking, speaking, speaking, reading, reading, writing, reading, reading, reading, reading, writing, reading, writing and writing through bilingual teaching. The ability to enable students to master the relevant knowledge of optoelectronic devices and materials; understand the optoelectronic components of different functions, and use therefore cultivate students' application ability to apply the functional characteristics of optoelectronic devices; understand the domestic and international development trend research hotspots in the basic field of optoelectronics technology, and understand China's development and contribution in the basic field of optoelectronics technology. The main contents of the course include an Introduction to Optoelectronics, Physical Foundation for Optical Technology, Optical Detection Technology, Semiconductor Lighting and Display Technology, Semiconductor Laser Principles, and cutting - edge special technologies.

Recommended Textbooks/References:

1. O. Kasap. 《Optoelectronics and Photonics Principles and Practices》(Second Edition). Electronic Industry Press，2007

2. Zhang Yonglin Optoelectronic Technology Higher Education Press, 2005

3.Tamir, Theodor, Giora Griffel, and Henry L. Bertoni, eds. Guided-wave optoelectronics: device characterization, analysis, and design. Springer Science & Business Media, 2013.

0010690 物联网基础器件与传感器件

课程编码：0010690

课程名称：物联网基础器件与传感器件

英文名称：Special Devices& Sensitive Devices

课程性质：专业选修课

学分：2.0　　**学时：**32

面向对象：电子科学与技术（实验班）专业本科生

先修课程：大学物理 I

考核形式：开卷考试

撰写人：朱彦旭

课程简介：（250-300 字）

《物联网基础器件与传感器件》课程是本科生的选修课，主要讲授作为物联网与智能应用场景中比较典型的电子器件与光电子器件的原理，结构，制备与应用。主要涉及用于构成物联网基础与智能应用等的红外探测、特种光源、微光探测、高性能显示、物理参数测量传递以及生物敏感等典型器件知识。主要是为了提高电子科学与技术（实验班）专业本科生在电子学科与光电子学科交叉学科的知识。一方面，可以促进本科生理解传感器件的知识，增强其适应微电子产业人才市场及广范围工作需要的能力；另一方面本课程可以开扩学生视野与知识面，为培养创新型交叉领域研究生作准备；思政教育，树立国家科技安全意识与为国贡献的意识，增强民族自信心，培养爱国爱家的情怀。

推荐教材或主要参考书：

[1]叶伟国、余国祥，大学物理，清华大学出版社出版，2012 年 12 月版

[2]彭军，光电器件基础与应用，科学出版社，2009 年版

[3]赵勇，王琦，传感器敏感材料及器件，机械工业出版社，2012 年版

[4]传感器原理与应用，黄贤武，电子科大出版社，2004 年 3 月第三版

0010690 Special Devices& Sensitive Devices

Course Number: 0010690

Course Title: Special Devices& Sensitive Devices

Course Type: Electives

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

Students: Undergraduate students major in electronic science and technology

Prerequisites: University Physics

Evaluation Method: Open-book Examination

Writer: Zhu Yanxu

Course Description:

This course is a restrictive elective course of Electronic Science and Technology professional, and is suitable to the undergraduate students. The purpose of this course is to make students major in Electronic Science and Technology understand he principle, structure, preparation and application of electronic devices and optoelectronic devices, which are typical in the Internet of things and intelligent application scenarios. It mainly involves the knowledge of typical devices such as infrared detection, special light source, low light detection, high performance display, devices of measurement and transmission of physical parameters, and biological sensitivity and the like. It helps undergraduate students to improve the knowledge in the interdisciplinary field of electronic and optoelectronic science. On the one hand, it can promote undergraduates to understand the knowledge of semiconductor devices and enhance the practical engineering ability of device design by using the knowledge they have learned, which can help them to meet the needs of the talent market of microelectronics industry and a wide range of work. On the other hand, it can be used as a preparatory course for the study field of optoelectronic devices and semiconductor devices, which can expand students' vision and knowledge and give a preparing for the cultivation of innovative interdisciplinary graduate students. And the last, it providing ideological and political education, and establish the awareness of national science, technology security, and contribution to the country.

Recommended Textbooks/References:

1.R Weiguo Ye, Guoxiang, Yu, University Physics, Tsinghua University Press. 2012

2.Jun Peng, The basic and application of optoelectronic devices, Science Press. 2009

3.Yong Zhao, Qi Wang, Sensitive Materials and Sensing Devices, China Machine Press, 2012

4.Xianwu Huang, Principle and application of Sensors, UESTCP, 2004

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

0010683 微电子器件可靠性技术(自学)

课程编码：0010683

课程名称：微电子器件可靠性技术(自学)

英文名称：Reliability of Micro-electronic Devices（self-study）

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）专业本科生

先修课程：半导体器件原理，集成电路分析与设计

考核形式：平时成绩+自学成绩

课程简介：

《微电子器件可靠性技术(自学)》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选修课程类型。本课程的任务是通过本课程的学习能够让学生掌握有关半导体器件可靠性的一般基础知识和基本概念，并把这些知识灵活的与所学过的半导体器件原理和集成电路等有关知识结合起来，运用到实际中去。教学内容重点：阐述半导体可靠性的基本概念，寿命试验的数据处理，半导体器件的表面、体内、电极系统及封装对器件性能的影响，半导体器件常见的失效机理，失效分析技术和器件的正确使用等内容。教学内容的难点：产品的寿命特征，加速寿命试验，电极系统及封装的失效机理，CMOS 集成电路的闭锁效应，器件几种典型的特性曲线分析。

推荐教材或主要参考书：

1.张小玲编著. 微电子器件可靠性技术，北京工业大学出版社，2021 年 12 月

2.恩云飞编著.电子元器件质量与可靠性技术丛书-可靠性物理.电子工业出版社，2015 年

3.顾瑛著.电子元器件质量与可靠性技术丛书-可靠性工程数学.电子工业出版社，2004 年

4.郝跃著.微纳米 MOS 器件可靠性与失效机理.科学出版社，2008 年 3 月

5.史保华.微电子器件可靠性.西安电子科技大学出版社，1999 年 1 月

6.Ajith Amerasekera , Failure Mechanisms in Semiconductor Devices, *Typeset by Thomson Press.*1997

0010683 Reliability of Micro-electronic Devices（self-study）

Course Number: 0010683

Course Title: Reliability of Micro-electronic Devices（self-study）

Course Type: Electives

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Transistor Principle: Integrated Circuit Analysis and Design

Evaluation Method: Course participation + self-study

Writer: Zhang Xiaoling

Course Description:

Reliability of Micro-electronic Devices（self-study） is one of the professional optional courses for undergraduate students Major in Electronic Science and Technology. The main target of this course is to clarify: through studying this course, the students can grasp the basic reliability knowledge and can help them to design the more reliable devices. This course is focus on reliability of semiconductor, system reliability analysis. The teaching contents are mainly covered by the following aspects: the basic concepts of reliability, data dealing of lifetime-test, interface failure, body failure, electronics system and packaging effects on the devices. The difficulties of teaching contents are described as followings: life characteristics of products，accelerated life test，failure mechanism of electrode system and package，latch up effect of CMOS IC，analysis of several typical characteristic curves of devices

Recommended Textbooks/References:

1．ZHANG Xiao-ling. Reliability technology of Microelectronic devices, *BJUT Press,*2021.12

2.EN Yun-fei. Electronic components quality and Reliability Technology Series –reliability physics. *Electric Industry Press*, 2015.

3. GU Ying. Electronic components quality and Reliability Technology Series - Reliability Engineering Mathematics. *Electric Industry Press*, 2004

4. HAO Yue. Reliability and failure mechanism of micro nano MOS devices. *Science Press*，2008.

5. SHI Bao-hua. Reliability of microelectronic devices. *Xidian University Press*, 1999

6. Ajith Amerasekera , Failure Mechanisms in Semiconductor Devices, *Typeset by Thomson Press.* 1997

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

0010682 微电子器件仿真与设计

课程编码：0010682

课程名称：微电子器件仿真与设计

英文名称：Design and Simulation of Microelectronic Device

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+实验环节

撰写人：胡冬青

课程简介：

《微电子器件设计与仿真》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选修。本课程的任务是为毕业要求 4.1 和 6.2 的实现提供支持。课程通过具体器件设计、仿真优化与版图实现，将所学半导体物理、晶体管原理、工艺原理相关知识贯穿起来，明确器件设计的主体思路，掌握器件设计的基本方法，深刻领会细节设计对品质保证的重要性，为将来从事半导体器件研发应用相关的工作奠定良好的设计基础。

教学内容重点：器件结构设计、场终端设计、MOSFET 元胞设计、器件版图设计；器件设计过程中的仿真优化。

教学内容的难点：三个扩展：器件从物理结构向产品结构的扩展；从剖面结构向立体结构的扩展；从几何尺寸向设计尺寸的扩展。

推荐教材或主要参考书：

1.B.J Baliga. Fundamentals of Power Semiconductor Devices (Second Edition). Springer, 2018

2.Josef Luts, Heinrich Schlangenotto, Uwe Scheuermann, Rik De Doncker, “Semiconductor Power Devices” (Second Edition), Springer, 2019

3.Stefan Linder, “Power Semiconductors”, EPFL Press, 2006

4.Avant Corporation, “Medici User’s manual” Avant, 1999

5. Avant Corporation, “Tsuprem-4 User’s manual” Avant, 1999

6.ISE, “Mdraw(8.0) User’s manual” ISE,2000

0010682 Design and Simulation of Semiconductor Devices

Course Number: 0010682

Course Title: Simulation and Design of Microelectronic Devices

Course Type: Electives

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

Students: Undergraduate students majoring in electronic science and technology

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

Evaluation Method: Written Exam + homework + lab practice

Writer: Hu Dongqing

Course Description:

Simulation and Design of Microelectronic Devices is one of the elective courses for undergraduate students Major in electronic science and technology. The main target of this course is to provide support for graduation requirement index point 4.1 and 6.2. This course is focus on devices structure design, simulation optimization and layout realization. The teaching contents are mainly covered by the following aspects: structure design for diode and MOSFET, field terminal design, cell design for MOSFET, layout realization. The difficulties of teaching contents are described as followings: Extension from physical structure to production structure; Extension from profile structure to architecture structure; Extension from physical dimension to design dimension.

Recommended Textbooks/References:

1. B.J Baliga. Fundamentals of Power Semiconductor Devices (Second Edition). Springer，2018

2. Josef Luts, Heinrich Schlangenotto, Uwe Scheuermann, Rik De Doncker, “Semiconductor Power Devices” (Second Edition), Springer, 2019

3. Stefan Linder, “Power Semiconductors”, EPFL Press, 2006

4. Avant Corporation, “Medici User’s manual” Avant, 1999

5. Avant Corporation, “Tsuprem-4 User’s manual” Avant, 1999

6. ISE，“Mdraw(8.0) User’s manual” ISE,2000

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;

0002009 功率半导体器件及应用

课程编码：0002009

课程名称：功率半导体器件及应用

英文名称：Power Semiconductor Devices and Applications

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）专业本科生

先修课程：半导体物理、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：

《功率半导体器件及应》用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选修课程。本课程的任务是让学生在已学过的半导体物理和电路分析知识的基础上，了解和掌握功率半导体器件及其应用电路(电力电子电路)的基本工作原理,熟悉相关的描述、评价、分析和计算方法。通过本门课的学习可以使学生综合理解功率半导体器件从底层到应用层的整个系统环节，促进学生逻辑思维的培养，激发学生对电力电子行业的学习兴趣。教学内容重点：功率半导体器件的基本工作原理、结构设计参数、工作环境要求等。教学内容的难点：AC/DC、AC/AC、DC/AC、DC/DC 变换变换技术，基本电路拓扑结构，电路基本工作原理等。

推荐教材或主要参考书：

1. Benda 原著，吴郁等译，《功率半导体器件——理论及应用》，化工出版社，2005 年 5 月

2. 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

3. 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

4. B.J Baliga. Fundamentals of Power Semiconductor Devices (Second Edition). Springer，2018

5. Josef Luts, Heinrich Schlangenotto, Uwe Scheuermann, Rik De Doncker, “Semiconductor Power Devices” (Second Edition), Springer, 2019

0002009 Power Semiconductor Devices and Applications

Course Number: 002009

Course Title: Power Semiconductor Devices and Applications

Course Type: Major Elective

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

Students: Undergraduate students majoring in electronic science and technology

Prerequisites: Semiconductor physics, Digital Electronic Technique, Analog Electronic Technique

Evaluation Method: Course participation + written exams

Writer: Zhou Xintian

Course Description:

Power Semiconductor Devices and Applications is one of the major elective courses for undergraduate students Major in electronic science and technology. The main target of this course is to make the students understand and master the fundamental operating principle of the power semiconductor devices and their application circuits, on the basis of the already studied knowledge on the semiconductor physics and circuit analysis. Let them comprehend the relevant description, evaluation, analysis and calculation methods. According to the study of this course, the students could understand the whole system link from bottom to the application level with respect to the power semiconductor devices. This course helps the students to promote the cultivation of logical thinking and stimulate interest in learning power electronics. The teaching contents are mainly covered by the following aspects: the fundamental working principles of power semiconductor devices and the structure design parameters. The difficulties of teaching contents are described as followings: the technology for the AC/DC, AC/AC, DC/AC and DC/DC conversion, the basic circuit topology and the primary operating principles.

Recommended Textbooks/References:

1.Benda, Power Semiconductor Devices——theory and applications，May 2005.

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

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

4.B.J Baliga. Fundamentals of Power Semiconductor Devices (Second Edition). Springer，2018

5.Josef Luts, Heinrich Schlangenotto, Uwe Scheuermann, Rik De Doncker, “Semiconductor Power Devices” (Second Edition), Springer, 2019

0010070 第三代半导体技术（双语）

课程编码：0010070

课程名称：第三代半导体技术（双语）

英文名称：The Third Generation Semiconductor Technology

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）本科生

先修课程：无

考核形式：课内研讨+大报告

撰写人：高志远

课程简介：

第三代半导体技术是信息学部为电子科学与技术专业本科生开设的研究性课程类型。本课程的任务是使学生掌握第三代半导体从材料性质和制备到电子与光电子器件制造的完整过程，能够对第三代半导体结构与性质的对应关系以及区别于其它半导体的特点进行归纳和凝练，具有自主学习和探索的能力。教学内容重点：第三代半导体的微结构、电学、光学性质、材料的制备和表征方法，以及第三代半导体电子和光电子器件的基本器件结构、工作原理、工艺流程和表征方法。教学内容的难点：第三代半导体材料的微结构成因及其对应光电性质，第三代半导体器件的工作原理和特点。

推荐教材或主要参考书：

1.“氮化物宽禁带半导体材料与电子器件”，郝跃，张金风，张进成著，科学出版社，2013

2.“碳化硅宽带隙半导体技术”，郝跃，彭军，杨银堂编著，科学出版社，2000

3.“纳米科学与技术 自驱动系统中的纳米发电机”，王中林著，科学出版社，2012

0010070 The Third Generation Semiconductor Technology

Course Number: 0010070

Course Title: The Third Generation Semiconductor Technology

Course Type: Electives

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

Students: Undergraduate students majoring in Electronic Science and technology

Prerequisites: None

Evaluation Method: In-class discussion + final reports

Writer: Gao Zhiyuan

Course Description:

The Third Generation Semiconductor Technology is one of the research courses for undergraduate students Major in electronic and microelectronic science and technology. The main target of this course is to let the students understand the whole processes, from material properties and preparation to electronic and optoelectronic device fabrication, in the third generation semiconductor materials and devices, and to let the students to review and summarize the characteristics and correlations between structures and properties of the third generation semiconductor. This course is focus on developing students' ability of self-study and performing scientific research. The teaching contents are mainly covered by the following aspects: the microstructure, electrical and optical properties, material synthesis and characterization of the third generation semiconductor materials and devices, and the basic device structures, operation principles, fabrication process and characterization methods of the third generation semiconductor. The difficulties of teaching contents are described as followings: the microstructure origin and corresponding electrical and optical properties the third-generation semiconductor materials, and the operation principles and characteristics of the third generation semiconductor devices.

Recommended Textbooks/References:

1.Hadis Morkoc, Handbook of nitride semiconductors and devices, *Wiley-VCH Verlag GmbH & Co. KGaA Press*, 2008.

2.Zhonglin Wang, Nanogenerators for self-powered devices and systems, *Georgia Institute of Technology Press,* 2011.

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.

0008140 异质结与光电子器件

课程编码：0008140

课程名称：异质结与光电子器件

英文名称：Heterojunction and Optoelectronic 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）专业本科生

先修课程：量子力学III、固体物理学、半导体物理

考核形式： 平时成绩+考试

撰写人：解意洋

课程简介：

《异质结与光电子器件》介绍半导体科学和技术的前沿相关的理论和技术基础及其最新的进展，为学生后续的学习和职业发展打下坚实的基础。课程主要内容是半导体异质结物理及其在光电子和超高速微电子器件上的应用。包括异质结的基本理论，异质结生长技术，应变层、超晶格、量子阱、二维电子气等；异质结双极型晶体管，共振隧道器件的工作机理和热电子器件的原理；半导体光跃迁、受激辐射的基本原理，异质结、量子阱激光器和发光管的工作原理和基本结构，以及异质结、量子阱在其他光电子器件中的应用等。通过本课程的学习，学生应掌握关于异质结物理方面的基础知识和异质结在光电子器件方面的应用优势，了解其常用制备方法和特点，以及目前国际上光电子器件技术的最新的发展。

推荐教材或主要参考书：

1. 虞丽生.半导体异质结物理(第二版)北京：科学出版社，2006 年
2. 刘恩科，朱秉升，罗晋升，半导体物理学（第六版）. 北京：电子工业出版社，2004 年
3. 施敏，伍国珏.半导体器件物理（第 3 版）.西安交通大学出版社.2008

0008140 Heterojunction and Optoelectronic Devices

Course Number: 0008140

Course Title: Heterojunction and Optoelectronic Devices

Course Type: Electives

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

Students: Undergraduate students majoring in Electronic Science and Technology

Prerequisites: Quantum Mechanics, Solid State Physics, Semiconductor Physics

Evaluation Method: Course participation + written exams

Writer: Xie Yiyang

Course Description:

The course introduces the science and technology of semiconductor and its related forefront theory and latest development， it lays a solid foundation for students' subsequent learning and career development. The main content is the physics of semiconductor heterojunction and its application in optical and supper high-speed microelectronics devices, including the epitaxy of heterojunction, strained layer, supper lattice, quantum well, 2D electronic gas, double heterojunction transistor, the working principle of resonant tunnel device and the theory of hot electronic device, semiconductor optical transition, the basic principle of stimulated radiation, operation principle and the application of quantum well semiconductor laser devices, heterojunction, light emitting diode, and other optical devices. Upon completion of this course, the students should master the basic knowledge of heterojunction and the advantages of application in optical devices, learning about the common preparation methods, the features of the devices, and the latest developments of optoelectronic devices in the world.

Recommended Textbooks/References:

1. YU Lisheng, Semiconductor Heterojunction physics (second edition). Beijing.
Science Press.2006

2. LIU Enke, ZHU Bingsheng, LUO Jinsheng. Semiconductor physicals (sixth edition).
Publishing House of Electronics Industry.2004

3.Shi Min, Wu Guojue. Physics of Semiconductor Device (third edition). Xi'an Jiaotong University Press. 2008

0010109 集成电路设计方法学

课程编码：0010109

课程名称：集成电路设计方法学

英文名称：Design Methodology for Very Large Scale Integrated Circuits (VLSI)

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）专业本科生

先修课程：集成电路分析与设计、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：张万荣

课程简介：

随着集成电路的发展迅速，集成度越来越高，设计的复杂度不断攀升，使得设计策略和设计方法变得越来越重要。本课程除要求学生掌握相关基本概念、理论外，还含有基本问题求解的典型思路和方法，继在逻辑设计、电路设计和版图设计后，再从系统级和整体上对不同层级的设计方法和目标再认识，提升对复杂集成电路设计的水平，增强一体化设计能力，体验自顶向下集成电路设计实现的乐趣。课程的主要内容包括：全定制、定制、半定制、可编程逻辑器件、混合模式等集成电路设计方法，高级综合技术，逻辑综合技术，物理综合技术，以及逻辑模拟、电路模拟、器件和工艺模拟、集成电路测试技术。

推荐教材或主要参考书：

1.张兴，黄如.微电子学概论.北京大学出版社，2017 年 9 月

2.李冰.《集成电路 CAD》. 电子工业出版社，2018 年 01 月

3.杨之廉、申明编著.《超大规模集成电路设计方法学导论》. 北京：清华大学出版社. 2017

4.徐宁，洪先龙. 超大规模集成电路物理设计理论与算法. 北京：清华大学出版社. 2019

5.Wayne Wolf. Modern VLSI Design Systems on Silicon(现代 VLSI 电路设计)（第 3 版，英文影印版）. 北京：科学出版社. 2013

6.洪先龙，严晓浪. 超大规模集成电路布图理论与算法. 北京：科学出版社. 1998

0010109 Design Methodology for Very Large Scale Integrated Circuits

Course Number: 0010109

Course Title: Design Methodology for Very Large Scale Integrated Circuits (VLSI)

Course Type: Electives

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

Students: Undergraduate students majoring in electronic science and technology

Prerequisites: Analysis and Design of VLSI, Digital Circuits, Analog Circuits

Evaluation Method: Course participation + written exams

Writer: Zhang Wanrong

Course Description:

Design Methodology for Very Large Scale Integrated Circuits (VLSI) is one course for undergraduate students major in electronic science and technology, and microelectronic science and engineering. The main target of this course is to provide students design strategies and design methodology so as to cope with the increase in integration level and complexity of VLSI. The students are expected to understand not only basic concepts, theories and methods, but also logic design, circuit design and layout design. Furthermore, different design methods and targets in different design stages is recognized from system level and as a whole to increase integrative design level for complex VLSI, and to experience a delight of VLSI realization by top-to-down design style. The teaching contents are mainly covered by the following aspects: design methods of custom, semi-custom, mixed style and programmable VLSI; advanced synthesis tmethod; logical synthesis method; physical synthesis method; logical simulation method; circuits simulation method; device and process simulation method; VLSI test techniques.

Recommended Textbooks/References:

1.Zhang Xing, Huang Ru. Introduction to Microelectronics. Beijing: Peking University Press. 2017

2.Li Bing. CAD for Integrated Circuits. Beijing: Publishing House of Electronics Industry, 2018

3.Yang Zilian, Shen Ming. Introduction to Design Methodologies for VLSI. Tsinghua University Press. 2017

4.Wayne Wolf. Modern VLSI Design Systems on Silicon. Science Press. 2013

5.Xu Ning, Hong Xianlong. Theory and Algorithms for VLSI Design. Beijing: Tsinghua University Press. 2017

6.Hong Xianlong, Yan Xiaolang. Routing Theory and Algorithms for VLSI. Beijing: Science Press. 2008

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

0010699 新一代通讯系统设计基础

课程编码：0010699

课程名称：新一代通讯系统设计基础

英文名称：Design Basis of New Generation Communication System

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）专业本科生

先修课程：模拟电子技术、数字电子技术、信号与系统III

考核形式： 平时成绩+考试

撰写人：王慧慧

课程简介：

移动通信和互联网这两个发展最快、创新最活跃领域的融合产生了巨大的发展空间，创新的业务模式、商业模式层出不穷，甚至在不断改变整个信息产业的发展模式。移动互联网是移动网络与互联网融合的产物，随着两者融合的扩大和深入，逐渐成为更具移动特性的、能够深入到人们生产生活的网络与服务体系。移动互联网以手机、个人数字助理（PDA）、便携式计算机、专用移动互联网终端等作为终端，以移动通信网络（包括 2G、3G、4G 等）或无线局域网（WiFi）、无线城域网（WiMAX）作为接入手段，直接或通过无线应用协议（WAP）访问互联网并使用互联网业务。

回顾移动通信技术的发展历史和 4C 通信网络所面临的挑战，引出 5G 的愿景与需求、5G 的标准化、5G 的性能要求，接着介绍为满足 5G 性能要求所需要的无线技术、网络技术及支撑技术，分析 5G 的频谱需求和 5G 网络的安全需求，最后探讨 5G 网络规划和部署方面的问题。

推荐教材或主要参考书：

[1] 张传福，赵立英，张宇等著，5G 移动通信系统与关键技术，电子工业出版社，2018 年 11 月

[2] 李晓辉，刘晋东，李丹涛等， 从 LTE 到 5G 移动通信系统：技术原理及其 LabVIEW 实现， 清华大学，2019 年 12 月

[3] 王振世编著，一本书读懂 5G 技术，机械工业出版社，2022 年 5 月

0010699 Design Basis of New Generation Communication System

Course Number: 0010699

Course Title: Design Basis of New Generation Communication System

Course Type: Electives

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

Students: Undergraduate students majoring in Electronic Science and technology

Prerequisites: Analog electronic technology, Digital electronic technology, Signal and system III

Evaluation Method: Course participation + written exams

Writer： Wang Huihui

Course Description:

The fastest-growing and most active areas of mobile communications and Internet, which have created a huge space for development. Innovative business models and business models emerge one after another. The development model of the entire information industry has been constantly changed. Mobile Internet is the product of the integration of mobile network and Internet. With the integration of them expanding and deepening, it has gradually become a more mobile network and service system that can penetrate into people's production and life.Mobile phones, personal digital assistants (PDA), portable computers and dedicated mobile Internet terminals are terminals of Mobile Internet. Mobile communication networks (including 2G, 3G, 4G, etc.) or wireless local area network (WiFi) and wireless metropolitan area network (WiMAX) as a means of access, access the Internet directly or through Wireless Application Protocol (WAP) and use Internet services.

Reviewing the development history of mobile communication technology and the challenges faced by 4C communication network, the vision and requirements, the standardization and the performance requirements of 5G were introduced in this course. Then it introduces the wireless technology, network technology and supporting technology needed to meet the performance requirements of 5G, analyzes the spectrum requirements of 5G and the security requirements of 5G network, and finally discusses the problems of 5G network planning and deployment.

Recommended Textbooks/References:

1. Zhang Chuanfu, Zhao Liying, Zhang Yu, etc., 5g mobile communication system and key technologies, electronic industry press, November 2018

2. Li Xiaohui, Liu Jindong, Li Dantao, etc., from LTE to 5g mobile communication system: technical principle and LabVIEW implementation, Tsinghua University, December 2019

3. Edited by Wang Zhenshi, Understand 5G Technology in One Book, Machinery Industry Press, May 2022.

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

0010124 面向人工智能的器件与电路

课程编码：0010124

课程名称：面向人工智能的器件与电路

英文名称：Neuromorphic Devices and Circuits for Implementing Artificial Intelligence

课程类型：专业选修课

学分： 32 **总学时：** 2

面向对象：电子科学与技术（实验班）专业本科生

先修课程：半导体物理学，半导体器件原理

考核形式： 平时成绩+考试

撰写人：刘博

课程简介：

《面向人工智能的器件与电路》是微电子学院（信息学部）为电子科学与技术（实验班）专业本科生开设的学科基础选修课程类型。本课程的任务是夯实半导体器件物理的基础，介绍主流存储器结构，发展与挑战，阐述存储器运行的物理机制，进一步结合人工智能的相关理论和技术，使学生理解新一代存内计算智能芯片的基本观念, 以及了解国家及行业对于半导体集成电路相关领域的人才缺口。教学内容重点：非挥发性存储器的简介，阻变式存储器在逻辑，神经运算上的应用，晶体管-存储器结构的运作机制。教学内容的难点：阻变式存储器在类神经器件应用中的物理机制，神经网络学习的实现与优化以及类脑计算器件及阵列。

推荐教材或主要参考书：

1. 尼曼著，《半导体物理与器件（第三版）》. 电子工业出版社，2010.07.01

2. 萧宏著，《半导体制造技术导论（第二版）》.电子工业出版社，2013.1.

3. Shimeng Yu, Resistive Random Access Memory (RRAM): From Device to Array Architectures, Morgan & Claypool Publishers, 2016.

4. Shimeng Yu, Neuro-inspired Computing Using Resistive Synaptic Devices, Springer, 2017

0010124 Neuromorphic Devices and Circuits for Implementing Artificial Intelligence

Course Number: 0010124

Course Title: Neuromorphic Devices and Circuits for Implementing Artificial Intelligence **Course Type:** Electives

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

Students: Undergraduate students majoring in Electronic Engineering

Prerequisites: Semiconductor physics and principle of semiconductor devices

Evaluation Method: Course participation + written exams

Writer： Liu Bo

Course Description:

“Neuromorphic Devices and Circuits for Implementing Artificial Intelligence” is one of the elective bases of disciplinary courses for undergraduate students Major in Electronic Engineering. The main target of this course is to clarify the structure，mechanism, development and challenge of non-volatile random-access memory (NVRAM), especially of resistive type random-access memory. Moreover, bridging the electronic devices with artificial intelligent to illustrate the next generation in-memory computing circuit and the huge demands of respect area in our country. The teaching contents are mainly covered by the following aspects: introduction of NVRAM, the application of RRAM in logic and neuromorphic computing, the operation mechanism of 1-transistor-1-RRAM architecture. The difficulties of teaching contents are described as followings: physical mechanism of RRAM in neuromorphic computing, the realization and optimization of artificial neuron network, and the neuromorphic devices and array.

Recommended Textbooks/References:

1. Donald A.Neamen, <Semiconductor Physics and Devices (Third Edition)>. Publishing House of Electronics Industry, 2010.07.01

2. Hong Xiao, <Introduction to Semiconductor Manufacturing Technology (Second Edition)>.Publishing House of Electronics Industry, 2013.1.

3. Shimeng Yu, Resistive Random Access Memory (RRAM): From Device to Array Architectures, Morgan & Claypool Publishers, 2016.

4. Shimeng Yu, Neuro-inspired Computing Using Resistive Synaptic Devices, Springer, 2017

0010680 微波电路设计的智能学习技术

课程编码：0010680

课程名称：微波电路设计的智能学习技术

英文名称：Artificial Intelligence Methods in Microware Circuit Design

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、半导体器件原理

考核形式：平时成绩+考试

撰写人：那伟聪

课程简介：

《微波电路设计的智能学习技术》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选修课。本课程作为现代科学技术与实践应用十分紧密的电子工程类课程，侧重于应用技术理论和实践的结合，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。本课程依据学生的特点，从神经网络和深度学习的基本结构和训练方法出发，介绍利用神经网络和深度学习技术进行微波电路设计的基本原理、应用与实践，以及该领域最前沿技术和发展现状。教学内容重点：神经网络的结构、训练和验证，深度学习模型，神经网络和深度学习技术在微波无源/有源电路设计中的应用。教学内容的难点：神经网络的训练算法、深度学习模型及卷积神经网络的主流架构。

推荐教材或主要参考书：

[1] Q.J. Zhang, K.C. Gupta. Neural Networks for RF and Microwave Design. Boston, MA: Artech House, 2000.

[2] Simon Haykin 著, 叶世伟, 史忠植译. 神经网络原理（第 2 版）. 机械工业出版社, 2004.

[3] S. Haykin. Neural Networks and Learning Machines. Upper Saddle River, New Jersey: Prentice Hall, 2008.

[4] 马锐编著，人工神经网络原理. 机械工业出版社，2017.

[5] 陈明等编著，MATLAB 神经网络原理与实例精解. 清华大学出版社，2019.

[6] 阿努拉格•巴德瓦杰著，魏佳宁，杨伟，李征等译，深度学习基础教程. 机械工业出版社，2018.

0010680 Artificial Intelligence Methods in Microwave Circuit Design

Course Number: 0010680

Course Title: Artificial Intelligence Methods in Microware Circuit Design

Course Type: Electives

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

Students: Undergraduate students majoring in Electronics Science and Technology

Prerequisites: Basis of Circuit Analysis, Analog Electronics Technique, Digital Electronics Technique, Semiconductor Device

Evaluation Method: Course participation + written exams

Writer： Na Weicong

Course Description:

Artificial Intelligence Methods in Microware Circuit Design is one of the major elective courses for undergraduate students Major in Electronics Science and Technology. As an electronic engineering course closely related to modern science and technology and practical application, this course focuses on the combination of applied technology theory, the cultivation of students' scientific thinking mode and the ability to recognize and apply new technologies. Based on the characteristics of students, this course introduces the basic principles and applications of microwave device design by using neural network and deep learning technology. This course also introduces the most advanced research results, so that students can understand the latest technology and development status of neural network and deep learning technology in the field of microwave devices design. The teaching contents are mainly covered by the following aspects: structure, training and verification of neural network, deep learning models, applications of neural network and deep learning technology in the design of microwave passive / active components. The difficulties of teaching contents are described as followings: the training algorithm of neural network, deep learning model, volume and the mainstream architecture of neural network.

Recommended Textbooks/References:

1. Q.J. Zhang, K.C. Gupta. Neural Networks for RF and Microwave Design. Boston, MA: Artech House, 2000.
2. Simon Haykin. Principles of Neural Networks (2nd Edition). China Machine Press，2004.
3. S. Haykin. Neural Networks and Learning Machines. Upper Saddle River, New Jersey: Prentice Hall, 2008.
4. Rui Ma，Principle of Artificial Neural Network. China Machine Press，2017.
5. Ming Chen，Principle of Neural Network and Examples in MATLAB. Tsinghua University Press，2019.
6. Anurag Badwaj, Basic Course for Deep Learning. China Machine Press，2018.

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