

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	<b>课程名称 Course Title</b>	微机原理与微系统 <b>Microprocessors and Microsystems</b>
2.	<b>授课院系 Originating Department</b>	电子与电气工程系 Department of Electrical and Electronic Engineering
3.	<b>课程编号 Course Code</b>	EE351
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业选修课 Major Elective Courses
6.	<b>授课学期 Semester</b>	秋季 Fall
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation &amp; Contact (For team teaching, please list all instructors)</b>	姜俊敏, 电子与电气工程系, <a href="mailto:jiangjm@sustech.edu.cn">jiangjm@sustech.edu.cn</a> Junmin Jiang, Department of Electrical and Electronic Engineering, <a href="mailto:jiangjm@sustech.edu.cn">jiangjm@sustech.edu.cn</a>
9.	<b>实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact</b>	无 NA
10.	<b>选课人数限额(可不填) Maximum Enrolment (Optional)</b>	

11. 授课方式 Delivery Method	讲授	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	Total
学时数 Credit Hours	32	0	32	0	64
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	EE201-17 模拟电路, EE202-17 数字电路				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无				
14. 其它要求修读本课程的学系 Cross-listing Dept.	无				

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

本课程通过对微型处理器基础知识、8086/ARM 微处理器内部结构、指令系统、汇编语言程序设计、总线操作与时序、半导体存储器、输入输出接口技术、中断与 DMA 技术、定时与计数技术、并行接口与串行接口、人机交互接口、模拟量输入输出接口、传感器输入输出接口、电源管理模块等内容的学习，同时配合软件编程和硬件设计等实验上机的实践练习，培养学生构建基于微型计算机的嵌入式微系统工作原理，使学生掌握现代电子系统设计理论和初步的构建经验，为学生以后开展信息、通信、光电等领域的研究、设计与应用工作打好基础。

This course will cover basic knowledge of microprocessors, 8086/ARM microprocessor internal structure, instruction system, assembly language programming, bus operation and timing, semiconductor memory, input and output interface technology, interrupt and DMA technology, timing and counting technology, parallel interface and serial interface, human-computer interaction interface, analog input and output interface, sensor input and output interface, power management module, etc., and practical experiments including microprocessor based software programming and microsystem hardware design. The target of this course is to train students to build fundamental knowledge of the working principle of embedded micro-system based on microcomputer, and enable students to understand modern electronic systems design theory and preliminary construction experience. This course will lay a solid foundation for students to carry out research, design and application in the electronic fields of information, communication, and optoelectronics.

#### 16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生应达到以下要求：

1. 要求了解并掌握微处理器内部工作原理及外部特性、微处理器芯片的指令系统并能熟练编写汇编语言程序、熟练掌握微处理器中各部件的工作原理、作用及系统组成；
2. 要求熟练掌握微系统中各个接口芯片特点、内部工作原理、在系统中的作用及外部的连接和应用技术、特别是熟练掌握微系统设计、各应用接口硬件电路设计、应用软件设计的方法；
3. 具有初步设计、调试、分析常见基于微型处理器的微型系统的基本能力。

Upon the completion of this course, students should meet the following requirements:

1. Understand the internal working principle and external characteristics of the microprocessor, the instruction system of the microprocessor chip, and be able to write assembly language programs proficiently, and be proficient in the working principle, function and system composition of each component in the microprocessor;
2. Familiar with the characteristics of each interface chip in the micro system, internal working principles, role in the system, and external connection technology. Especially students should be familiar with hardware circuit design of each application interface in the microsystem, and software design methods;
3. Have the basic ability to design, debug, and analyze common microprocessor-based microsystems.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

理论教学大纲：

序号	章节	内容	学时
1	Introduction 绪论	The development of microcomputers and processors, typical microprocessors, the development of microelectronic systems, the application of electronic systems  微型计算机和处理器的的发展，典型的微型处理器，微型电子系统的发展、电子系统的应用	1 学时
2	Fundamental of microcomputer 微型计算机基础知识	2.1 Representation of numbers in microcomputers: Carry counting system, binary coding, representation of signed numbers 2.2 The basic structure and software of microcomputer: the basic structure of microcomputer, microcomputer software 2.3 Microcomputer structure and system: basic structure of microcomputer, microcomputer system  2.1 微型计算机中数的表示方法：进位计数制，二进制编码，带符号数的表示方法 2.2 微型计算机的基本结构和软件：微型计算机的基本结构，微型计算机软件 2.3 微型计算机结构和系统：微型计算机基本结构，微型计算机系统	2 学时
3	Microprocessor internal structure 微处理器内部结构	3.1 The structure and working mode of the microprocessor: the internal structure and memory organization of the 8086 CPU, the internal structure and working process of the 8086 CPU, the internal registers of the 8086 CPU, the pin functions of the 8086/8088 CPU, and the memory organization of the 8086 3.2 8086 working mode and bus operation: minimum mode system, maximum mode system, bus operation timing 3.3 Structure and working mode of 32-bit microprocessor: Introduction to the structure of 32-bit microprocessor, working mode of 32-bit microprocessor  3.1 微处理器的结构和工作模式：8086 CPU 的内部结构和存储器组织，8086 CPU 内部结构及工作过程，8086 CPU 内部寄存器，	2 学时

		<p>8086/8088 CPU 的引脚功能，8086 的存储器组织</p> <p>3.2 8086 的工作模式和总线操作：最小模式系统，最大模式系统，总线操作时序</p> <p>3.3 32 位微处理器的结构与工作模式：32 位微处理器结构简介，32 位微处理器的工作模式</p>	
4	<p>Instruction system</p> <p>指令系统</p>	<p>4.1 8086 addressing mode and instruction system: 8086 addressing mode, immediate addressing mode, register addressing mode, memory addressing mode, other addressing modes</p> <p>4.2 The machine code representation method of instructions: the coding purpose and characteristics of machine language instructions, the preparation of machine language instruction codes, the 8086 instruction system, data transmission instructions, arithmetic operation instructions, logic operations and shift instructions, string processing instructions, control Transfer instruction</p> <p>4.1 8086 的寻址方式和指令系统：8086 的寻址方式，立即寻址方式，寄存器寻址方式，存储器寻址方式，其它寻址方式</p> <p>4.2 指令的机器码表示方法：机器语言指令的编码目的和特点，机器语言指令代码的编制，8086 的指令系统，数据传送指令，算术运算指令，逻辑运算和移位指令，字符串处理指令，控制转移指令，处理器控制指令</p>	4 学时
5	<p>Assembly language programming</p> <p>汇编语言程序设计</p>	<p>5.1 Assembly language program format and pseudo-instructions: assembly language program format, pseudo-instruction statements, complete assembly language program framework</p> <p>5.2 Assembly language program design methods and examples: sequential structure program design, branch program design, loop structure program, code conversion program, procedure call</p> <p>5.1 汇编语言程序格式和伪指令：汇编语言程序格式，伪指令语句，完整的汇编语言程序框架</p> <p>5.2 汇编语言程序设计方法与实例：顺序结构程序设计，分支程序设计，循环结构程序，代码转换程序，过程调用</p>	3 学时
6	<p>Processor bus operation and timing</p> <p>处理器总线操作与时序</p>	<p>6.1 Overview of the bus: bus classification, bus performance indicators and bus standards, several typical computer buses</p> <p>6.2 USB bus: Introduction to USB bus</p> <p>6.1 总线概述：总线的分类，总线的性能指标与总线标准，几种典型的计算机总线</p> <p>6.2 USB 总线：USB 总线简介</p>	2 学时
7	<p>Memory</p> <p>存储器</p>	<p>7.1 Memory classification: internal memory, external memory, memory performance indicators</p> <p>7.2 Random access memory RAM: static RAM (SRAM), dynamic RAM (DRAM), memory sticks</p> <p>7.3 Read-only memory ROM: Programmable erasable ROM (EPROM), electrically erasable programmable ROM (EEPROM)</p> <p>7.4 Connection between memory and CPU</p> <p>7.5 High-speed cache memory: the principle of high-speed cache, the basic structure of high-speed cache</p> <p>7.1 存储器分类：内部存储器，外部存储器，存储器的性能指标</p> <p>7.2 随机存取存储器 RAM：静态 RAM (SRAM)，动态 RAM (DRAM)，内存条</p>	3 学时

		<p>7.3 只读存储器 ROM: 可编程可擦除 ROM (EPROM), 电可擦除可编程 ROM (EEPROM)</p> <p>7.4 存储器与 CPU 的连接</p> <p>7.5 高速缓冲存储器: 高速缓存的原理, 高速缓存的基本结构</p>	
8	<p>Input and output interface</p> <p>输入输出接口技术</p>	<p>8.1 Interface: I/O interface function, I/O port and its addressing mode, data transfer mode between CPU and peripherals, PC I/O address allocation</p> <p>8.2 Working principle of 8255A: structure and function of 8255A</p> <p>8.3 Application example of 8255A: basic input and output application example, keyboard interface</p> <p>8.1 接口: I/O 接口的功能, I/O 端口及其寻址方式, CPU 与外设间的数据传送方式, PC 机的 I/O 地址分配</p> <p>8.2 8255A 的工作原理: 8255A 的结构和功能</p> <p>8.3 8255A 的应用举例: 基本输入输出应用举例, 键盘接口</p>	3 学时
9	<p>Mid-term exam</p> <p>课程期中考试</p>	<p>Mid-term exam</p> <p>课程期中测试</p>	3 学时
10	<p>Interrupt</p> <p>中断技术</p>	<p>10.1 Interrupt: Interrupt concept and classification, interrupt response and processing process</p> <p>10.2 The working principle of 8259A: 8259A pin signal and internal structure, 8259A working mode, 8259A command word and programming</p> <p>10.3 8259A application examples: cascaded use of 8259A, interrupt vector settings and interrupt handler design examples</p> <p>10.1 中断: 中断概念和分类, 中断的响应与处理过程</p> <p>10.2 8259A 的工作原理: 8259A 的引脚信号和内部结构, 8259A 的工作方式, 8259A 的命令字及编程</p> <p>10.3 8259A 应用举例: 8259A 的级联使用, 中断向量的设置和中断处理程序设计实例</p>	3 学时
11	<p>Direct memory access</p> <p>DMA 技术</p>	<p>11.1 Overview of DMA technology</p> <p>11.2 The composition and working principle of 8237A (323)</p> <p>11.3 Timing of 8237A: DMA data transfer timing between peripherals and memory</p> <p>11.1 DMA 技术概述</p> <p>11.2 8237A 的组成和工作原理(323)</p> <p>11.3 8237A 的时序: 外设和内存间的 DMA 数据传送时序</p>	1 学时
12	<p>Timing and counting</p> <p>定时与计数技术</p>	<p>12.1 The working principle of 8253: the internal structure and pin signal of 8253, the function of initial programming step and gate control signal</p> <p>12.2 Working mode of 8253: application example of 8253/8254, application example of 8253 timing function, application example of 8253/8254 counting function</p> <p>12.1 8253 的工作原理: 8253 的内部结构和引脚信号, 初始化编程步骤和门控信号的功能</p> <p>12.2 8253 的工作方式: 8253/8254 的应用举例, 8253 定时功能的应用举例, 8253/8254 计数功能的应用举例</p>	3 学时
13	<p>Parallel interface and serial interface</p> <p>并行接口与串行接口</p>	<p>13.1 Overview of the bus: the classification of the bus, its performance indicators and bus standards, several typical computer buses</p> <p>13.2 USB bus: Introduction to USB bus, USB data encoding and information transmission</p>	2 学时

		13.1 总线概述: 总线的分类, 总线的性能指标与总线标准, 几种典型的计算机总线 13.2 USB 总线: USB 总线简介, USB 的数据编码和信息传输	
14	Sensors and human-machine interaction  传感器与人机交互	14.1 Overview of sensors: sensor classification, sensor performance indicators, several typical sensors 14.2 Typical sensors: temperature sensor, pressure sensor, speed sensor  14.1 传感器概述: 传感器分类, 传感器性能指标, 几种典型的传感器 14.2 典型传感器: 温度传感器, 压力传感器, 速度传感器	1 学时
15	Mixed-signal data converter  数模混合变换器	15.1 Overview of analog-to-digital (A/D) and digital-to-analog (D/A) conversion: a real-time control system, sampling, quantization and coding 15.2 D/A converter: D/A converter principle, the main performance index of D/A converter, D/A converter AD7524, DAC0832 and DAC1210 15.3 A/D converter: A/D converter principle, A/D converter ADC0809 and AD574A  15.1 模数(A/D)和数模(D/A)转换概述: 一个实时控制系统, 采样、量化和编码 15.2 D/A 转换器: D/A 转换器原理, D/A 转换器的主要性能指标, D/A 转换器 AD7524、DAC0832 和 DAC1210 15.3 A/D 转换器: A/D 转换器原理, A/D 转换器 ADC0809 和 AD574A	1 学时
16	Power management  电源管理	16.1 Overview of Power Management 16.2 Basic control method of DC-DC conversion 16.3 Switched inductors, switched capacitors, linear regulators and other power management  16.1 电源管理概述 16.2 DC-DC 变换的基本控制方式 16.3 开关电感, 开关电容, 线性稳压器等电源管理	1 学时

实验教学大纲:

序号	章节	内容	学时
1	Software programming: memory access  软件实验: 内存操作	Programming language, memory operation, read ROM, write RAM, write FLASH/EEPROM  编程语言, 内存操作, 读 ROM, 写 RAM, 写 FLASH/EEPROM	3 学时
2	Software programming: Number system and code conversion  软件实验: 数制与代码转换	Number conversion, code conversion  数制转换, 代码转换	3 学时
3	Software programming: Arithmetic	Arithmetic operation, logic operation, parallel operation  算术运算, 逻辑运算, 并行运算	3 学时

	operation  软件实验 ：算术运算		
4	Software programming: Comparison and look-up table  软件实验：比较与查表	Data reading, data comparison, look-up table operation  数据读入，数据比较，查表运算	3 学时
5	Hardware experiment: I/O interface control  硬件实验：I/O 接口控制	I/O operation, I/O read operation, I/O write operation, I2C interface, SPI interface  I/O 调用，接口读入操作，接口写操作，I2C 接口，SPI 接口	4 学时
6	Hardware experiment: Timer and counter  硬件实验：定时器计数器	Timer operation, counter operation  定时器操作，计数器操作	4 学时
7	Hardware experiment: keyboard and display  硬件实验：按键与显示	Keyboard coding, anti-shake operation, display interface, display image  按键编码，防抖操作，调用显示接口，编辑显示图像	4 学时
8	Hardware experiment: data converters  硬件实验：数据转换器	Data converter interface, AD operation, DA operation  数据转换器接口，AD 操作，DA 操作	4 学时
9	Hardware experiment: sensors  硬件实验：传感器	Sensor interface, temperature sensor, photosensitive sensor, pressure sensor  传感器接口，温度传感器，光敏传感器，压力传感器	4 学时

18. 教材及其它参考资料 Textbook and Supplementary Readings

Textbook:

周荷琴, 微型计算机原理与接口技术(第6版), 中国科学技术大学出版社。(ISBN: 9787312046124)

Reference:

Douglas V Hall, Microprocessor and Interfacing, TMH, Second Edition. (ISBN-10: 0070257426)

M.H. Hassan, Microprocessors and Systems Design. (ISBN-10: 1791971121)

### 课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance	0	0		
课堂表现 Class Performance	0	0		
小测验 Quiz	0	0		
课程项目 Projects	6	20		
平时作业 Assignments	8	20		
期中考试 Mid-Term Test	6	20		
期末考试 Final Exam	6	0		
期末报告 Final Presentation	0	40		
其它(可根据需要 改写以上评估方式) Others (The above may be modified as necessary)				

### 20. 记分方式 GRADING SYSTEM

- A. 十三级等级制 Letter Grading  
 B. 二级记分制(通过/不通过) Pass/Fail Grading

### 课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过  
 This Course has been approved by the following person or committee of authority





南方科技大学  
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

