**《计算机组成与体系结构》教学大纲**

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| 课程代码 | 145196 |
| 课程名称 | 计算机组成与体系结构 |
| 英文名称 | Computer Organization and Architecture |
| 课程类别 | 专业基础课 |
| 课程性质 | 必修 |
| 学时 | 总学时：64 实验学时：16 实习学时：0 其他学时：0 |
| 学分 | 4 |
| 开课学期 | 第四学期 |
| 开课单位 | 计算机科学与工程学院 |
| 适用专业 | 计算机科学与技术专业、软件专业、信息安全专业 |
| 授课语言 | 中文授课 |
| 先修课程 | 无 |
| 课程对毕业要求的支撑 | （本学院开设的专业课填写；根据专业所列的毕业要求来填写） |
| 课程目标 | 本课程是计算机专业的核心专业基础课程，在计算机专业的各门课程中起着承上启下的重要作用。本课程的教学目标是使学生掌握计算机原理的基本概念、基本原理、基本设计和分析方法，通过实验教学努力提高学生在计算机硬件设计和实现方面的能力，适当了解提高计算机的部件和整机硬件性能的各种可能途径，并能对当前计算机的最新研究、发展与应用趋势有一般性的了解。 |
| 课程简介 | 计算机组成是依据计算机体系结构，在确定并分配了硬件子系统的概念和结构和功能特性的基础上，设计计算机各部件的具体组成及它们之间的连接关系，实现机器指令级的各种功能和特点。即计算机组成是计算机体系结构的逻辑实现。  学生通过学习，从层次的观点，掌握计算机组成和运行机制方面的基本概念、基本原理、基本设计和分析方法等系统知识，奠定必要的专业知识基础；从系统的观点，理解提高计算机整机的硬软件性能和部件性能的各种可行途径，了解计算机系统中硬件、软件的功能划分和相互配合关系，进而初步了解从计算机系统结构的角度进一步提高系统性能的主体思想，能站在更高层次上思考和解决工作中遇到的问题。通过本课程的学习，还可以培养学生从形象思维向抽象思维过渡，掌握自顶向下分析和解决问题的能力，提高温故知新、举一反三和自主学习的能力，最终建立计算机系统的完整概念。 |
| 教学内容与学时分配 | 1. 计算机组成概述（2学时）   1. 计算机系统的基本组成及其层次结构  2. 计算机的体系结构、组成和实现  3. 计算机系统的发展进步  教学要求：  1. 理解计算机系统的含义及层次结构；  2. 理解计算机组成的基本概念，以及与体系结构、实现之间的关系；  3. 理解计算机的组成结构；  4. 了解系列机、兼容机概念；  5. 了解计算机系统的发展进步。  教学重点： 计算机的层次结构、计算机组成的基本概念及结构、计算机组成与体系结构及实现之间的关系。  教学难点： 计算机组成的基本概念及结构、计算机的层次结构。  第二章 数字电路基础和计算机中的逻辑器件（4学时）  1. 组合逻辑及其应用；  2. 时序逻辑及其应用；  3. 现场可编程器件及其应用；  4. 几个专用功能器件和存储器芯片的引脚图。  教学要求：  1. 复习组合逻辑及其应用、时序逻辑及其应用；  2. 了解可编程逻辑器件FPGA及其应用。  教学重点：  现场可编程器件功能及其应用  教学难点：  现场可编程器件功能及其应用  第三章 数据表示、运算算法和线路实现（8学时）  1. 数字化信息编码的概念和二进制编码知识（8421码、CRC码）；  2. 数据表示—常用的信息编码（逻辑类型数据、字符类型数据、数据类型数据）；  3. 二进制数据的编码与运算算法（原码、反码、补码、补码加/减法运算算法及电路实现、原码一位除法运算算法及电路实现、补码一位乘法/除法运算算法及电路实现）。  教学要求：  1. 理解并掌握各种数据的表示方法；  2. 了解汉明码、CRC码的定义及应用；  3. 理解并掌握各种运算算法及电路实现。  教学重点： 各种数据的表示方法、各种运算算法及电路实现。  教学难点： 各种运算算法及电路实现。  第四章 运算器部件的组成与设计（4学时）  1. 运算器部件概述；  2. 算术逻辑运算器74LS181；  3. 教学计算机运算器的设计与实现；  4. 浮点运算与浮点运算器；  5. 提高运算器部件处理能力的可行途径。  教学要求：  1. 理解定点运算器部件的基本功能、基本组成原理；  2. 掌握定点运算器部件基本设计和实现方法；  3. 理解并掌握算术逻辑运算器74LS181原理及应用；  4. 掌握浮点运算与浮点运算器；  5. 了解提高运算器部件处理能力的可行途径。  教学重点： 定点运算器部件的基本功能、基本组成原理、基本设计和实现方法； 算术逻辑运算器74LS181原理及应用；  教学难点： 提高运算器部件处理能力的可行途径。  第五章 指令、指令系统和汇编程序设计（8学时）  1. 指令格式和指令系统概述；  2. 寻址方式概述；  3. 指令系统举例  4. 汇编语言程序举例（包括汇编语言程序设计）。  教学要求：  1．理解指令格式和寻址方式；  2．掌握教学计算机的指令系统及汇编语言程序设计。  教学重点：指令格式、寻址方式、教学计算机的指令系统及汇编语言程序设计。  教学难点：寻址方式、教学计算机的指令系统及汇编语言程序设计  第六章 控制部件的组成与设计（8学时）  1. 微过程控制器部件的组成与设计；  2. 硬布线控制器部件的组成与设计；  3. 硬布线控制器部件的组成与设计；  4. 提高指令执行速度的可能性途径。  教学要求：  1. 理解控制器的功能、组成原理；  2. 理解微程序控制器部件的组成原理，掌握微程序控制器的设计方法；  3. 了解硬布线控制器部件的组成原理及设计方法；  4. 了解硬布线控制器部件的组成与设计；  5. 了解提高指令执行速度的可能性途径。  教学重点：  控制器的组成原理、微程序控制器部件的组成原理及设计方法。  教学难点：  微程序控制器部件的组成原理及设计方法。  第七章 多级结构的存储器系统（6学时）  1. 存储器系统原理（三级结构、统一管理、调度一体化、存储速度、存储容量、单位价格）；  2. 主存储器组成原理及实现技术（教学计算机内存储器的组成与设计）；  3. 外部存储设备与磁盘阵列技术；  4．高速缓冲存储器cache原理；  5．虚拟存储器原理；  6．提高存储器系统性能的可行途径。  教学要求：  1. 了解存储器系统原理；  2. 理解主存储器部件的组成原理；  3. 掌握教学计算机内存储器的组成原理与实现技术；  4. 了解外部存储设备与磁盘阵列技术；  5. 了解高速缓冲存储器cache原理；  6. 了解虚拟存储器原理；  7. 了解提高存储器系统性能的可行途径。  教学重点：  存储器系统原理、主存储器部件的组成原理及实现技术、高速缓冲存储器cache原理、虚拟存储器原理、提高存储器系统性能的可行途径。  教学难点：  主存储器部件的组成原理及实现技术、高速缓冲存储器cache原理、虚拟存储器原理。  第八章 输入输出设备与输入输出系统（8学时）  1． 输入输出系统概述；  2． 计算机总线的构成原理；  3． 输入输出接口的基本功能和一般组成；  4． 常用的输入输出方法；  5． 提高数据输入输出能力和可靠性的可行途径。  教学要求：  1． 了解输入输出系统及常用输入输出设备；  2． 理解计算机总线的构成原理；  3． 了解输入输出接口的基本功能和一般组成；  4． 掌握常用的输入输出方法；  5． 了解提高数据输入输出能力和可靠性的可行途径。  教学重点： 计算机总线的构成原理、输入输出接口的基本功能和一般组成、常用的输入输出方法、提高数据输入输出能力和可靠性的可行途径。  教学难点： 计算机总线的构成原理、输入输出接口的基本功能和一般组成、常用的输入输出方法。 |
| 实验教学（包括上机学时、实验学时、实践学时） | 实验学时：16学时，上机学时：0学时，实践学时：0学时 |
| 教学方法 | 课程教学以课堂教学、综合讨论以及实验上机操作等共同实施。 |
| 考核方式 | 本课程注重过程考核，成绩比例为：  平时课堂表现：10%  实验报告：20%  期末考试（闭卷）：70% |
| 教材及参考书 | 现用教材：  白中英 戴志涛编著 《计算机组成原理》科学出版社 2014年  主要参考资料  [1] 王诚等.计算机组成与设计（第三版）.北京:清华大学出版社.2007年  [2] 唐朔飞.计算机组成原理.北京：高等教育出版社  [3] 白中英.计算机组成原理.北京：科学出版社  [4] Linda Null, Julia Lobur.黄河等译.计算机组成与体系结构.北京：机械工业出版社，2006.8  [5] Andrew S.Tanenbaum.刘卫东等译.计算机组成-结构化方法.北京：人民邮电出版社，2006.7  [6] 潘松，潘明.现代计算机组成原理.北京：科学出版社，2007.2  [7] 王爱英.计算机组成与结构.北京：清华大学出版社，2002 |
| 制定人及制定时间 | 赖晓铮 2019年4月10日 |

***“Computer Organization and Architecture”* Syllabus**

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| Course Code | 145196 |
| Course Title | Computer Organization and Architecture |
| Course Category | Specialty Basic Courses |
| Course Nature | Compulsory Course |
| Class Hours | Total Hours: 80 Experimental Hours: 16 Internship Hours: 0 Other Hours: 0 |
| Credits | 4 |
| Semester | Seventh Semester |
| Institute | School of Computer Science & Engineering |
| Program Oriented | Computer Science and Technology Major; Software Major; Information Security Major |
| Teaching Language | Chinese |
| Prerequisites | Not |
| Student Outcomes  (Special Training  Ability) | (Fill in the specialized courses offered by the Institute and fill in the required  graduation requirements) |
| Course Objectives | This course is the core specialized basic course of computer science. It plays an important role in the course of computer major. The aim of this course is to make students master the basic concepts, basic principle, basic principle of computer design and analysis methods, to improve the students in the aspect of hardware design and implementation of computer ability through experiment teaching, proper understanding of possible ways to improve the various computer components and the hardware performance, and the latest research and development and the trend of application of the current computer has a general understanding. |
| Course Description | Computer composition is based on the computer architecture, based on determining the distribution and hardware subsystem and the concept of structural and functional characteristics, the connection between the design of the various components of the computer and their specific composition, to achieve a variety of functions and characteristics of the machine instruction level. That is, the computer composition is the logical implementation of the computer architecture. The students, from the hierarchy view, grasp the basic concepts of computer, composition and operation mechanism of the basic principle, basic design and analysis methods of knowledge system, lay the necessary foundation of professional knowledge; from the point of view of system, improve the understanding of all kinds of feasible ways of hardware and software performance and the performance of computer components, understand the function the hardware and software in a computer system, and cooperate with each other, and then a preliminary understanding to further improve the system performance of the main ideas from computer system structure perspective, can stand on a higher level of thinking and solving the problems encountered in the work. Through this course, students can also transition from image thinking to abstract thinking, grasp the top-down analysis and problem solving ability, improve the new lines, and ability of autonomous learning, finally establishes the concept of computer system. |
| Teaching Content and Class Hours  Distribution | Chapter 1: Computer composition overview (4 hours)  1. understand the meaning and structure of the computer system;  2. understand the basic concepts of computer composition, and the relationship with the system structure, the;  3. understand the composition of the structure of the computer;  4. understand series machine, compatible machine concept;  5. understand the development and progress of computer system  Teaching emphasis: computer architecture, computer basic concept and structure, computer components and the relationship between the system structure and implementation.  Teaching difficulties: the hierarchical structure of the basic concept and structure, composed of the computer computer.  Chapter 2: Fundamentals of digital circuits and logic devices in computers (6 hours)   1. combinational logic and its application;   2. temporal logic and its application;  3. field programmable device and its application;  4. several special function devices and memory chip pin map.  Teaching requirements: Understand the basics:   1. Review combinatorial logic and its applications, temporal logic and their applications; 2. Understanding programmable logic device FPGA and its application.   Teaching emphasis: field programmable device function and its application.  Teaching difficulties: field programmable device function and its application  Chapter 3: Data representation, operation algorithms, and line implementation (8 hours)   1. The concept of digital information coding and binary coding knowledge (8421   yards and CRC codes);  2. Data representation - commonly used information encoding (logic type data,  character type data, data type data);  3. Encoding and algorithm of binary data (original code, complement,  complement, complement addition / subtraction algorithm, source code and circuit implementation of a division algorithm and circuit implementation, complement a multiplication / division algorithm and circuit implementation).  Teaching requirements:  1. Understand and master the representation of various data;  2. Understand Hamming code, CRC code definition and application;  3. Understand and master various calculation algorithms and circuit  implementation.  Teaching emphasis: representation method, various arithmetic and circuit data.  Teaching difficulties: various arithmetic and circuit realization.  Chapter 4: Composition and design of arithmetic unit (10 hours)  1. Alu unit overview;  2. Arithmetic logic unit 74LS181;  3. Design and implementation of teaching computer operator;  4. Floating point arithmetic and floating point arithmetic unit;  5. A feasible approach to improve processor processing capability.  Teaching requirements:   1. Understand the basic functions and basic components of a fixed-point   arithmetic unit;  2. Master the basic design and implementation method of fixed-point arithmetic unit;  3. Understand and master the principles and applications of Alu 74LS181;  4. Master floating point arithmetic and floating point arithmetic;  5. Understanding the possible ways to improve processor processing capacity.  Teaching emphasis: the basic function, fixed-point arithmetic components the basic composition and the basic design principle and realization method; the principle and application of arithmetic and logic 74LS181;  Teaching difficulties: the feasible way to improve the operation component processing ability.  Chapter 5: Instruction and instruction system and assembly program design (8 hours)   1. Instruction format and instruction system overview; 2. Addressing mode overview; 3. Instruction system example; 4. Assembly language procedures for example (including assembly language programming).   Teaching requirements:   1. Understanding instruction formats and addressing modes; 2. Master the instruction system of instruction computer and assemble language   program design.  Teaching emphasis: instruction format, addressing mode, instruction system of instruction computer and assembly language program design.  Teaching difficulties: addressing methods, teaching computer instruction system and assembly language program design.  Chapter 6: Composition and design of control components (10 hours)   1. Components and design of micro process controller components; 2. Composition and design of hard wired controller components; 3. Composition and design of hard wired controller components; 4. The possibility of increasing the speed of instruction execution.   Teaching requirements:   1. Understand the function and composition principle of the controller; 2. Understand the composition principle of micro program controller components, and master the design method of micro program controller; 3. Understand the component principle and design method of hard wired controller components; 4. Understand the components and design of hard wired controller components; 5. Understand the possibility of increasing the speed of instruction execution.   Teaching emphasis: principle and method of design principle, controller micro controller unit.  Teaching difficulties: the principle and design method of micro controller unit.  Chapter 7: Memory system with multilevel structure (10 hours)   1. Memory system principle (three levels of structure, unified management, integration of scheduling, storage speed, storage capacity, unit price); 2. Principle and implementation technology of main memory (composition and design of teaching computer memory); 3. External storage devices and disk array technology; 4. Cache memory cache principle; 5. Virtual memory principle; 6. Feasible ways to improve memory system performance.   Teaching requirements:   1. Understanding memory system principles; 2. Understand the composition principle of main memory components; 3. Master the composition principle and implementation technology of teaching computer memory; 4. Knowledge of external storage devices and disk array technologies; 5. Understanding the principles of cache memory cache; 6. Understanding virtual memory principles; 7. Understanding the possible ways to improve memory system performance.   Teaching emphasis: memory system principle, main memory components and the realization of the principle of technology, cache, virtual memory principle, cache principle to improve the memory system performance way.  Teaching difficulties: the principle of main memory components and realization technology, cache cache principle, principle of virtual memory.  Chapter 8: I / O device and I / O system (8 hours)   1. I / O system overview; 2. The composing principle of computer bus; 3. The basic functions and general components of the input / output interface; 4. Common methods of input and output; 5. Feasible ways to improve data input and output capability and reliability.   Teaching requirements:   1. Understanding input and output systems and common input / output devices; 2. Understand the principles of a computer bus; 3. Understand the basic functions and general components of the input / output interface; 4. Master the commonly used input and output methods; 5. Understanding the practical ways to improve data input and output capabilities and reliability.   Teaching emphasis: computer bus basic principle function, input and output interface and general composition, commonly used input output method, a feasible way to improve the capacity and reliability of the data input and output.  Teaching difficulties: computer bus basic principle function, input and output interface and general composition, commonly used input output method. |
| Experimental Teaching | Experimental Hours: 16 on Board Hours: 0 Practical Hours: 0 |
| Teaching Method | The course teaching is carried out by classroom teaching, comprehensive discussion, experiment and computer operation. |
| Examination Method | This course focuses on process assessment, and the achievement ratio is:  Classroom performance: 10%  Experiment report: 20%  Final examination (closed): 70% |
| Teaching Materials  and Reference Books | Present textbook:  Zhongying Bai, Zhitao Dai. Principles of Computer Organization. Science Press, 2014.  The main reference material:  [1] Cheng Wang. Computer composition and design (Third Edition). Beijing: Tsinghua University Press, 2007.  [2] Shuofei Tang. Principles of Computer Organization. Beijing: Higher  Education Press.  [3] Zhongying Bai. Principles of Computer Organization. Science Press.  [4] Linda Null, Julia Lobur. Computer composition and architecture. Beijing:  China Machine Press, 2006.8.  [5] Andrew S.Tanenbaum. Computer composition. Structured method. Beijing:  People's Posts and Telecommunications Press, 2006.7.  [6] Song Pan, Ming Pan. Principles of modern computer science. Beijing:  Science Press, 2007.2.  [7] Aiying wang. Computer composition and structure. Beijing: Tsinghua  University press, 2002 |
| Prepared by Whom  and When | Xiaozheng Lai April 10, 2019 |