计算机组成原理　教学大纲

Principles of Computer Organization　Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100213011	开课学期: Semester	5
课程分类: Category	专业教育 PA	所属课群: Section	专业平台 MT
课程学分: Credit Points	4.5	总学时/周: Total Hours/Weeks	72
理论学时: LECT. Hours	56	实验学时: EXP. Hours	16
PBL 学时: PBL Hours	0	实践学时/周: PRAC. Hours/Weeks	0
开课学院: College	东北大学 悉尼智能科技学院 Sydney Smart Technology College Northeastern University	适用专业: Stream	计算机科学与技术 CST
课程属性: Pattern	选修 Elective	课程模式: Mode	互认 EQV
中方课程协调人: NEU Coordinator	方淼 Fang Miao	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	无 none		
英文参考教材: EN Textbooks	David A. Patterson, John L. Hennessy. Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Elsevier		
中文参考教材: CN Textbooks	唐朔飞，《计算机组成原理》（第三版），高等教育出版社，2020 Tang Shuofei, Principles of Computer Organization (the third Edition), Higher Education Press, 2020		
教学资源: Resources			
课程负责人(撰写人): Subject Director	方淼	提交日期: Submitted Date	4/5/2023
任课教师(含负责人): Taught by	方淼 Fang Miao		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	4/10/2023

二、教学目标 Subject Learning Objectives (SLOs)

注：毕业要求及指标点可参照悉尼学院本科生培养方案，可根据实际情况增减行数

Note: GA and index can be referred from undergraduate program in SSTC website. Please add/reduce lines based on subject.

整体目标: Overall Objective		《计算机组成原理》是计算机科学与技术专业本科生的一门重要的必修课程。以冯诺依曼机的结构为主线，比较全面的阐述计算机硬件系统的工作原理和组成结构。主要内容包括运算器与运算方法，存储系统，指令系统，中央处理器，总线，输入和输出系统等。。本课程培养学生对计算机系统的的兴趣，以及创造力。 Principle of computer organization is an important compulsory course for undergraduates majoring in computer science and technology. Taking the structure of von Neumann machine as the main line, this paper comprehensively expounds the working principle and composition structure of computer hardware system. The main contents include arithmetic unit and arithmetic method, memory system, instruction system, central processing unit, bus, input and output system, etc.. This course cultivates students' interest in computer system and creativity.
（1）专业目标: Professional Ability	1-1	掌握计算机器件和结构的发展历史和规律，理解计算机性能指标，理解计算机组成与体系结构，实现之间的关系，了解计算机的最新研究、发展与应用趋势。 Master the development history and law of computer devices and structure, understand the performance index of computer, understand the relationship between the composition and architecture of computer, and understand the latest research, development and application trend of computer.
	1-2	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，建立计算机整机系统的完整概念，培养计算机硬件设计和实现方面的能力。 Master the basic concept, basic principle, basic design and analysis method of computer principle, establish the complete concept of computer system, and cultivate the ability of computer hardware design and implementation
	1-3	通过科学思维方法的训练,培养学生运用科学原理解决实际问题的工程能力,最终能把在相关课程中所学的软、硬件知识有机地结合起来,为学习本专业后继课程和从事与计算机系统分析和设计有关的技术工作奠定基础。 Through the training of scientific thinking methods, the students' engineering ability to solve practical problems by using scientific principles is cultivated. Finally, the software and hardware knowledge learned in relevant courses can be organically combined, which lays the foundation for learning the subsequent courses of this major and engaging in the technical work related to computer system analysis and design.
（2）德育目标: Essential Quality	2-1	培养科学与工程应用的意识和素质,逐步培养学生的探索精神和创新能力。

		To cultivate the consciousness and quality of science and engineering application, and gradually cultivate students' exploration spirit and innovation ability.
	2-2	能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。 Be able to play the role of individual, team member and leader in a multidisciplinary team.

课程教学目标与毕业要求的对应关系 Matrix of GA & SLOs

毕业要求 GA	指标点 GA Index	教学目标 SLOs
1、工程知识：能够将数学、自然科学、工程基础和专业知识用于解决复杂工程问题。	指标点 1-2：掌握程序设计、数据结构、算法分析与设计、计算机数字系统、操作系统等专业知识，具备计算机程序设计开发能力和计算机与信息系统设计开发与维护能力。	1-1，1-2，1-3,1-4
3、设计/开发解决方案：能够设计针对复杂工程问题的解决方案，设计满足特定需求的系统、单元或流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。	指标点 3-1：能够设计针对本专业相关复杂工程问题的解决方案，能够设计和开发实现特定功能、满足特定需求的计算机、软件或网络系统。	1-3
	指标点 3-3：能够在设计和开发的各个环节中综合考虑社会、健康、安全、法律、文化以及环境等因素。	1-3，2-1
4、研究：能够基于科学原理并采用科学方法对复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	指标点 4-1：能够基于科学原理并采用科学方法，在本专业相关理论指导下对复杂工程问题设计实验进行研究。	1-3，2-2
4、职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。	指标点 8-2：了解本专业相关的职业道德与规范并认识其重要性，具备良好的职业道德和社会责任感，能够对工程实践活动的社会道德进行判断和评鉴，并履行相应的责任；	2-1

批注 [HP1]: 参考课程培养方案中的本专业的具体指标点

三、教学内容 Content (Topics)

注：以中英文填写，各部分内容的表格可根据实际知识单元数量进行复制、扩展或缩减

Note: Filled in both CN and EN, extend or reduce based on the actual numbers of knowledge unit

批注 [HP2]: 全部使用双语撰写，注意翻译准确，可以适当采用英文翻译工具，例如"百度翻译""必应翻译"协助翻译，注意翻译后的检查和对照工作，注意大小写、缩进、字体及标点符号的规范性

(1) 理论教学 Lecture

知识单元序号: Knowledge Unit No.	1	支撑教学目标: SLOs Supported	1-1
知识单元名称 Unit Title	绪论 Introduction		

知识点: Knowledge Delivery	计算机系统，计算机器件，计算机系统层次结构，计算机分析和设计的概念； Computer systems, computer devices, hierarchical structure of computer systems, concepts of computer analysis and design;	
	计算机组成、实现与结构之间的关系。 The relationship between computer composition, implementation and structure.	
学习目标: Learning Objectives	了解: Recognize	计算机组成的基本概念，以及与体系结构、实现之间的关系。 Understand the basic concept of computer composition, as well as the relationship between architecture and implementation.
	理解: Understand	掌握计算机的硬件组成,掌握计算机系统的多级层次结构。 the hardware composition of the computer, the multi-level hierarchical structure of the computer system.
	掌握: Master	计算机系统性能分析方法。 the computer system performance analysis method.
德育目标 Moral Objectives	培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。 To cultivate the consciousness and quality of science and engineering application, and gradually cultivate students' exploration spirit and innovation ability.	
重点: Key Points	掌握计算机的硬件组成,掌握计算机系统的多级层次结构。 The hardware composition of the computer, the multi-level hierarchical structure of the computer system. 计算机系统性能分析方法。 The computer system performance analysis method.	
难点: Focal points	计算机系统性能分析方法。 The computer system performance analysis method.	

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-1 1-2
知识单元名称 Unit Title	运算方法及运算器 Arithmetic method and arithmetic unit		
知识点: Knowledge Delivery	无数据的编码与进位计数制表示方法；数的机器码表示方法； Coding without data and representation of carry counting system; The machine code representation method of number; 定点数加减法运算；加法器；定点乘法运算；定点除法运算；浮点数运算方法； Fixed point number addition and subtraction operation; Adder; Fixed point multiplication operation; Fixed point division operation; Floating point calculation method;		

		运算器的功能与工作原理；定点运算器的组成和结构；浮点运算器的组成。 The function and working principle of the arithmetic unit; The composition and structure of fixed-point arithmetic unit; The composition of floating point arithmetic unit.
学习目标: Learning Objectives	了解: Recognize	浮点运算器的工作原理；一个典型的定点运算器芯片实例；提高运算器部件处理能力的可行途径； the working principle of floating point arithmetic unit; A typical example of fixed-point arithmetic chip; The feasible way to improve the processing ability of the arithmetic unit;
	理解: Understand	数据的编码；理解定点数的补码一位除法和浮点数的乘除法运算；理解基本运算器设计； the coding of data; Understand the complement one bit division of fixed-point numbers and multiplication and division of floating-point numbers; Understand basic arithmetic unit design;
	掌握: Master	数制及转换；定点小数、整数、浮点数在计算机内的表示及特点；补码加减法的运算规则；二进制数据的定点数的算术运算方法；浮点数的加减运算方法及特点；运算器的功能与组成；掌握加法器的基本设计和实现方法；算术逻辑单元的设计与工作原理。 the number system and conversion; Master the representation and characteristics of fixed-point decimals, integers and floating-point numbers in the computer; the operation rules of complement addition and subtraction; the arithmetic operation method of fixed-point number of binary data; the methods and characteristics of addition and subtraction of floating point numbers; the function and composition of arithmetic unit; the basic design and implementation of adder; the design and working principle of arithmetic logic unit.
德育目标 Moral Objectives		培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。 To cultivate the consciousness and quality of science and engineering application, and gradually cultivate students' exploration spirit and innovation ability.
重点: Key Points		数据的编码；定点数的补码一位除法和浮点数的乘除法运算；基本运算器设计； the coding of data; the complement one bit division of fixed-point numbers and multiplication and division of floating-point numbers; basic arithmetic unit design;

	数制及转换；定点小数、整数、浮点数在计算机内的表示及特点；补码加减法的运算规则；二进制数据的定点数的算术运算方法；浮点数的加减运算方法及特点；运算器的功能与组成；加法器的基本设计和实现方法；算术逻辑单元的设计与工作原理。 the number system and conversion; the representation and characteristics of fixed-point decimals, integers and floating-point numbers in the computer; the operation rules of complement addition and subtraction; the arithmetic operation method of fixed-point number of binary data; the methods and characteristics of addition and subtraction of floating point numbers; the function and composition of arithmetic unit; the basic design and implementation of adder; the design and working principle of arithmetic logic unit.
难点: Focal points	数制及转换；定点小数、整数、浮点数在计算机内的表示及特点；补码加减法的运算规则；二进制数据的定点数的算术运算方法；浮点数的加减运算方法及特点；运算器的功能与组成；加法器的基本设计和实现方法；算术逻辑单元的设计与工作原理。 the number system and conversion; the representation and characteristics of fixed-point decimals, integers and floating-point numbers in the computer; the operation rules of complement addition and subtraction; the arithmetic operation method of fixed-point number of binary data; the methods and characteristics of addition and subtraction of floating point numbers; the function and composition of arithmetic unit; the basic design and implementation of adder; the design and working principle of arithmetic logic unit.

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-1 1-2
知识单元名称 Unit Title	存储系统 storage system		
知识点: Knowledge Delivery	存储器系统的层次结构；存储器的分类；主存储器分类与技术指标； The hierarchical structure of memory system; The classification of memory; Main memory classification and technical index;		
	半导体读写存储器；半导体只读存储器； Semiconductor read write memory; Semiconductor read only memory;		
	高速缓冲存储器；虚拟存储器； Cache memory; Virtual memory;		
	双端口存储器；多体交叉存储器；相联存储器；硬磁盘存储设备；磁带存储设备；光盘存储设备； Dual port memory; Multi body cross memory; Associated memory; Hard disk storage device; Magnetic tape storage device; Optical disk storage device;		
学习目标: Learning Objectives	了解: Recognize	只读存储器、闪速存储器、并行存储器（双端口存储器、多体交叉存储器）及相联存储器等的工作原理；外存储器（磁盘、磁带、光盘等）的组成与工作原理；提高存储器系统性能的可行途径；	

		the working principle of read-only memory, flash memory, parallel memory (dual port memory, multi-body cross memory) and associated memory; the composition and working principle of external memory (disk, tape, CD, etc.); the feasible way to improve the performance of memory system;
	理解: Understand	半导体存储器的组成与控制；虚拟存储的原理；存储系统的分级结构及作用；存储器的分类； the composition and control of semiconductor memory; the principle of virtual memory; the hierarchical structure and function of storage system; the classification of memory;
	掌握: Master	主存储器的技术指标；主存与 CPU 的连接及读写过程；随机存取存储器的存储原理及逻辑结构；主存储器容量的扩展方法； Cache 存储器的工作过程、地址映像方法与替换策略。 the technical index of main memory; the connection between main memory and CPU and the process of reading and writing; the storage principle and logical structure of ram; the expansion method of main memory capacity; the working process, address mapping method and replacement strategy of cache memory.
德育目标 Moral Objectives	2-1 培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。 To cultivate the consciousness and quality of science and engineering application, and gradually cultivate students' exploration spirit and innovation ability.	
重点: Key Points	存储器系统的层次结构及作用； 主存储器的组成与工作原理； 半导体读写存储器的组成与工作过程； 主存储器容量的扩展方法； 高速缓冲存储器的工作原理、地址映射方法与替换策略； 虚拟存储器的作用。 The hierarchical structure and function of memory system; The composition and working principle of main memory; The composition and working process of semiconductor read-write memory; The expansion method of main memory capacity; Working principle, address mapping method and replacement strategy of cache; The function of virtual memory.	
难点: Focal points	半导体读写存储器的组成与工作过程； 主存储器容量的扩展方法； 高速缓冲存储器的工作原理与地址映射方法。	

	The composition and working process of semiconductor read-write memory; The expansion method of main memory capacity; The working principle and address mapping method of cache memory.		

知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-2 1-3 1-4
知识单元名称 Unit Title	Instruction system		
知识点: Knowledge Delivery	指令系统的发展和性能要求； The development and performance requirements of instruction system; 指令格式； Instruction format; 指令和数据的寻址方式 Addressing mode of instruction and data; 指令的类型； The type of instruction; 典型指令系统介绍； Introduction of typical instruction system;		
学习目标: Learning Objectives	了解: Recognize	指令系统的发展（RISC 和 CISC）以及他们的特点； the development of instruction system (RISC and CISC) and their characteristics;	
	理解: Understand	指令的分类与应用；指令系统的兼容性；指令系统的概念； the classification and application of instructions; the compatibility of instruction system; the concept of instruction system;	
	掌握: Master	指令的格式与操作码扩展方法；指令和数据的寻址方式；指令系统综合分析与设计。 the instruction format and opcode expansion method; the addressing mode of instruction and data; command system comprehensive analysis and design.	
德育目标 Moral Objectives	能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。 Be able to play the role of individual, team member and leader in a multidisciplinary team.		
重点: Key Points	指令格式；指令操作码扩展； Instruction format; Instruction opcode extension; 指令和数据的寻址方式； Addressing mode of instruction and data; 指令系统综合分析与设计。 Comprehensive analysis and design of instruction system.		
难点: Focal points	指令操作码扩展； Instruction opcode extension;		

	寻址方式； Addressing mode; 指令系统综合分析与设计； Comprehensive analysis and design of instruction system;		

知识单元序号: Knowledge Unit No.	5	支撑教学目标: SLOs Supported	1-2 1-3 1-4
知识单元名称 Unit Title	控制器 Controller		
知识点: Knowledge Delivery	中央处理器的功能和组成； The function and composition of CPU; 控制器的组成与功能； The composition and function of the controller; 指令周期；时序产生器和控制方式； Instruction cycle; Timing generator and control mode; 微程序控制器；微程序设计技术； Micro program controller; Microprogramming technology; 组合逻辑控制器； Combined logic controller; 典型的 CPU 介绍；流水线处理器。 The introduction of typical CPU; Pipeline processor.		
学习目标: Learning Objectives	了解: Recognize	时序系统的作用与体制；控制器的控制方式；流水 CPU 的工作原理及特点； the function and system of time series system; the control mode of the controller; the working principle and characteristics of pipelined CPU;	
	理解: Understand	组合逻辑控制器的组成与基本原理；中央处理器的功能与组成；控制器的功能与组成； PC、IR、AR 等专用寄存器的作用及应用；指令周期的基本概念； the composition and basic principle of combinational logic controller; the function and composition of CPU; the function and composition of the controller; the function and application of PC, IR, AR and other special registers; the basic concept of instruction cycle;	
	掌握: Master	指令周期设计；微程序控制器原理；微程序设计技术。 instruction cycle design; the principle of microprogram controller; microprogramming technology.	
德育目标 Moral Objectives	2-1 培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。 To cultivate the consciousness and quality of science and engineering application, and gradually cultivate students' exploration spirit and innovation ability.		
重点:	控制器的功能与组成；		

Key Points	The function and composition of the controller; 指令的执行过程； The execution process of instruction; 微程序控制器的工作原理； The working principle of microprogram controller; 微程序设计。 Microprogramming
难点: Focal points	指令的执行过程； The execution process of instruction; 微程序控制器的工作原理； The working principle of microprogram controller; 微程序设计； Microprogramming; 硬布线控制器设计； Hardwired controller design; 模型机综合分析与设计。 Comprehensive analysis and design of model machine.

知识单元序号: Knowledge Unit No.	6	支撑教学目标: SLOs Supported	1-2 1-3
知识单元名称 Unit Title	总线系统 bus system		

知识点: Knowledge Delivery	总线的概念与类型； The concept and type of bus; 单机系统的总线结构； The bus structure of single machine system; 总线接口； Bus interface; 总线的控制和通信； Bus control and communication; 典型总线。 Typical bus.		

学习目标: Learning Objectives	了解: Recognize	总线通信方式和定时方式 the bus communication mode and timing mode;
	理解: Understand	典型几种总线的工作原理；各种总线控制的原理与特点； the working principle of several typical buses; the principle and characteristics of various bus control;
	掌握: Master	总线的基本概念与类型；单机系统的总线结构。 the basic concept and type of bus; the bus structure of stand-alone system.

德育目标 Moral Objectives	能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。

	Be able to play the role of individual, team member and leader in a multidisciplinary team.
重点: Key Points	典型几种总线的工作原理；各种总线控制的原理与特点； the working principle of several typical buses; the principle and characteristics of various bus control; 总线的基本概念与类型；单机系统的总线结构。 the basic concept and type of bus; the bus structure of stand-alone system.
难点: Focal points	各种总线控制的原理与特点； the principle and characteristics of various bus control;

知识单元序号: Knowledge Unit No.	7	支撑教学目标: SLOs Supported	1-2 1-3

知识单元名称 Unit Title	输入输出系统 Input output system
知识点: Knowledge Delivery	外围设备概述；输入设备；显示设备；打印设备；输入输出系统的作用； Overview of peripheral equipment; Input device; Display device; Printing equipment; The function of input and output system; 外设的编址方式；输入输出接口； The addressing mode of peripheral devices; I / O interface; 输入输出控制方式（程序查询方式；程序中断方式；DMA 方式；通道方式；外围处理机方式。 Input and output control mode (program query mode; Program interrupt mode; DMA mode; Channel mode; Peripheral processor mode.

学习目标: Learning Objectives	了解: Recognize	各种外围设备（输入设备、显示设备、打印设备等）的工作原理； the working principle of various peripheral devices (input device, display device, printing device, etc.);
	理解: Understand	输入输出接口的组成与作用；程序查询方式的方法与特点；通道方式的类型与原理； the composition and function of I / O interface; the methods and characteristics of program query mode; the type and principle of channel mode; Master the function of I / O system;
	掌握: Master	I/O 系统的作用；外设的编址方式；外围设备与主机的信息交换的五种方式的基本原理；中断概念以及中断处理流程； DMA 的特点、组成与工作流程。 the addressing method of peripherals; the basic principles of five ways of information exchange between peripheral equipment and host computer; the concept and process of interrupt; the characteristics, composition and workflow of DMA.

德育目标 Moral Objectives	培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。 To cultivate the consciousness and quality of science and engineering application, and gradually cultivate students' exploration spirit and innovation ability.
重点: Key Points	输入输出系统的作用；外设的编址方式；程序中断方式；DMA 方式。 The function of input and output system; The addressing mode of peripheral devices; Program interrupt mode; DMA mode.
难点: Focal points	程序中断方式；DMA 方式。 Program interrupt mode; DMA mode.

(2) 实验教学 Experiments

注：可根据实际情况增减行数。实验类型可分为验证性、设计性、综合性，实验性质可分为选做、必做。

Note: Please add/reduce lines based on subject. The Type contains Verify, Design, and Comprehensive, while the Pattern contains Required and Elective

序号 No.	实验项目名称 Experiment Topic	学时 Hours	每组人数 MPG*	实验类型 Type	实验性质 Pattern
1	数字集成电路设计方法 Digital Integrated Circuit Design	2	1	设计性 Design	必做 Elec
2	MIPS 寄存器堆 Register Stack based on MIPS	2	1	设计性 Design	必做 Elec
3	指令存储器 Instruction Memory	2	1	设计性 Design	必做 Elec
4	数据存储器 Data Memory	2	1	设计性 Design	必做 Elec
5	基于 MIPS 指令集运算器 Arithmetic Circuits based on MIPS Architecture	2	1	综合性 Comp	必做 Elec
6	基于 mips 指令集流水 CPU the Processor based on MIPS Architecture	6	1	综合性 Comp	必做 Elec
	总计 Total	16			

*MPG: Members per group

实验项目序号: Experiment No.	1	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title	数字集成电路设计方法 Digital Integrated Circuit Design		

实验内容: Content	完成组合逻辑电路裁判表决器设计。 the Design of Combination Logic Circuit- Referee Voter
	完成时序逻辑电路 D 触发器的设计。 the Design of D Filp-Flop
学习目标: Learning Objectives	了解数字集成电路设计方法。熟悉并运用 Verilog 语言进行电路设计。 Learn the design methods of digital integrated circuits.Acquire the ability to use Verilog language for circuit design.
教学要求: Requirements	自行设计本次实验的方案，画出结构框图。根据设计的实验方案，使用 verilog 编写相应代码。 对编写的代码进行仿真，得到正确的波形图。 Design the scheme of this experiment by oneself. Draw the structure diagram of logic circuit.According to the designed experimental scheme, the corresponding code is written using verilog.The code is simulated to get the correct waveform.
实验场地: Location	1207
实验软硬件设备: Software/Hardware	装有 Xilinx Vivado 的计算机一台。 A computer with Xilinx vivado

实验项目序号: Experiment No.	2	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title	MIPS 寄存器堆 Register Stack based on MIPS		
实验内容: Content	MIPS 指令集通用寄存器 Register Stack based on MIPS		
	程序计数器 Program Counter		
学习目标: Learning Objectives	1.熟悉并掌握 MIPS 计算机中寄存器堆的原理和设计方法。 2.初步了解 MIPS 指令结构和源操作数/目的操作数的概念。 1. Familiar with and master the principle and design method of register stack based on MIPS architecture. 2. Understand the MIPS instruction structure and the concept of source / destination operand.		
教学要求: Requirements	自行设计本次实验的方案，画出结构框图。根据设计的实验方案，使用 verilog 编写相应代码。 对编写的代码进行仿真，得到正确的波形图。 Design the scheme of this experiment by oneself. Draw the structure diagram of logic circuit.According to the designed experimental scheme, the corresponding code is written using verilog.The code is simulated to get the correct waveform.		

实验场地: Location	1207	
实验软硬件设备: Software/Hardware	装有 Xilinx Vivado 的计算机一台。 A computer with Xilinx vivado	

实验项目序号: Experiment No.	3	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title	指令存储器 Instruction Memory		
实验内容: Content	指令存储器设计仿真 the Design and Simulation of Instruction Memory		
学习目标: Learning Objectives	了解只读存储器 ROM 原理。 理解 ROM 读取数据的过程。理解取指过程。 Understand the principle of ROM. Understand the process of reading data from ROM. Understand the process of fetching instruction.		
教学要求: Requirements	自行设计本次实验的方案，画出结构框图。根据设计的实验方案，使用 verilog 编写相应代码。 对编写的代码进行仿真，得到正确的波形图。 Design the scheme of this experiment by oneself. Draw the structure diagram of logic circuit.According to the designed experimental scheme, the corresponding code is written using verilog.The code is simulated to get the correct waveform.		
实验场地: Location	1207		
实验软硬件设备: Software/Hardware	装有 Xilinx Vivado 的计算机一台。 A computer with Xilinx vivado		

实验项目序号: Experiment No.	4	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title	数据存储器 Data Memory		
实验内容: Content	数据存储器设计仿真 the Design and Simulation of Data Memory		
学习目标: Learning Objectives	了解随机存取存储器 RAM 的原理。理解 RAM 读取、写入数据的过程。理解计算机中存储器地址编址和数据索引方法。 Understand the principle of RAM. Understand the process of reading and writing data from RAM. Understand memory addressing mode and data index method.		

教学要求: Requirements	自行设计本次实验的方案，画出结构框图。根据设计的实验方案，使用 verilog 编写相应代码。 对编写的代码进行仿真，得到正确的波形图。 Design the scheme of this experiment by oneself. Draw the structure diagram of logic circuit.According to the designed experimental scheme, the corresponding code is written using verilog.The code is simulated to get the correct waveform.
实验场地: Location	1207
实验软硬件设备: Software/Hardware	装有 Xilinx Vivado 的计算机一台。 A computer with Xilinx vivado

实验项目序号: Experiment No.	5	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title			
实验内容: Content			
学习目标: Learning Objectives			
教学要求: Requirements			
实验场地: Location			
实验软硬件设备: Software/Hardware			

实验项目序号: Experiment No.	5	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title	基于 MIPS 指令集运算器 Arithmetic Circuits based on Mips Architecture		
实验内容: Content	运算器的设计和仿真 the Design and Simulation of Arithmetic Circuits		
学习目标: Learning Objectives	了解 MIPS 指令集中的运算指令，学会对这些指令进行归纳分类。熟悉并掌握 ALU 的原理、功能和设计。 Understand the operation instructions in MIPS instruction set and learn to classify them. Familiar with the principle, function and design of ALU.		
教学要求: Requirements	自行设计本次实验的方案，画出结构框图。根据设计的实验方案，使用 verilog 编写相应代码。 对编写的代码进行仿真，得到正确的波形图。 Design the scheme of this experiment by oneself. Draw the structure diagram of logic circuit.According to the designed experimental scheme, the corresponding code is written using verilog.The code is simulated to get the correct waveform.		
实验场地: Location	1207		
实验软硬件设备: Software/Hardware	装有 Xilinx Vivado 的计算机一台。 A computer with Xilinx vivado		

实验项目序号: Experiment No.	6	支撑教学目标: SLOs Supported	
每组成员: Members per Group	1	指导教师: Tutor	张旭 Zhang Xu
实验名称: Experiment Title	基于 mips 指令集流水 CPU the Processor based on MIPS Architecture		
实验内容:	基于 mips 指令集流水 CPU 的设计和仿真		

Content	the Design and Simulation of the Processor based on MIPS Architecture
学习目标: Learning Objectives	深入理解 CPU 流水线的概念。熟悉并掌握流水线 CPU 的原理和设计。设计并实现静态 5 级流水线 CPU，加深对计算机组成原理的理解。 Understand the concept of CPU pipeline. Familiar with the principle and design of pipeline CPU. Design and implement a static 5-stage pipeline CPU to deepen the understanding of the principle of computer composition.
教学要求: Requirements	自行设计本次实验的方案，画出结构框图。根据设计的实验方案，使用 verilog 编写相应代码。 对编写的代码进行仿真，得到正确的波形图。 Design the scheme of this experiment by oneself. Draw the structure diagram of logic circuit.According to the designed experimental scheme, the corresponding code is written using verilog.The code is simulated to get the correct waveform.
实验场地: Location	1207
实验软硬件设备: Software/Hardware	装有 Xilinx Vivado 的计算机一台。 A computer with Xilinx vivado

四、教学安排 Teaching Schedule

注：可根据实际情况增减行数

Note: Please add/reduce lines based on subject.

教学内容 Teaching Content	学时(周) Hour(Week)			
	理论 LECT.	实验 EXP.	课外实践 PBL	集中实践 PRAC.
绪论 Introduction	4	2		
运算方法及运算器 Arithmetic Method and Arithmetic Unit	12	4		
存储系统 Storage System	12	4		
指令系统 Instruction System	6	2		
控制器 Controller	12	4		
总线系统 Bus System	4			

批注 [HP3]: 注意与授课日历对应

输入输出系统 Input and Output System	6			
总计 Total	56	16		

五、教学方法 Teaching Methodology

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

勾选 Check	教学方法与特色 Teaching Methodology & Characters
☑	多媒体教学：基于信息化设备的课堂教学 Multi-media-based lecturing
☑	实践能力传授：理论与行业、实际案例相结合 Combining theory with industrial practical problems
☑	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education
☑	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
☐	其他:单击或点击此处输入文字。 Other:单击或点击此处输入文字。

批注 [HP4]: 根据实际情况勾选或不选，建议勾选前四项

六、成绩评定 Assessment

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

批注 [HP5]: 根据实际情况填写，详细、准确的写明给分要求，每个活动的分数项，以及分数最终录入到教务系统时的考核环节记录（平时、期中、实验、期末）

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	方淼
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	满分 100 分，以学生平时考勤、课堂表现、课堂教师随机提问，学生平时作业完成情况综合评定，其中，学生考勤占比 50%，平时课堂表现、课堂教师随机提问占比 10%，学生平时作业(课前预习作业、课后作业)完成情况占比 40%. The full score is 100. Students' attendance, classroom performance, random questions from teachers, and students' homework completion are comprehensively evaluated. Among them, students' attendance accounts for 50%, classroom performance and random questions from teachers account for 10%, and students' homework (preview homework before class and homework after class) accounts for 40%.		

考核环节: Assessment Content	实验 Experiment	环节负责人: Director	张旭

给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	满分 100 分，通过实验报告记录学生成绩，按照学生的报告完成情况和贡献程度酌情给分，抄袭、给他人抄袭或未交实验报告不得分。 The full score is 100, and the students' scores are recorded through PBL experimental report. According to the students' report completion and contribution degree, the score is given. Plagiarism, plagiarism to others or failure to hand in the experimental report will not be scored.		

考核环节: Assessment Content	期末 Final	环节负责人: Director	方淼
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	60
考核方式: Measures	满分 100 分，通过批阅期末考试试卷给出学生成绩。 The full score is 100, and students' scores are given according to the final examination.		

七、改进机制 Improvement Mechanism

注：未尽事宜以教学团队以及学院教学指导委员会商定为准。

Note: Matters not covered in this file shall be determined by TAB of SSTC, NEU.

教学大纲改进机制 Subject Syllabus Improvement Mechanism			
考核周期(年): Check Period (YR)	4	修订周期(年): Revise Period (YR)	4
改进措施: Measures	课程负责人根据课程教学内容与人才培养目标组织课程团队讨论并修改教学大纲，报分管教学工作副院长审核后由执行院长批准。 The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approvement.		
成绩评定改进机制 Assessment Improvement Mechanism			
考核周期(年): Check Period (YR)	1	修订周期(年): Revise Period (YR)	1
改进措施: Measures	课程负责人根据课程教学内容、课堂教学效果以及成绩分布，对课程教学方法和成绩评定环节进行改进，并同步优化评定办法。 The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.		

批注 [HP6]: 一般可保留本部分信息，全部修订完成后规范命名文件名，并删除全部批注，单面打印签字，随电子版一同提交教科办