

# Linux 操作系统及内核分析 教学大纲

## Linux operating system Subject Syllabus

### 一、课程信息 Subject Information

课程编号: Subject ID	3100213014	开课学期: Semester	2
课程分类: Category	专业教育 PA	所属课群: Section	工程能力 EA
课程学分: Credit Points	2.5	总学时/周: Total Hours/Weeks	40/6
理论学时: LECT. Hours	24	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	袁晓铭 Yuan Xiaoming	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	操作系统 operating system		
英文参考教材: EN Textbooks			
中文参考教材: CN Textbooks	单击或点击此处输入文字。		
教学资源: Resources			
课程负责人(撰写人): Subject Director	于七龙 Yu Qilong	提交日期: Submitted Date	4/8/2023
任课教师(含负责人): Taught by	于七龙 Yu Qilong		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	4/8/2023

## 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.

<p>整体目标: Overall Objective</p>	<p>在本课程的学习中,使学生了解 Linux 操作系统的发展,理解 Linux 的内在优势与应用前景。掌握 Linux 操作系统的使用、维护以及开发的基本方法。其中 Linux 系统的安装、配置与使用,内核的分析作为基础应重点掌握,同时 Linux 环境下的开发工具、以及相应的应用与开发是学生应该熟练掌握的另一个重点。</p> <p>In this course, students learn about the development of Linux operating systems and understand the inherent advantages and application prospects of Linux. Learn the basic methods of using, maintaining, and developing Linux operating systems. Among them, linux system installation, configuration and use, kernel analysis as the basis should focus on mastering, at the same time Linux environment development tools, as well as the corresponding application and development is another focus that students should master</p>	
<p>(1) 专业目标: Professional Ability</p>	1-1	<p>了解 Linux 发展历史与操作系统功能。 Learn about Linux's history and operating system capabilities</p>
	1-2	<p>掌握 Linux 基本命令。 Master the basic commands of Linux</p>
	1-3	<p>掌握 Linux 内核设计原理。 Master the linux kernel design principles</p>
	1-4	<p>具备 Linux 保障能力,能在实际应用环境下运用所学的知识分析、判断和解决所遇到的信息安全问题。 W Linux assurance capabilities, in the practical application environment can use the knowledge learned to analyze, judge and solve the information security problems encountered</p>
	1-5	<p>培养科学与工程应用的意识和素质,培养学生的探索精神和创新能力。 Cultivate the consciousness and quality of science and engineering application, and cultivate students' exploration spirit and innovation ability</p>
<p>(2) 德育目标: Essential Quality</p>	2-1	<p>应当遵循法律法规与工程伦理原则。 Laws and regulations and engineering ethics principles should be followed</p>
	2-2	<p>认知当前全球,操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world</p>
<p><b>课程教学目标与毕业要求的对应关系 Matrix of GA &amp; SLOs</b></p>		
<p>毕业要求 GA</p>	<p>指标点 GA Index</p>	<p>教学目标 SLOs</p>
<p>1、工程知识:能够将数学、</p>	<p>指标点 1-5: 掌握在计算机科学与技术专</p>	<p>1-3, 1-4, 1-5</p>

<p>自然科学、工程基础和专业 知识用于解决复杂工程问 题。</p> <p>GA1.                   Engineering Knowledge: Apply knowledge of mathematics, natural science,                   engineering fundamentals           and an engineering specialization to the solution of complex engineering problems.</p>	<p>业的相关领域进行工程设计、技术创新 的能力。</p>	
<p>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。</p> <p>Design/Development       of Solutions: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.</p>	<p>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。</p> <p>3-1: Capable of designing solutions to complex engineering problems related to the major, and capable of designing and developing computers, software or network systems that can function specifically and meet specific requirements.</p>	<p>1-3, 1-4, 1-5</p>
<p>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。</p> <p>Investigation:           Conduct investigations of complex problems                   using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.</p>	<p>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。</p> <p>3-3: Capable of taking social, health, safety, legal, cultural and environmental factors in consideration during all aspects of design and development.</p>	<p>1-4, 1-5, 2-1, 2-2</p>
<p>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。</p> <p>Investigation:           Conduct investigations of complex problems                   using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.</p>	<p>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。</p> <p>Capable of designing experiments and doing research on complex engineering problems based on scientific principles and scientific methods, under the guidance of related theories of the major.</p>	<p>1-5, 2-2</p>

### 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

#### (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	课程简介与绪论 Introduction		
知识点: Knowledge Delivery	课程简介 Introductions		
	操作系统及 Linux 概述 Overview of operating systems and Linux		
学习目标: Learning Objectives	了解: Recognize	Linux 发展历史 Overview of Linux	
	理解: Understand	操作系统功能 Operating system features	
	掌握: Master	Linux 安装方法 Linux installation	
德育目标 Moral Objectives	理解操作系统对互联网的影响 Understand the impact of the operating system on the Internet		
重点: Key Points	操作系统功能 Operating system features		
难点: Focal points	操作系统功能 Operating system features		
知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-2, 1-3
知识单元名称 Unit Title	Linux 基本命令 Linux basic commands		
知识点: Knowledge Delivery	Linux 文件管理 Linux file management		
	Linux 用户管理 Linux usermanagement		
	Linux 权限管理 Linux rights management		
学习目标: Learning Objectives	了解: Recognize	防火墙与 iptables Firewall and iptables	
	理解: Understand	Linux 操作系统使用模式 Linux operating system usage mode	
	掌握: Master	文件管理、用户管理、权限管理基本命令 Basic commands for file management, user management, and rights management	

德育目标 Moral Objectives	认知当前全球，操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world
重点: Key Points	文件管理、用户管理、权限管理基本命令 Basic commands for file management, user management, and rights management
难点: Focal points	文件管理、用户管理、权限管理基本命令 Basic commands for file management, user management, and rights management

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	内存寻址 Memory addressing		
知识点: Knowledge Delivery	X86 内存寻址 Memory addressing in X86		
	Linux 的分段与分页 Segmentation and pagination of Linux		
	Linux 中的汇编语言 Assembly language in Linux		
学习目标: Learning Objectives	了解: Recognize	Linux 中的汇编语言 Assembly language in Linux	
	理解: Understand	X86 内存寻址 Memory addressing in X86	
	掌握: Master	Linux 的分段与分页 Segmentation and pagination of Linux	
德育目标 Moral Objectives	认知当前全球，操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world		
重点: Key Points	Linux 的分段与分页 Segmentation and pagination of Linux		
难点: Focal points	分段与分页 Segmentation and pagination		

知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	进程 process		
知识点: Knowledge Delivery	Linux 的进程组织方式 How Linux processes are organized		
	Linux 进程调度		

	Process scheduling	
	Linux 进程创建 The process creation process in Linux	
学习目标: Learning Objectives	了解: Recognize	Linux 进程相关系统调用 Linux process-related system calls
	理解: Understand	Linux 进程控制块 Process control block
	掌握: Master	Linux 进程调度 Process scheduling
德育目标 Moral Objectives	认知当前全球，操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world	
重点: Key Points	Linux 进程调度 Process scheduling	
难点: Focal points	Linux 进程调度 Process scheduling	

知识单元序号: Knowledge Unit No.	5	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	内存管理 Mutual trust		
知识点: Knowledge Delivery	Linux 内存管理的框架 The framework for Linux memory management		
	物理内存的分配与回收 Allocation and recycling of physical memory		
	交换机制 The exchange mechanism		
学习目标: Learning Objectives	了解: Recognize	Linux 内存管理的框架 The framework for Linux memory management	
	理解: Understand	物理内存的分配与回收 Allocation and recycling of physical memory	
	掌握: Master	伙伴算法 Partner algorithm	
德育目标 Moral Objectives	认知当前全球，操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world		
重点: Key Points	物理内存的分配与回收 Allocation and recycling of physical memory		
难点: Focal points	伙伴算法 Partner algorithm		

知识单元序号: Knowledge Unit No.	6	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	中断 Interrupt		
知识点: Knowledge Delivery	中断的概念和中断处理程序 The concept of interrupts and interrupt handlers		
	中断处理机制的实现 Interrupt the implementation of the processing mechanism		
	软中断的实现和使用 Implementation and use of soft interrupts		
学习目标: Learning Objectives	了解: Recognize	中断的概念和中断处理程序 The concept of interrupts and interrupt handlers	
	理解: Understand	软中断的实现和使用 Implementation and use of soft interrupts	
	掌握: Master	软中断的实现和使用 Implementation and use of soft interrupts	
德育目标 Moral Objectives	认知当前全球, 操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world		
重点: Key Points	中断的上半部与下半部 The upper and lower parts of the interrupt		
难点: Focal points	The upper and lower parts of the interrupt		

知识单元序号: Knowledge Unit No.	7	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	系统调用 System calls		
知识点: Knowledge Delivery	系统调用组织结构 The system calls the organizational structure		
	处理程序及服务例程、封装例程 Handlers and service routines, encapsulation routines		
	添加新系统调用 Add a new system call		
学习目标: Learning Objectives	了解: Recognize	系统调用组织方式 The organization of system calls	
	理解: Understand	处理程序及服务例程、封装例程 Handlers and service routines, encapsulation routines	
	掌握: Master	系统调用使用方法 The system calls the usage method	
德育目标 Moral Objectives	认知当前全球, 操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。		

	To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world
重点: Key Points	系统调用使用方法 The system calls the usage method
难点: Focal points	系统调用组织方式 The organization of system calls

知识单元序号: Knowledge Unit No.	8	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	内核中的同步 Synchronization in the kernel		
知识点: Knowledge Delivery	临界区和竞争状态 Critical zones and competitive states		
	内核同步方法 Kernel synchronization method		
学习目标: Learning Objectives	了解: Recognize	内核同步的意义 The meaning of kernel synchronization	
	理解: Understand	临界区和竞争状态 Critical zones and competitive states	
	掌握: Master	内核同步方法 Kernel synchronization method	
德育目标 Moral Objectives	认知当前全球，操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world		
重点: Key Points	临界区和竞争状态、死锁、内核同步方法、原子操作、自旋锁、信号量 Critical zone and competitive state, deadlock, kernel synchronization method, atomic operation, spin lock, semaphore		
难点: Focal points	临界区和竞争状态、死锁、内核同步方法、原子操作、自旋锁、信号量 Critical zone and competitive state, deadlock, kernel synchronization method, atomic operation, spin lock, semaphore		

知识单元序号: Knowledge Unit No.	9	支撑教学目标: SLOs Supported	1-3, 1-4, 1-5
知识单元名称 Unit Title	文件系统 file system		
知识点: Knowledge Delivery	Linux 文件系统 Linux file system		
	虚拟文件系统 VFS		
学习目标:	了解:	文件系统的安装和卸载	



Learning Objectives	Recognize	Installation and uninstall of the file system
	理解: Understand	Linux 文件、设备管理方式 Linux files, device management
	掌握: Master	文件类型分类 File type classification
德育目标 Moral Objectives	认知当前全球, 操作系统的发展对提升中国工程关键技术及核心竞争力的重要意义。 To recognize the importance of the development of operating system to enhance the key technology and core competitiveness of Chinese engineering in the world	
重点: Key Points	文件类型分类 File type classification	
难点: Focal points	文件类型分类 File type classification	

#### 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.	实践 PRAC.	PBL
课程简介与绪论 Introduction	2	0	0	0
Linux 基本命令 Linux basic commands	6	10	0	0
内存寻址 Memory addressing	2	0	0	0
进程 process	2	0	0	0
内存管理 Mutual trust	2	2	0	0
中断 Interruption	2	2	0	0
系统调用 System calls	2	0	0	0
内核中的同步 Synchronization in the kernel	2	0	0	0
文件系统 file system	4	2	0	0
总计 Total	24	16	0	0

## 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
<input checked="" type="checkbox"/>	多媒体教学：基于信息化设备的课堂教学 Multi-media-based lecturing
<input checked="" type="checkbox"/>	实践能力传授：理论与行业、实际案例相结合 Combining theory with industrial practical problems
<input checked="" type="checkbox"/>	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education
<input checked="" type="checkbox"/>	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
<input type="checkbox"/>	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。

## 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.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	于七龙
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	<p>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 20%，学生平时作业(课前预习作业、课后作业)完成情况占比 30%.</p> <p>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 20%, and students' homework (preview homework before class and homework after class) accounts for 30%.</p>		

考核环节: Assessment Content	实验 Experiment	环节负责人: Director	于七龙
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30

考核方式: Measures	<p>满分 100 分，通过 PBL 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。</p> <p>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.</p>
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考核环节: Assessment Content	期末 Final	环节负责人: Director	于七龙
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	50
考核方式: Measures	<p>满分 100 分，通过批阅期末考试试卷给出学生成绩。</p> <p>The full score is 100, and students' scores are given according to the final examination.</p>		

## 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	<p>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。</p> <p>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 improvement.</p>		
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	<p>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。</p> <p>The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.</p>		