计算机网络基础 教学大纲

Network Fundamentals   Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100212004	开课学期: Semester	3
课程分类: Category	专业教育 PA	所属课群: Section	专业基础 MF
课程学分: Credit Points	3.5	总学时/周: Total Hours/Weeks	56
理论学时: LECT. Hours	48	实验学时: EXP. Hours	8
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	适用专业: Stream	计算机科学与技术 CST
课程属性: Pattern	必修 Compulsory	课程模式: Mode	互认 EQV
中方课程协调人: NEU Coordinator	韩鹏	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	C Programing Mathematic Modeling1		
英文参考教材: EN Textbooks	Computer Networking: A Top-Down Approach (7th Edition), James Kurose, Keith Ross, PEARSON; ISBN 9780133594140		
中文参考教材: CN Textbooks	《计算机网络：自顶向下方法(原书第 6 版)》， James Kurose, Keith Ross,机械工业出版社, ISBN 9787111453789		
教学资源: Resources	INTERACTIVE END-OF-CHAPTER EXERCISES: http://gaia.cs.umass.edu/kurose_ross/interactive/ eBook: http://www.pearson.com.au/9781292153599		
课程负责人(撰写人): Subject Director	韩鹏	提交日期: Submitted Date	8/27/2023
任课教师(含负责人): Taught by	Dr Beeshanga Jayawickrama (UTS), Dr Peng Han (NEU), Dr Firas Al-Doghman (UTS), and Dr Lyu Yanxia (NEU)		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	8/27/2023

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		Today's internet is arguably the largest engineered system ever created by humanity, carrying petabytes of data every minute. It is important for data engineers to understand how data is transferred through the internet, and the guiding principles and structures of data transportation designs. This subject provides students with a modern introduction to the dynamic field of computer networking, including layered network architecture and the TCP/IP protocol suite. Student practical works include observing network traffic inaction and building their own network applications through socket programming. Students also have hands-on opportunities to build their own networks using Cisco network equipment. By developing problem-solving and design skills in this subject, students also acquire the ability to select the most appropriate network services, and design and develop network applications, e.g., web server and client, to achieve the best data performance.
（1）专业目标: Professional Ability	1-1	Understand the key architectural principles of the Internet, namely protocol layering and service models.
	1-2	Analyse various components of the Internet, including Applications, Transport, Network, Addressing, and Data Link, to select the most appropriate network services.
	1-3	Examine and explain end-to-end packet delivery throughout the network system to gain insight into the behaviour of the Internet.
	1-4	Design and implement network applications to provide a service, such as web and email.
（2）德育目标: Essential Quality	2-1	Understand the importance of networking to the national security and social development.
	2-2	Understand the latest development of the computer networking related technologies.
	2-3	Understand the computer networking related industry in China and abroad.
	2-4	Keep a sense of engineering ability and "Craftsman Spirit" through the study of this subject

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	1-3：了解本专业涉及相关行业的发展趋势以及相关产业的运营模式，具备在本专业相关领域进行工程设计、技术创新的能力。	1-1~1-4
6、工程与社会	6-1：能够基于本专业相关背景知识进行	2-1~2-4

	合理分析，评价通信相关工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响；		
	6-2：理解本专业工程实践和相关行业工程问题解决方案对社会、健康、安全、法律以及文化应承担的责任。		

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、2-1、2-2
知识单元名称 Unit Title	Chapter 1 Introduction			
知识点: Knowledge Delivery	what is the Internet?			
	network edge and network core			
	delay, loss, throughput in networks			
	protocol layers, service models, computer networking history			
学习目标: Learning Objectives	了解: Recognize	History of the computer networks		
		ISPs in Australia and China		
	理解: Understand	What's the Internet: nuts and bolts view		
		The concept of protocol layers, service models		
	掌握: Master	The concept of end systems, access networks, links, packet switching, circuit switching, network structure delay, loss, throughput in networks, network edge/core Network performance: delay, loss, throughput		
德育目标 Moral Objectives	Understand the importance of networking to the national security and social development.			
	Understand the latest development of the computer networking related technologies.			
	Understand the computer networking related industry in China and abroad (e.g. Australia).			
重点: Key Points	Packet switching versus circuit switching, Internet structure Network performance: delay, loss, throughput			
难点: Focal Points	Computer Networking Context, overview, feel of networking why layering in the complex systems			

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-1、1-2、2-1
知识单元名称 Unit Title	Chapter 2 Application Layer		

		principles of network applications
知识点: Knowledge Delivery		Web and HTTP
		Email, DNS, socket programming with UDP and TCP
学习目标: Learning Objectives	了解: Recognize	Application architectures: client server vs peer to peer Processes communicating, Cookies Typical network apps: email/web/P2P/streaming
	理解: Understand	Sockets, Addressing processes Services: data integrity / reliable, timing, throughput P2P applications Video streaming and content distribution networks principles of network applications Web and HTTP, electronic mail: SMTP, POP3, IMAP
	掌握: Master	Internet transport protocols services Socket programming with UDP and TCP
德育目标 Moral Objectives		Understand the importance of networking to the national security and social development.
重点: Key Points		Application architectures: client server vs peer to peer (P2P) HTTP overview, TCP and UDP concept Centralized vs. decentralized
难点: Focal Points		What transport service do Apps need? Socket programming with UDP and TCP

知识单元序号: Knowledge Unit No.	3		支撑教学目标: SLOs Supported	1-2, 2-3
知识单元名称 Unit Title	Chapter 3 Transport Layer			
知识点: Knowledge Delivery	transport-layer services, multiplexing and demultiplexing			
	connectionless transport: UDP, principles of reliable data transfer			
	connection-oriented transport: TCP, TCP congestion control			
	principles of congestion control			
学习目标: Learning Objectives	了解: Recognize	Transport layer services Principles of congestion control TCP congestion control		
	理解: Understand	Multiplexing and demultiplexing, Flow control Connection management		
	掌握: Master	Connectionless transport: UDP principles of reliable data transfer Connection oriented transport: TCP Segment structure, Reliable data transfer		
德育目标 Moral Objectives	Understand the importance of networking to the national security and social development.			
	Understand the latest development of the computer networking related technologies.			
重点:	Transport services and protocols			

Key Points	TCP segment structure, TCP seq. numbers, ACK s
难点: Focal Points	Addressing: Transport vs. network layer TCP flow control, UDP checksum

知识单元序号: Knowledge Unit No.	4		支撑教学目标: SLOs Supported	1-3、2-3
知识单元名称 Unit Title	Chapter 4 Network Layer: The Data Plane			
知识点: Knowledge Delivery	Overview of Network layer			
	What's inside a router: Router architecture			
	IP: Internet Protocol			
学习目标: Learning Objectives	了解: Recognize	Overview of Network layer What's inside a routerIPv6 Two network layer functions		
	理解: Understand	Data plane vs control plane Network service model Scheduling mechanisms		
	掌握: Master	IP: Internet Protocol: datagram format, fragmentation, IPv4 addressing, network address, translation Subnetting networks, CIDR, NAT		
德育目标 Moral Objectives	Understand the computer networking related industry in China and abroad.			
	Understand the latest development of the computer networking related technologies.			
重点: Key Points	IPv4 addressing, network address, translation, Subnetting networks IP addressing: CIDR, NAT: network address translation			
难点: Focal Points	Network service model			

知识单元序号: Knowledge Unit No.	5		支撑教学目标: SLOs Supported	1-3、2-3
知识单元名称 Unit Title	Chapter 5 Network Layer: The Control Plane			
知识点: Knowledge Delivery	Introduction of routing algorithms			
	intra-AS routing in the Internet: OSPF			
	routing among the ISPs: BGP			
	ICMP& SNMP			
学习目标: Learning Objectives	了解: Recognize	Graph abstraction of the network Making routing scalable		
	理解: Understand	Routing algorithm classification Traditional routing algorithms Routing protocols: Link state distance vector		
	掌握: Master	Intra AS routing in the Internet: OSPF Routing among the ISPs: BGP ICMP: The Internet Control Message Protocol		

		Network management and SNMP
德育目标 Moral Objectives	Understand the computer networking related industry in China and abroad.	
	Keep a sense of engineering ability and "Craftsman Spirit" through the study of this subject	
重点: Key Points	Approaches to network control plane	
	BGP route selection, Path attributes and BGP routes	
难点: Focal Points	BGP: glue that holds the Internet together	
	Network management concept	

知识单元序号: Knowledge Unit No.	6	支撑教学目标: SLOs Supported	1-4、2-4
知识单元名称 Unit Title	Chapter 6 The Link Layer and LANs		
知识点: Knowledge Delivery	Introduction of services, error detection, correction		
	multiple access protocols		
	Switched LANs		
	a day in the life of a web request		
学习目标: Learning Objectives	了解: Recognize	Link layer services	
		LANs and basic concepts	
	理解: Understand	Multiple access protocols	
		Random Access MAC protocols	
		MAC Address resolution	
		Switch: frame filtering/forwarding	
	掌握: Master	Ethernet frame structure	
		Error detection, correction	
		Addressing, ARP, CSMA	
		Switches and VLANS	
德育目标 Moral Objectives	Keep a sense of engineering ability and "Craftsman Spirit" through the study of this subject		
	Understand the latest development of the computer networking related technologies.		
重点: Key Points	Multiple access protocols, Ethernet frame structure		
	Random Access MAC protocols		
	Self-learning Switching		
难点: Focal Points	Reliable delivery between adjacent nodes		
	Adaptors communicating		
	Switches vs. routers		

(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	协议综合分析 Protocol Comprehensive Analysis	2	1	综合性 Comp	必做 Elec
2	应用层协议实验 Application Layer Protocol Experiment	2	1	设计性 Design	必做 Elec
3	运输层协议实验 Transport Layer Protocol Experiment	2	1	设计性 Design	必做 Elec
4	网络层协议实验 Network Layer Protocol Experiment	2	1	设计性 Design	必做 Elec
	总计 Total	8			

*MPG: Members per group

实验项目序号: Experiment No.	1	支撑教学目标: SLOs Supported	1-1、2-1、2-2
每组成员: Members per Group	1	指导教师: Tutor	管莹 Ying Guan
实验名称: Experiment Title	协议综合分析 Protocol Comprehensive Analysis		
实验内容: Content	创建网络拓扑，观察网络协议 Create Network Topology and Observe Network Protocol		
学习目标: Learning Objectives	加深对网络协议的理解 Deepen Understanding of Network Protocols		
教学要求: Requirements	1..Preview, clarify the experimental purpose, principle, method and precautions in operation, so as to avoid and reduce errors. 2.We must take a serious attitude during the experiment. 3.The experimental results must be carefully observed and recorded, and then scientifically analyzed to draw appropriate conclusions. 4.Complete the experimental report independently and carefully, with concise language and clear charts. 5. Comply with laboratory rules.		
实验场地: Location	计算机与通信工程学院网络实验室 Network Laboratory, School of Computer and Communication Engineering		
实验软硬件设备: Software/Hardware	pc 机、一体化实验教学平台 Computer、Integrated Experimental Teaching Platform		

实验项目序号: Experiment No.	2	支撑教学目标: SLOs Supported	1-1、1-2、2-1
每组成员: Members per Group	1	指导教师: Tutor	管莹 Ying Guan

实验名称: Experiment Title	应用层协议实验 Application Layer Protocol Experiment
实验内容: Content	研究 HTTP 协议、观察运转中的 DNS Study HTTP Protocol and Observe DNS in Operation
学习目标: Learning Objectives	研究运行中的协议 Study Running Protocol
教学要求: Requirements	1..Preview, clarify the experimental purpose, principle, method and precautions in operation, so as to avoid and reduce errors. 2.We must take a serious attitude during the experiment. 3.The experimental results must be carefully observed and recorded, and then scientifically analyzed to draw appropriate conclusions. 4.Complete the experimental report independently and carefully, with concise language and clear charts. 5. Comply with laboratory rules.
实验场地: Location	计算机与通信工程学院网络实验室 Network Laboratory, School of Computer and Communication Engineering
实验软硬件设备: Software/Hardware	pc 机、一体化实验教学平台 Computer、Integrated Experimental Teaching Platform

实验项目序号: Experiment No.	3	支撑教学目标: SLOs Supported	1-2, 2-3
每组成员: Members per Group	1	指导教师: Tutor	管莹 Ying Guan
实验名称: Experiment Title	运输层协议实验 Transport Layer Protocol Experiment		
实验内容: Content	TCP 连接和释放过程 TCP Connection and Release Process		
学习目标: Learning Objectives	探究 TCP 协议 Explore TCP protocol		
教学要求: Requirements	1..Preview, clarify the experimental purpose, principle, method and precautions in operation, so as to avoid and reduce errors. 2.We must take a serious attitude during the experiment. 3.The experimental results must be carefully observed and recorded, and then scientifically analyzed to draw appropriate conclusions. 4.Complete the experimental report independently and carefully, with concise language and clear charts. 5. Comply with laboratory rules.		
实验场地: Location	计算机与通信工程学院网络实验室 Network Laboratory, School of Computer and Communication Engineering		

实验软硬件设备: Software/Hardware	pc 机、一体化实验教学平台 Computer、Integrated Experimental Teaching Platform		

实验项目序号: Experiment No.	4	支撑教学目标: SLOs Supported	1-4、2-4
每组成员: Members per Group	1	指导教师: Tutor	管莹 Ying Guan
实验名称: Experiment Title	网络层协议实验 Network Layer Protocol Experiment		
实验内容: Content	观察 ARP 交换、捕获和研究 ICMP 报文 Observe ARP Exchange、Capture and Study ICMP Messages		
学习目标: Learning Objectives	理解 ARP、ICMP 的工作原理 Understand the Working Principle of ARP and ICMP		
教学要求: Requirements	1..Preview, clarify the experimental purpose, principle, method and precautions in operation, so as to avoid and reduce errors. 2.We must take a serious attitude during the experiment. 3.The experimental results must be carefully observed and recorded, and then scientifically analyzed to draw appropriate conclusions. 4.Complete the experimental report independently and carefully, with concise language and clear charts. 5. Comply with laboratory rules.		
实验场地: Location	计算机与通信工程学院网络实验室 Network Laboratory, School of Computer and Communication Engineering		
实验软硬件设备: Software/Hardware	pc 机、一体化实验教学平台 Computer、Integrated Experimental Teaching Platform		

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.
Chapter 1 Introduction	8			
Chapter 2 Application Layer	8	4		
Chapter 3 Transport Layer	8	2		
Chapter 4Network Layer: The Data Plane	8			

Chapter 5 Network Layer: The Control Plane	8	2		
Chapter 6 The Link Layer and LANs	8			
总计 Total	48			

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。

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 linesor revise content based on subject.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	韩鹏
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30
考核方式: Measures		Assessed by attendance check, in-class behavior (10pts per time), quizzes (10pts per time), activity engagement($\pm$1~5pts per time), etc. The final score is no more than 100 points, not less than 0 points.	

考核环节: Assessment Content	实验 Experiment	环节负责人: Director	管莹
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures		Assessed by in-class behavior (20pts per Exp), lab report(5pts per Exp). The final score is no more than 100 points, not less than 0 points.	

考核环节:	期末 Final	环节负责人:	韩鹏

Assessment Content		Director	
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	50
考核方式: Measures	Assessed by an 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 approval		
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.		