# 东北大学秦皇岛分校本科课程教学大纲

## 一、课程基本信息

<table>
<tr><td>开课单位</td><td colspan="3">计算机与通信工程学院</td><td>课程代码</td><td colspan="5">3100212007</td></tr>
<tr><td>中文名称</td><td colspan="8">计算机网络基础</td></tr>
<tr><td>英文名称</td><td colspan="8">Network Fundamentals</td></tr>
<tr><td>总学时</td><td>60</td><td rowspan="2">理论学时</td><td rowspan="2">48</td><td rowspan="2">实验学时</td><td rowspan="2">12</td><td rowspan="2">上机学时</td><td rowspan="2"></td><td rowspan="2">设计学时</td><td rowspan="2"></td><td rowspan="2">课外学时</td><td rowspan="2"></td></tr>
<tr><td>学　分</td><td>3.5</td></tr>
<tr><td>课程类型</td><td colspan="8">☐理论课程　☑理论（含实验）课程　☐实践类课程</td></tr>
<tr><td>课程类别</td><td colspan="8">☐通识类　☑学科基础类　☐专业方向类　☐实践类</td></tr>
<tr><td>适用专业</td><td colspan="8">计算机科学与技术</td></tr>
<tr><td>先修课程</td><td colspan="8">《C++程序设计基础》</td></tr>
<tr><td>建议开课学期</td><td colspan="8">☐1-1 ☐1-2 ☑2-1 ☐2-2 ☐3-1 ☐3-2<br>☐4-1 ☐4-2 ☐5-1 ☐5-2 ☐*（代表每学期都开设）</td></tr>
<tr><td>考核方式</td><td colspan="3">☑考试 ☐考查</td><td>成绩分制</td><td colspan="4">☑百分制 ☐五级制 ☐二级制</td></tr>
<tr><td>使用教材</td><td colspan="8">《计算机网络：自顶向下方法》，James Kurose, Keith Ross，<br>机械工业出版社，ISBN 9787111453789</td></tr>
<tr><td>参考书<br>及教学资源</td><td colspan="8">在线练习题资源：http://gaia.cs.umass.edu/kurose_ross/interactive<br>电子书资源：http://www.pearson.com.au/9781292153599<br>学习通课程资源：https://mooc1.chaoxing.com/subject-ans/ps/213596278</td></tr>
<tr><td>其他说明</td><td colspan="8">无</td></tr>
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## 二、课程简介

中文描述

计算机网络已成为人类历史上构建的最庞大的人造系统之一，每分钟承载着海量的数据交换，对致力于信息技术领域与数据工程的学生而言，深入理解数据在网络中的传输机制，以及数据传输设计的核心指导原则与架构布局，显得尤为关键。

本课程致力于为学生构筑坚实的计算机网络理论与实践基石。课程全面覆盖了计算机网络的基本概念、发展历程、体系结构及核心协议，剖析了数据通信原理、网络拓扑结构、IP 地址与子网划分等关键技术。学生将通过系统学习，掌握网络硬件设备的配置与管理技巧，洞悉局域网、广域网及国际互联网的运作机理，并学会运用网络工具进行网络系统仿真与优化。同时，课程还融入了课程思政、工程伦理、信息安全的内容，旨在培育学生的工匠精神，引导学生将个人成长与行业、社会发展有机联系，强化信息安全意识。

本课程注重理论与实践的深度融合、强调行业联系，设计了一系列丰富的实验项目和作业，使学生能够亲身体验网络配置与管理的全过程，从而有效提升解决实际问题的能力，为后续深造以及职业生涯的长远发展奠定坚实根基。通过本课程的系统培养，学生将进一步锤炼问题解决与设计创新的技能，理解计算机网络在中国与全球的发展趋势，学会配置和甄选最适宜的网络架构，并为后续开展计算机网络架构配置与应用开发奠定基础。

English Description

Computer networks have become the largest artificial system ever built, carrying massive amounts of data exchange every minute. For students dedicated to the field of information technology and data engineering, it is particularly crucial to deeply understand the transmission mechanisms of data within networks, as well as the guiding principles and architectural layouts of data transmission.

This subject is committed to laying a solid foundation for students in both the theory and practice of computer networks. It comprehensively covers the basic concepts, development history, architecture, and core protocols of computer networks, delving into key technologies such as data communication principles, network topology, IP addressing, and subnet division. Through systematic learning, students will master the skills of configuring and managing network hardware devices, gain insights into the operating mechanisms of local area networks, wide area networks, and the Internet, and learn to use network tools for network system simulation and optimization. Additionally, the subject incorporates elements of ideological education, engineering ethics, and information security, aiming to cultivate students' craftsmanship spirit, guide them to connect their personal growth with industry and societal development, and enhance their awareness of information security.

This subject emphasizes the deep integration of theory and practice, as well as industry connections. It has designed a series of rich experimental projects and assignments to enable students to experience the entire process of network configuration and management, thereby effectively enhancing their ability to solve practical problems and laying a solid foundation for further advanced studies in computer network subjects and long-term career development. Through the systematic training of this subject, students will further refine their problem-solving and design innovation skills, understand the development trends of computer networks in China and globally, learn to configure and select the most appropriate network architectures, and lay the groundwork for subsequent computer network architecture configuration and application development.

# 三、课程目标

**1、知识目标：**

1-1. 掌握计算机网络的基本概念、发展历程、体系结构及核心协议。

Master the basic concepts, development history, architecture, and core protocols of computer networks.

1-2. 深入理解数据通信原理、网络拓扑结构、IP 地址与子网划分等关键技术。

Gain a deep understanding of key technologies such as data communication principles, network topology, IP addressing, and subnet division.

1-3. 熟悉局域网、广域网及国际互联网的运作机理，了解网络在中国与全球的发展趋势。

Know the operating mechanisms of local area networks, wide area networks, and the Internet. Understand the development trends of computer networks in China and globally.

**2、能力目标：**

2-1. 具备网络硬件设备的配置与管理能力。

Acquire skills in configuring and managing network hardware devices.

2-2. 能够运用网络工具进行网络系统仿真与优化。

Be able to use network tools for network system simulation and optimization.

2-3. 学会配置适宜的网络架构，提升解决实际问题的能力。

Learn to configure the appropriate network, enhancing the ability to solve practical problems.

**3、德育/素养目标：**

3-1. 树立工匠精神，注重精益求精，培养诚实守信、勤奋努力的品质。

Cultivate a craftsmanship spirit, fostering qualities of continuous improvement, honesty, trustworthiness, diligence, and hard work.

3-2. 将个人成长与行业、社会发展有机联系，具备社会责任感。

Connect personal growth with industry and societal development and possess social responsibility.

3-3. 强化信息安全素养，注重保护个人数据安全。

Strengthen awareness of information security and prioritize the protection of personal data.

**表 1 课程目标与毕业要求的对应关系**

| 毕业要求 | 指标点 | 课程目标 | 关联性（H/M/L） |
|---|---|---|---|
| 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、2-1 2-2、2-3、3-3 | M |
| 6、工程与社会：能够基于本专业相关背景知识和相关法规标准进行合理分析，评价本专业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，并理解应承担的责任。 | 指标点 6-1：能够基于本专业相关背景知识进行合理分析，评价计算机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。 | 1-1、1-2、2-3、3-1、3-2 | H |

| | | | |
|---|---|---|---|
| 8、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 8-1：具备健全的人格，坚定的理想信念和社会责任感，科学的世界观、人生观和价值观，良好的人文社会科学素养。 | 1-3、3-1、3-2 | H |
| 12、终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。 | 指标点 12-2：适应本专业相关领域的新技术发展，能够灵活应对新的工作环境并采取合适的方式发展自身能力。 | 3-1、3-2、3-3 | L |

# 四、主要教学内容

## （一）理论教学

**第 1 章 Introduction （支撑课程目标 1-1、1-2、2-1、2-2、3-1、3-2）**

**【1】知识点：**

1-1 Basic concepts and definitions of computer networks.

1-2 Development history of computer networks.

1-3 Classification and application of computer networks.

1-4 Importance and impact of computer networks.

**【2】学习目标：**

2-1 Understand the basic concepts and definitions of computer networks.

2-2 Master the development history and important milestones of computer networks.

2-3 Know the classification of computer networks and their applications in different fields.

2-4 Recognize the importance of computer networks in modern society.

**【3】重点内容：**

3-1 Definition and core functions of computer networks.

3-2 Development history of computer networks, especially the development of the Internet.

3-3 Classification of computer networks, including local area networks, wide area networks, metropolitan area networks, etc.

**【4】难点内容：**

4-1 Understand the working principles and key technologies of computer networks.

4-2 Distinguish the characteristics and applicable scopes of different types of computer networks.

4-3 The impact of computer networks on social economy, culture, education, and other aspects.

**【5】思政案例：**

5-1 The application of the "Internet +" strategy in China's economic development, showcasing how computer networks drive innovated workforce as well as industrial upgrading and transformation.

5-2 The popularization of remote education and online office work during the epidemic period, reflecting the role of computer networks in social emergency response.

5-3 Cases of network security and personal information protection, discussing the ethical and legal responsibilities in the use of computer networks.

**第 2 章 Application Layer （支撑课程目标 1-2、1-3、2-2、3-1、3-2）**

**【1】知识点：**

1-1 Basic concepts and functions of the application layer.

1-2 Protocols of the application layer, including HTTP, FTP, DNS, SMTP, POP3, IMAP, etc.

1-3 Working principles and application scenarios of application layer protocols.

**【2】学习目标：**

2-1 Understand the role and position of the application layer in the computer network architecture.

2-2 Master the principles and applications of application layer protocols, such as HTTP, FTP, DNS, etc.

2-3 Know the security issues and performance optimization of application layer protocols.

**【3】重点内容：**

3-1 Concepts including its functions and position in the network architecture.

3-2 Principles of application layer protocols, such as HTTP, FTP, DNS, etc.

3-3 Security issues of application layer protocols, such as security risks of HTTP.

3-4 Performance optimization of the application layer, such as the caching & congestion control.

**【4】难点内容：**

4-1 Understand the working principles and interaction processes of application layer protocols.

4-2 Analyze the security issues of application layer protocols and propose corresponding solutions.

**【5】思政案例：**

5-1 Cases of DNS protocol security, discussing the responsibilities and challenges of application layer technology in protecting the security of user network access.

5-2 Cases of application layer performance optimization in 5G applications, such as CDN technology.

5-3 Applications and challenges of application layer in promoting the development of the society, such as mobile Internet, IoT, and other fields.

**第 3 章 Physical Layer （支撑课程目标 1-3、2-2、2-3、3-2、3-3）**

**【1】知识点：**

1-1 Basic concepts and functions of the physical layer.

1-2 Transmission media of the physical layer, including wired and wireless.

1-3 Interfaces and standards of the physical layer, such as RS-232, USB, etc.

1-4 Signal encoding and modulation techniques of the physical layer.

**【2】学习目标：**

2-1 Understand the role of the physical layer in the computer network architecture.

2-2 Master the transmission media of the physical layer and their characteristics.

2-3 Know the interface standards and applications of the physical layer.

2-4 Know the basic principles of signal encoding & modulation techniques of the physical layer.

**【3】重点内容：**

3-1 Basic concepts of the physical layer, including its functions and importance.

3-2 Applications of wired transmission media, such as twisted pair, coaxial cable, optical fiber, etc.

3-3 Principles of wireless transmission technologies, including radio, infrared rays, microwaves, etc.

3-4 Common interface standards of the physical layer and their applications in actual devices.

**【4】难点内容：**

4-1 Understand the principles of signal encoding and modulation techniques of the physical layer.

4-2 Transmission characteristics and applicable scenarios of different transmission media.

4-3 Know the development trends and future technologies of physical layer interface standards.

**【5】思政案例：**

5-1 Application of wireless networks in the popularization of education in remote areas, reflecting the role of physical layer technology in promoting social equity and development.

5-2 Cases of physical layer security and privacy protection, discussing the responsibilities and challenges of physical layer technology in protecting user data security.

5-3 Innovations and applications of physical layer technology on the Internet of Things.

**第 4 章 Transport Layer （支撑课程目标 1-2、2-2、2-3、3-2、3-3）**

【1】知识点：

1-1 Basic concepts and functions of the transport layer.

1-2 Protocols of the transport layer, including TCP and UDP.

1-3 Connection management including connection establishment, maintenance, and termination.

1-4 Flow control, congestion control, and error control mechanisms of the transport layer.

【2】学习目标：

2-1 Understand the role and position of the transport layer in the computer network architecture.

2-2 Master the working principles and application scenarios of TCP and UDP protocols.

2-3 Know the connection management process of the transport layer and its importance.

2-4 Master the flow control, congestion control, and error control mechanisms of the transport layer.

【3】重点内容：

3-1 Concepts of the transport layer, including its functions and position in the network architecture.

3-2 Principles of TCP, including connection management, data transmission, and reliability.

3-3 Characteristics and applications of UDP, such as real-time video transmission, DNS, etc.

3-4 Implementation and effects of flow, congestion, and error control mechanisms.

【4】难点内容：

4-1 Understand the TCP three-way handshake and four-way waveoff processes.

4-2 Analyze the principles of flow control and congestion control mechanisms of the TCP protocol.

4-3 Explore the application and optimization of transport layer protocols in actual environments.

【5】思政案例：

5-1 The development of the TCP/IP, showcasing the importance in the modern Internet.

5-2 Application cases of the UDP protocol in real-time communication.

5-3 Innovations and applications of transport layer technology in cloud computing and big data environments, emphasizing its role in promoting the development of an information-based society.

**第 5 章 Network Layer （支撑课程目标 1-1、1-2、1-3、3-2、3-3）**

【1】知识点：

1-1 Basic concepts and functions of the network layer.

1-2 Protocols of the network layer, including IP, ARP, ICMP, etc.

1-3 Routing algorithms and forwarding mechanisms.

1-4 IPv4 and IPv6 protocols and their transition technologies.

【2】学习目标：

2-1 Understand the role and position of the network layer in the computer network architecture.

2-2 Master principles and applications of the IP protocol, including IP addresses, subnetting, etc.

2-3 Know the basic principles of routing algorithms and forwarding mechanisms.

2-4 Know the differences between IPv4 and IPv6 protocols, transition technologies and new features.

【3】重点内容：

3-1 Basic concepts of the network layer, including its functions and position in the network architecture.

3-2 Principles of the IP, including IP datagrams format, addressing, fragmentation and reassembly, etc.

3-3 Classification and comparison of routing algorithms, such as static routing, dynamic routing, etc.

3-4 New features of the IPv6 protocol, such as a larger address space, built-in security, etc.

【4】难点内容：

4-1 Understand IP protocol addressing methods, including subnetting, CIDR, etc.

4-2 Analyze the working principles, advantages, and disadvantages of routing algorithms.

4-3 Explore transition technologies and deployment strategies for IPv4 and IPv6.

**【5】思政案例：**

5-1 Cases of routing algorithms in optimizing network performance and resource utilization.

5-2 Cases of IPv6 protocol security features and challenges of network layer technology.

**第 6 章 Link Layer （支撑课程目标 1-3、2-2、2-3、3-1、3-2）**

**【1】知识点：**

1-1 Basic concepts and functions of the link layer.

1-2 Protocols of the link layer, including frame structure, frame synchronization, error control, etc.

1-3 Common link layer technologies, such as Ethernet, flow control, medium access control, etc.

**【2】学习目标：**

2-1 Understand the role and position of the link layer in the computer network architecture.

2-2 Master the basic principles and implementation methods.

2-3 Know the common link layer technologies and their characteristics.

**【3】重点内容：**

3-1 Concepts including its position in the network architecture, functions.

3-2 Principles including frame structure, frame synchronization, and error control mechanisms.

3-3 Common link layer technologies, their characteristics, and application scenarios.

**【4】难点内容：**

4-1 Understand the frame synchronization and error control in link layer protocols.

4-2 Analyze characteristics and application of different link layer technologies to make choices.

4-3 Know about the flow control and medium access control, which involve complex algorithms.

**【5】思政案例：**

5-1 The widespread application of Ethernet technology demonstrates the important role of link layer technologies in promoting the development of an information-based society.

5-2 By analyzing error control mechanisms in link layer protocols, discuss the importance of ensuring data accuracy and reliability in network communication.

## （二）实验教学

The experimental teaching of this subject focuses on computer network protocols. As a collection of rules, standards, and conventions followed for data exchange in computer networks, network protocols hold great significance for learning and mastering computer networks. The experimental teaching of this subject aims to guide students in exploring the implementation process, principles, and engineering technical problems solved by computer network communication through advanced experimental environments and diversified network protocols for computer network experiments. The experimental teaching is centered around four core experimental projects: protocol comprehensive analysis, application layer protocol experiments, transport layer protocol experiments, and network layer protocol experiments. Adopting a teaching mode that emphasizes student autonomy in operation and is supplemented by academic guidance from teachers, we fully leverage abundant network experimental environments and advanced tool resources to deeply tap into students' academic potential, lay a solid foundation for their network operation skills, and comprehensively enhance their integrated practical abilities.

The project title and class hour allocation related information are shown in Table 2.

**表 2 实验教学信息表**

| 序号 | 实验项目名称 | 实验学时 | 每组人数 | 实验类型 | 实验性质 |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | Protocol Comprehensive Analysis | 4 | 1 | 综合性 | 必做 |
| 2 | Application Layer Protocol Experiment | 2 | 1 | 综合性 | 必做 |
| 3 | Transport Layer Protocol Experiment | 2 | 1 | 综合性 | 必做 |
| 4 | Network Layer Protocol Experiment | 4 | 1 | 综合性 | 必做 |

**实验项目一： Protocol Comprehensive Analysis（支撑课程目标 1-1、2-1、3-1）**

**【1】实验内容：**

1-1 Build a small Internet to simulate the typical Web service process of the Internet.

1-2 Further understand the working principle and protocol process of the Internet, and improve their ability to apply comprehensive knowledge and analyze it.

**【2】实验目的：**

2-1 Create network topology and observe network protocol, deepen understanding of protocols.

2-2 Understand how various protocols work together to complete Internet information services.

**【3】教学要求：**

3-1 Preview, clarify the purpose, principle, method and precautions in operation to reduce errors.

3-2 Take a serious attitude during the experiment.

3-3 Results must be carefully observed & recorded, and then scientifically analyzed to draw conclusions.

3-4 Complete the experimental report independently & carefully, with concise language and clear charts.

3-5 Comply with laboratory rules.

**【4】实验方式：**

Computer Experiment, Cisco Packet Tracer software.

**【5】实验场地与设备：**

Network Laboratory, School of Computer and Communication Engineering, Computer.

**【6】思政案例：**

Application examples of computer networks in daily life, business, education, scientific research, and other fields.

**实验项目二： Application Layer Protocol Experiment（支撑课程目标 1-2、1-3、2-2、3-2）**

**【1】实验内容：**

1-1 Study HTTP Protocol and Observe DNS in Operation.

**【2】实验目的：**

2-1 Understand the role and position of the application layer in the computer network architecture.

2-2 Master the principles and applications of application layer protocols, such as HTTP, FTP, DNS, etc.

2-3 Understand the security issues and performance optimization of application layer protocols.

**【3】教学要求：**

3-1 Preview, clarify the purpose, principle, method and precautions in operation, so as to reduce errors.

3-2 We must take a serious attitude during the experiment.

3-3 Results must be carefully observed & recorded, and then scientifically analyzed to draw conclusions.

3-4 Complete the experimental report independently & carefully, with concise language and clear charts.

3-5 Comply with laboratory rules.

**【4】实验方式：**

Computer Experiment, Cisco Packet Tracer software.

**【5】实验场地与设备：**

Network Laboratory, School of Computer and Communication Engineering, Computer.

**【6】思政案例：**

Application examples of networks protocols in cyber security.

**实验项目三： Transport Layer Protocol Experiment（支撑教学目标 1-2、2-2、2-3、3-2）**

**【1】实验内容：**

1-1 Complete the experiment on the TCP protocol to verify the connection-oriented transmission protocol and the three communication phases it includes: connection establishment, data transmission, and connection release.

**【2】实验目的：**

2-1 Understand the role and position of the transport layer in the computer network architecture.

2-2 Master the working principles and application scenarios of TCP protocols.

2-3 Understand the connection management process of the transport layer and its importance.

2-4 Principles of flow control, congestion control, and error control mechanisms of the transport layer.

**【3】教学要求：**

3-1 Preview, clarify the purpose, principle, method and precautions in operation to reduce errors.

3-2 We must take a serious attitude during the experiment.

3-3 Results must be carefully observed & recorded, and then scientifically analyzed to draw conclusions.

3-4 Complete the experimental report independently & carefully, with concise language and clear charts.

3-5 Comply with laboratory rules.

**【4】实验方式：**

Computer Experiment, Cisco Packet Tracer software.

**【5】实验场地与设备：**

Network Laboratory, School of Computer and Communication Engineering, Computer.

**【6】思政案例：**

Cases of computer networks promoting cultural exchanges and international cooperation, emphasizing their role in building a community with a shared future for mankind.

**实验项目四： Network Layer Protocol Experiment（支撑教学目标 2-3、3-3）**

**【1】实验内容：**

1-1 Observe ARP Exchange、Capture and Study ICMP Messages.

**【2】实验目的：**

2-1 Understand the role and position of the network layer in the computer network architecture.

2-2 Master principles and applications of the IP protocol, including IP addresses, subnetting, etc.

2-3 Understand the working principle of ARP and ICMP.

**【3】教学要求：**

3-1 Preview, clarify the purpose, principle, method and precautions in operation to reduce errors.

3-2 We must take a serious attitude during the experiment.

3-3 Results must be carefully observed & recorded, and then scientifically analyzed to draw conclusions.

3-4 Complete the experimental report independently & carefully, with concise language and clear charts.

3-5 Comply with laboratory rules.

**【4】实验方式：**

Computer Experiment, Cisco Packet Tracer software.

**【5】实验场地与设备：**

Network Laboratory, School of Computer and Communication Engineering, Computer.

**【6】思政案例：**

Meanings of technology information in IT by protocols of the Network Layer.

## 五、教学安排与学时分配

This subject is primarily based on classroom teaching, supplemented by experimental teaching and abundant online learning resources. The classroom teaching content revolves around the fundamental concepts, theories, principles, and practical operations of computer networks, with a deep exploration of core knowledge points such as network architecture and network protocols. Adhering to the fundamental task of cultivating students with virtue and talent, the subject aims to nurture socialist builders and successors who are comprehensively developed in terms of morality, intelligence, physique, aesthetics, and labor. Starting from the basic principles of computer networks, the subject frames its core around the application of computer network technology in modern information society, as well as the categorization of computer network protocols and layers. During the teaching process, offline classrooms, online teaching resources, and ideological and political cases are fully utilized. Through the imparting of theoretical knowledge, experimental and practical operations, and the guidance of values, the subject aims to foster students' patriotism and the concept of strengthening the country, consolidate their foundational knowledge of computer networks, enhance practical skills and innovative thinking, and help students establish correct outlooks on life, the world, and values.

The class hour allocation related information is shown in Table 3.

**表 3 学时分配表**

| 讲　　课　　内　　容 | | 学时 | | | | |
|---|---|---|---|---|---|---|
| | | 讲课 | 实验 | 上机 | 设计 | 课外 |
| 第 1 章 | Introduction | 8 | 0 | 0 | 0 | 0 |
| 第 2 章 | Application Layer | 8 | 6 | 0 | 0 | 0 |
| 第 3 章 | Physical Layer | 8 | 0 | 0 | 0 | 0 |
| 第 4 章 | Transport Layer | 8 | 2 | 0 | 0 | 0 |
| 第 5 章 | Network Layer | 8 | 4 | 0 | 0 | 0 |
| 第 6 章 | Link Layer | 8 | 0 | 0 | 0 | 0 |
| 小计 | | 48 | 12 | 0 | 0 | 0 |
| 总计 | 60 | | | | | |

## 六、教学方法

**1.** Combine theory with practice: First explain the basic principles of computer networks, and then allow students to configure network devices through experimental classes and troubleshooting.

**2.** Case analysis method: Select actual failure cases, guide students to analyze the causes of the problems, discuss solutions, and cultivate their ability to solve practical problems.

**3.** Interactive T&L: Engage students through question-asking and group discussions, utilizing both online platforms and offline classes to promote a comprehensive understanding of the subject matter.

**4.** Incorporate ideological elements, allow students to keep up with industry trends, care about social needs and people's needs, and broaden their disciplinary horizons.

**5.** Introduce global resources: Import materials to helps students access international advancements in network technology, fostering a global mindset of the latest developments in the industry.

## 七、成绩评定

This subject is assessed based on the concept of comprehensive monitoring. The subject assessment includes three components: regular performance, experiments, and the final examination. Each score is rounded to the nearest integer, recorded in the educational administration system, and the final transcript is exported. Matters not covered here shall be subject to the regulations of the school's academic affairs office and the agreements reached by the teaching team and the college's teaching guidance committee.

Specific requirements and grading methods are as follows:

**1.Regular Performance:** Accounts for 30% of the total score. With a full score of 100 points, grades are given based on students' classroom concentration, Assignment completion, and additional classroom performance. Assignment is graded according to completion, and academic misconduct such as plagiarism or similarities without proper citation may result in deductions or no points. Teachers give additional performance points of -5 to +5 points per instance based on students' participation in classroom interactions, which are directly included in the regular performance score. If the adjusted regular performance score exceeds 100 points, it is recorded as 100 points; if it is below 0 points, it is recorded as 0 points. Students who are absent without reason for 1/3 or more of the classes will be disqualified from the examination according to the relevant school regulations.

**2.Experiments:** Accounts for 20% of the total score. With a full score of 100 points, the assessment includes two parts: grades are given based on experimental classroom performance and experiment reports. See the subject's experimental performance assessment and evaluation methods for details.

**3. Final Examination:** Accounts for 50% of the total score. The assessment is conducted through a written (or computer-based) examination, with a full score of 100 points.

## 八、评价与持续改进

Subject evaluation and continuous improvement mechanism:

**1. Syllabus**

Cycle: 4 years, Revision Cycle: 4 years.

Improvement Measures: The subject leader organizes all teachers in the subject team to discuss and propose improvement suggestions, which are then reviewed by the director of the teaching and research section and approved by the academic dean.

**2. Grade Evaluation and Assessment**

Cycle: 1 academic year, Evaluation Basis: Comprehensive analysis of students' final grades.

Improvement Measures: Adjust and optimize the subject content accordingly based on the

distribution of students' final grades and improve teaching methods.

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