

Computer Networks **Fall 2021-2022**

Part 1: Course Information

Instructor Information

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Course Description

The course discusses network protocols in some depth in order to enable students to understand the core issues involved in network protocol design. Fundamental algorithms and principles are explained in the context of existing IEEE / Internet protocols in order to demonstrate how they are applied in real-world scenarios. This course is recommended for all students with a strong interest in communication networks and distributed systems.

The course covers topics such as local area networks (IEEE 802), Internet protocols, routing algorithms and protocols, flow and congestion control mechanisms, data representation, application layer protocols, remote procedure calls, network security.

Prerequisite

- [Algorithms and Data Structure.](#)

Co-Requisite

- [Operating Systems.](#)

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Computer Networks such as the Internet play a critical role in today's connected world. This module discusses the technology of Internet services in-depth to enable students to understand the core issues involved in the design of modern computer networks. Fundamental algorithms and principles are explained in the context of existing protocols as they are used in today's Internet. Students taking this course should finally understand the technical complexity behind everyday online services such as Google or YouTube.

Textbook & Course Materials

- Andrew S. Tanenbaum, "Computer Networks", 4th Edition, Prentice Hall, 2002
- William Stallings, "Data and Computer Communications", 6th Edition, Prentice Hall, 2000
- Fred Halsall, "Data Communications, Computer Networks and Open Systems", 4th Edition, Addison-Wesley, 1996
- Christian Huitema, "Routing in the Internet", 2nd Edition, Prentice Hall, 1999
- William Richard Stevens, "TCP/IP Illustrated Volume 1: The Protocols", Addison Wesley, 1994
- Douglas Comer, "Internetworking with TCP/IP Volume 1: Principles Protocols, and Architecture", 4th Edition, Prentice Hall, 2000
- James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Edition, Addison-Wesley 2004
- Olivier Bonaventure, "**Computer Networking: Principles, Protocols and Practice**", 2nd Edition, online
- Peter L. Dordal, "**An Introduction to Computer Networks**", online

Course Requirements

- Internet connection (DSL, LAN, or cable connection desirable)
- Access to CampusNet/Moodle/Teams

Course Structure

- The course is an online course that consists of two main types: Theoretical part and practical part.
- Students are expected to be familiar with the C programming language and to learn the basics of higher-level programming languages such as Python (the official Python documentation is available on <https://docs.python.org/3/>).

Online Resources and Links

- *The material and the syllabus will be uploaded to Moodle.*
- [Internet Engineering Task Force \(IETF\)](#)
- [Institute of Electrical and Electronics Engineers \(IEEE\)](#)
- [International Telecommunication Union \(ITU\)](#)
- [Cooperative Association for Internet Data Analysis \(CAIDA\)](#)
- [The Internet Protocol Journal](#)
- [Warriors of the Net](#)

Part 2: Student Learning Outcomes

By the end of this module, the student will be able to

- Recall layering principles and the OSI reference model.
- Articulate the organization of the Internet and the organization involved in providing Internet Services.
- Describe Media Access Control, flow control, and congestion control mechanisms.
- Explain how Local Area Networks differ from global networks.
- Contrast addressing mechanisms and translations between addresses used at different layers.
- Demonstrates how the Internet network layer forwards packets.
- Present how routing algorithms and protocols are used to determine and select routes.
- Describe how the internet transport layer provides different end-to-end services.
- Summarize how application layer protocols send and access electronic mail or access resources on the World-Wide-Web (WWW).
- Design and implement simple application layer protocols.
- Recognize to which extent computer networks are fragile and evaluate strategies to cope with the fragility.
- Analyze traffic traces produced by a given computer network.

Computer Networks Fall2021-2022 Syllabus

Part 3: Topic Outline/Schedule

- **Week 01:** Introduction, Internet Concepts, and Principles, Internet Services Today
 - Internet Concepts and Design Principles.
 - Structure and Growth of the Internet.
- **Week 02:** Media Access Control, Cyclic Redundancy Checks

- Classification and Terminology
- Communication Channels and Transmission Media
- Media Access Control
- Transmission Error Detection
- Sequence Numbers, Acknowledgements, Timer

- **Week 03: Flow and Congestion Control, OSI 7-Layer Model**
 - Flow Control and Congestion Control
 - Layering and the OSI Reference Model

- **Week 04: Local Area Networks (LAN)**
 - Local Area Networks Overview
 - Ethernet (IEEE 802.3)
 - Bridges (IEEE 802.1)
 - Virtual Local Area Networks (IEEE 802.1Q)
 - Port Access Control (IEEE 802.1X)
 - Wireless LAN (IEEE 802.11)
 - Logical Link Control (IEEE 802.2)
- **Week 05: Internet Network Layer**
 - Concepts and Terminology
 - Internet Protocol Version 6
 - Internet Protocol Version 4

- **Week 06: Internet Routing**
 - Distance Vector Routing (RIP)
 - Link State Routing (OSPF)
 - Path Vector Policy Routing (BGP)
- **Week 07: Internet Routing**
 - Path Vector Policy Routing (BGP)
- **Week 08: Internet Transport Layer (UDP, TCP)**
 - Transport Layer Overview
 - User Datagram Protocol (UDP)
 - Transmission Control Protocol (TCP)
- **Week 09: Internet Transport Layer (UDP, TCP)**
 - Transport Layer Overview
 - User Datagram Protocol (UDP)
 - Transmission Control Protocol (TCP)
- **Week 10: Firewalls, Network Address Translators**
 - Middleboxes
 - Firewalls
 - Network Address Translators
- **Week 11: Domain Name System (DNS)**
 - Overview and Features
 - Resource Records
 - Message Formats

- Security and Dynamic Updates
- Creative Usage

- **Week 12: Electronic Mail (SMTP, MIME, IMAP, DKIM)**
 - Components and Terminology
 - Simple Mail Transfer Protocol (SMTP)
 - Multipurpose Internet Mail Extensions (MIME)
 - Internet Message Access Protocol (IMAP)
 - Filtering of Messages (SIEVE)
- **Week 13: World Wide Web (HTTP)**
 - URLs, URNs, URIs, IRIs
 - HTTP 1.1 Methods
 - HTTP 1.1 Features
 - HTTP 2.0

- **Week 14: Voice over IP (RTP, SIP)**
 - Voice over IP
 - Real-time Transport Protocol (RTP)
 - Session Initiation Protocol (SIP)
 - Session Initiation Protocol (SIP)

***Department/College**

***Course Name**

***Semester Syllabus**

Part 4: Grading Policy

Graded Course Activities

Points	Description
100%	Final Exam-Written Examination
100	Total Points Possible

Late Work Policy

Be sure to pay close attention to deadlines—there will be no make-up assignments or quizzes, or late work accepted without a serious and compelling reason and instructor approval.

Viewing Grades in CampusNet

Points you receive for graded activities will be posted to the CampusNet platform.

Your instructor will update the online grades each time a grading session has been complete—typically 7 days following the completion of an activity.