

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING***ECE 4436A – Networking: Principles, Protocols and Architecture*****Course Outline Fall 2026****COURSE DESCRIPTION:**

This course introduces the fundamental concepts of communication networks. Specifically, it is concerned with network architectures and protocols. The objective of the course is to allow students to develop a thorough understanding of the architectures of networks and the basic principles that allow the transmission of data over the networks.

ACADEMIC CALENDAR:

https://www.westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_015751_1&SelectedCalendar=Live&ArchiveID=

Introduction to networking, network architecture and protocols, layering, OSI and TCP/IP models. Physical layer: transmission media, data encoding, Asynchronous and synchronous transmission. Data link layer: error detection, flow control, error control. Packet Switching: datagrams, virtual circuits, routing, congestion control, internetworking. Local area networks, network layer and transport layer.

PRE OR COREQUISITES:

Engineering Science 1036A/B or Computer Science 1026A/B.

Restricted to year 4 Electrical or Integrated or year 3 Software or year 3 or 4 Computer Engineering students.

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course, and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

ANTIREQUISITES:

Computer Science 3357A/B.

CEAB ACADEMIC UNITS:

Engineering Science 75%, Engineering Design 25%.

INSTRUCTOR INFORMATION:

- **Name:**
- **Office:**
- **Office Hours:**
- **Email:**

CONTACT HOURS:

Timetable information is available at <https://draftmyschedule.uwo.ca/>.

LECTURE:	
LABORATORY:	

REQUIRED TEXT:

- James F. Kurose & Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 8th Edition, ISBN-13: 9780135928615, 2020. Cost ~ \$58 CAD.

RECOMMENDED REFERENCES:

- Andrew S. Tanenbaum and David J. Wetherall, Computer Networks (5th Edition), Prentice Hall, 2010. Cost ~ \$150 CAD.
- Kevin R. Fall and W. Richard Stevens, TCP/IP Illustrated, Volume 1: The Protocols, Addison–Wesley, 201. Cost ~ \$84 CAD.
- W. Stallings, Data and Computer Communications, Prentice Hall, 2002. Cost ~ \$46 CAD.

RECOMMENDED SOFTWARE:

All the listed software below is required for the course and can be downloaded for free.

- **Mininet** is a network emulator that allows you to create a virtual network on a single machine, complete with hosts, switches, routers, and links. It's widely used to test and develop OpenFlow-based SDN (Software-Defined Networking) applications in a scalable, flexible environment. It can be downloaded from <https://mininet.org/>
- **Wireshark** is a network protocol analyzer that captures and displays data packets in real-time. It allows users to inspect network traffic details for troubleshooting, analysis, and development. It can be downloaded from <https://www.wireshark.org/>
- **Oracle VirtualBox or Docker** will be used to run Mininet and Wireshark in a simulation environment. This allows students to create and manage isolated virtual networks for testing and analysis. VirtualBox provides full-fledged virtual machines, while Docker offers lightweight containers. Both enable efficient setup and testing of network configurations and traffic monitoring in a controlled environment.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES):

Knowledge Base	A	Engineering Tools	A	Impact on Society	
Problem Analysis	D	Individual & Team Work	A	Ethics and Equity	
Investigation	D	Communication		Economics and Project Management	
Design	D	Professionalism		Life-Long Learning	

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

COURSE MATERIALS:

Weekly content and guides for the laboratories will be available on the course OWL site. The material for this course will be taught in both lectures and labs; therefore, it is imperative that you attend each lecture and lab.

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES:

The following table summarizes the course learning outcomes along with CEAB GAs where the GAs in bold indicate ones to be measured and reported annually.

Course Objectives and Specific Learning Outcomes	CEAB GA Indicators	Tentative Timeline
Chapter 1: Computer Networks and the Internet At the end of this chapter, the students will be able to:		
a. Demonstrate an understanding of the Internet.		
b. Demonstrate knowledge of the Network Edge.		
c. Demonstrate knowledge of the Network Core.		
d. Demonstrate knowledge of the Network Access and Physical Media.		
e. Demonstrate an understanding of ISPs and Internet Backbones.		
f. Demonstrate an understanding of Delay and Loss in Packet-Switched Networks.		
g. Demonstrate an understanding of Protocol Layers and Their Service Models.		

Chapter 2: Application Layer		
At the end of this chapter, the students will be able to:		
a. Demonstrate an understanding of the Principles of Application Layer Protocols.	KB4 ET2 ET3	Week 3-4
b. Demonstrate an understanding of the Web, HTTP, FTP, DNS, and DNS-The Internet's Directory Service protocols.		
c. Understand and apply Socket Programming with TCP.		
d. Understand and apply Socket Programming with UDP.		
e. Design and build a Simple Web Server.		
f. Demonstrate an understanding of Content Distribution.		
Chapter 3: Transport Layer		
At the end of this chapter, the students will be able to:		
a. Demonstrate an understanding of Transport-Layer Services.	KB4 PA2 PA3 D2 D3 ET2 ET3	Week 5-6
b. Demonstrate an understanding of Multiplexing and De-multiplexing.		
c. Demonstrate an understanding of Connectionless Transport: UDP.		
d. Demonstrate an understanding of the Principles of Reliable Data Transfer.		
e. Build and apply the Principles of Reliable Data Transfer.		
f. Demonstrate an understanding of Connection-Oriented Transport: TCP.		
g. Design and apply the Principles of Congestion Control.		
h. Demonstrate an understanding of TCP Congestion Control.		
--- Reading Week ---		
Chapter 4: Networking Layer and Routing Protocols		
At the end of this chapter, the students will be able to:		
a. Demonstrate an understanding of Network Service Model.	KB4 PA2 PA3 ET2	Week 8-9
b. Build and apply the Routing Principles.		
c. Demonstrate an understanding of Hierarchical Routing.		
d. Demonstrate an understanding of The Internet Protocol.		
e. Demonstrate an understanding of Routing and the Internet.		
f. Demonstrate an understanding of what's Inside a Router.		
g. Demonstrate an understanding of IPv6.		
h. Demonstrate an understanding of Multicast Routing.		
i. Demonstrate an understanding of Mobility and the Network Layer.		
j. Demonstrate an understanding of Software Defined Networking (SDN).		
k. Demonstrate an understanding of Simple Network Management Protocol (SNMP).		

Chapter 5: Link Layer Services and Protocols

At the end of this chapter, the students will be able to:

a. Demonstrate an understanding of Data Link Layer Services.	KB4 PA2 I1 D2 D3 D4 ET3 ITW3	Week 10-11
b. Demonstrate an understanding of Multiple Access Protocols.		
c. Demonstrate an understanding of LAN Addresses and ARP.		
d. Demonstrate an understanding of Ethernet.		
e. Demonstrate an understanding of Hubs, Bridges and Switches functionalities.		
f. Design and build Local Area Networks.		
g. Design and build Wireless Local Area Networks.		
h. Demonstrate an understanding of PPP: The Point-to-Point Protocol.		
i. Demonstrate an understanding of Data Centre Networking.		

Chapter 6: Cloud Networking Principles

At the end of this chapter, the students will be able to:

a. Demonstrate an understanding of data center network stack specifics	KB4	Week 12
b. Demonstrate an understanding of management and sharing of network infrastructure in cloud data centers.		
c. Demonstrate an understanding of inter-data center WAN connectivity		

Chapter 7: Wireless Communications & Mobility

At the end of this chapter, the students will be able to:

a. Demonstrate an understanding of Wireless communications and Mobility.	KB4	Week 13
b. Build and design of Wi-fi networks.		

EVALUATION:

Name	% Worth	Assigned	Due Date	CEAB GAS ASSESSED
Assignments 1-2 (Individual)	20%	No	Posted on OWL	ET2 PA2 PA3
Assignment 3 (Teams)	10	No	Posted on OWL	I1 D2 D3 D4 ET3 ITW3
Midterm Exam	30%	Yes	Posted on OWL	KB4 PA2
Final Exam	40%	Yes	Final Exam Period	KB4 PA3
Attendance (iClicker)	+2%	No	Every Lecture	-

The four graded components sum to 100%. The lecture attendance bonus is applied after each graded component is calculated and cannot result in a final course mark above 100%. Marks will be assigned based on the analysis and presentation method, correctness of solution, clarity, and neatness.

For this course, the following assessments have been designated as requiring supporting documentation:

- Midterm Exam
- Final Exam

COURSE POLICIES:

Late Submission Policy:

Please note that the assignment submission deadline includes a 48-hour submission window (grace period). As a result, the instructor reserves the right to deny any requests for academic consideration for assignments submitted after this grace period.

If students submit their assignments after the 48-hour grace period, a penalty of 10% per day will be applied, up to a maximum of 3 days. After three days, late submissions will no longer be accepted.

Self-Reported Absence:

No weight-shifting is allowed for self-reported absence; missed work will be due after a covered period.

Laboratory:

There will be 3 laboratory assignments, each spanning three to four weeks. All laboratory assignments have equal weight. Students complete Assignments 1 and 2 individually. Assignment 3 is completed in teams and includes a design stage, a measurement plan, and individual peer and self-evaluations submitted by each team member. Laboratory assignments may be programming-based. This course uses the Python programming language. Assignments also make use of network analysis and emulation tools, including Wireshark and Mininet.

Midterm Test:

There will be one midterm test, a closed-book exam (no reference materials allowed), lasting two hours. Simple Calculators are permitted. If a student misses the midterm, the exam will not be rescheduled. Instead, the midterm weight will be added to the final exam, making the final exam worth 70% of the overall grade. If the student provides no valid justification for missing the midterm, they will receive a mark of zero for the test.

Final Examination:

The final exam is central to the learning objectives for this course. Accordingly, students seeking academic consideration for this assessment must provide formal supporting documentation. Students who are granted academic consideration for this assessment will have the following opportunity to make up this work: the final examination will take place during the regular examination period. It will be three hours long, closed-book, and no calculators are allowed.

A mark of 60% or more must be achieved on the final examination to obtain a passing grade in the course.

A final examination mark < 60% will result in a final course grade of 48% or less.

If you do not meet the above conditions, your final grade cannot exceed 48%. Students who have failed this course (i.e., final average < 50%) must repeat all course components.

Use of English:

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work, except for the final examination, may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance:

Attendance will be recorded during every lecture using iClicker. Students are expected to maintain a cumulative attendance rate of at least 70% throughout the semester. Students who fall below this threshold will be reported to the Dean's Office. Consistent with university regulations, any student who fails to meet this attendance requirement may, upon the recommendation of the department and with the permission of the Dean, be disqualified from writing the final examination.

A bonus of up to 2% is available for lecture attendance, determined by the number of lectures missed over the entire course:

Lectures Missed	Bonus Awarded
0–3	2%
4–5	1%
6 or more	0%

The bonus is added after all graded components are calculated and **cannot raise the final course mark above 100%**. The bonus is separate from the 70% attendance requirement below, which governs eligibility to write the final examination.

Use of generative AI

Generative AI, including agentic tools that write code and run commands on your behalf, is permitted on all three assignments in this course and is not permitted in the midterm or the final examination. Every submission must end with an **AI Statement** saying whether you used AI and, if you did, naming the tools and what each one did; a statement that you used none is equally acceptable, and honest disclosure is never penalized. You remain responsible for everything you hand in, exactly as if you had typed every character of it. You may be asked at any time, without notice, to explain any part of a submission, to modify it, or to predict how it would behave in a case you did not test; work you cannot account for is marked only on the portion you can, which may be zero. A missing or untrue AI Statement, results that no run of the tools produced, and any use of AI in an examination are academic offenses.

FACULTY OF ENGINEERING POLICIES

[Policies and Procedures for Undergraduate Students](#)