DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

AISE 4430A – Introduction to Computer Networking, Security and IoT Systems

Course Outline 2026-27

COURSE DESCRIPTION:

This course introduces the fundamental concepts of communication networks, network security, and Internet of Things (IoT) network systems. The objective of the course is to allow students to develop a thorough understanding of the architecture of networks, IoT network system protocols (e.g., WiFi, LoRa, and Zigbee) and security.

ACADEMIC CALENDAR:

https://www.westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_030977_1&SelectedCalendar=Live&ArchiveID=

Principles of computer networking architecture/layers and protocols, IoT network systems, protocols, security, and connections to cloud services with an emphasis on the ability to interface and collect data from things and move them securely through the internet to process in public and private data centers.

PRE OR COREQUISITES:

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

ANTIREQUISITES:

ECE 4436A.

CEAB ACADEMIC UNITS:

Engineering Science 75%, Engineering Design 25%.

INSTRUCTOR INFORMATION:

Name:
Office:
Office Hours: TBA
Email:

CONTACT HOURS:
Timetable information is available at https://draftmyschedule.uwo.ca/.

LECTURE:	3hrs per week during the term
LABORATORY:	3hrs per week during the term

REQUIRED TEXT:

- Computer Networking: A Top-Down Approach, 9th edition by Kurose and Ross, published by Pearson (June 20, 2025),

OR

- Computer Networking: A Top-Down Approach, 8th Edition by Kurose and Ross, published by Pearson Education (2021).

  To obtain a digital version of the 8th Edition of the text, please go to Book Store at Western or see VitalSource here: https://www.vitalsource.com/en-ca/products/computer-networking-james-kurose- keith-ross-v9780135928523 ($57.99 for 180 days, $87.99 for lifetime access)

  To obtain a digital version of the 9th Edition of the text, please visit: https://www.vitalsource.com/products/computer-networking-a-top-down-approach-pearson-james-kurose-keith-ross-v9780135415603?srsltid=AfmBOoqcjGAQ60qWQ3MTX9rLFGl4fdueTmHvmrfpbU2uXQ1Fps7vrsjx (USD $59.94 for 180-day access — note that this edition is not yet listed on VitalSource Canada).

  The 8th Edition remains acceptable, as the differences between the two editions are not significant.

- Qusay F. Hassan, Internet of Things A to Z: Technologies and Applications, Wiley-IEEE Press, ISBN: 978-1-119-45674-2, 2018.
  To obtain a digital version of the 1st Edition of the text, please visit VitalSource: Internet of Things A to Z: Technologies and Applications on VitalSource. (USD $125.00 for lifetime access)

RECOMMENDED REFERENCES:

- IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1st edition Published by Cisco Press, 2017.
- Andrew S. Tanenbaum and David J. Wetherall, Computer Networks (5th Edition), Prentice Hall, 2010
- W. Stallings, Data and Computer Communications, Prentice Hall, 2002.
- Leon-Garcia and I. Widjaja, Communication Networks: Fundamental Concepts and Key Architectures, McGraw-Hill, 2000.

RECOMMENDED SOFTWARE:

- 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 for testing and developing OpenFlow-based SDN (Software-Defined Networking) applications in a scalable and 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 the details of network traffic 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	I	Engineering Tools	A	Impact on Society	
Problem Analysis	D	Individual & Team Work		Ethics and Equity	
Investigation		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 Brightspace 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 GAIs where the GAIs in bold indicate ones to be measured and reported annually.

Course Topics and Specific Learning Outcomes	CEAB Graduate Attributes Indicators
1. Computer Networks and the Internet At the end of this section, 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.	Taught but not assessed KB1 KB2 PA2

f. Demonstrate an understanding of Delay and Loss in Packet-Switched Networks. **g.** Demonstrate an understanding of Protocol Layers and Their Service Models.	KB1 KB2
2. Application Layer At the end of this section, students will be able to:	
a. Demonstrate an understanding of the Principles of Application Layer Protocols.	PA2 PA3
b. Demonstrate an understanding of the Web, HTTP, FTP, DNS, and DNS-The Internet's Directory Service protocols.	PA4
c. Understand and apply Socket Programming with TCP.	PA3 ET2 ET 3
d. Understand and apply Socket Programming with UDP.	PA3 ET2 ET 3
3. Transport Layer At the end of this section, students will be able to:	
a. Demonstrate an understanding of Transport-Layer Services.	PA3 PA4
b. Demonstrate an understanding of Multiplexing and De-multiplexing.	PA3 PA4
c. Demonstrate an understanding of Connectionless Transport: UDP.	
d. Demonstrate an understanding of the Principles of Reliable Data Transfer.	PA3 PA4
e. Build and apply the Principles of Reliable Data Transfer.	
f. Demonstrate an understanding of Connection-Oriented Transport: TCP.	D2 D3 ET2 PA2 PA3
g. Design and apply the Principles of Congestion Control.	D3 ET2 ET3
h. Demonstrate an understanding of TCP Congestion Control.	PA3 PA4
4. Networking Layer & Routing At the end of this section, students will be able to:	
a. Demonstrate an understanding of Network Service Model.	PA2 PA3
b. Build and apply the Routing Principles.	D2 D3 ET3
c. Demonstrate an understanding of Hierarchical Routing.	PA3 PA4
d. Demonstrate an understanding of The Internet Protocol.	PA3 PA4
e. Demonstrate an understanding of Routing and the Internet.	PA3 PA4
f. Demonstrate an understanding of what's Inside a Router.	PA3 PA4
g. Demonstrate an understanding of IPv6.	PA3 PA4
h. Demonstrate an understanding of Multicast Routing.	PA3 PA4
i. Demonstrate an understanding of Mobility and the Network Layer.	PA3 PA4
j. Software Defined Networking (SDN).	PA3 PA4
k. Simple Network Management Protocol (SNMP).	
5. Link Layer At the end of this section, students will be able to:	
a. Demonstrate an understanding of Data Link Layer Services.	PA3 PA4

b. Demonstrate an understanding of Multiple Access Protocols.	PA3 PA4
c. Demonstrate an understanding of LAN Addresses and ARP.	PA3 PA4
d. Demonstrate an understanding of Ethernet.	PA3 PA4
e. Demonstrate an understanding of Hubs, Bridges and Switches functionalities.	PA3 PA4
f. Demonstrate an understanding of PPP: The Point-to-Point Protocol.	PA3 PA4
g. Data Centre Networking.	
6. Network Security	
At the end of this section, students will be able to:	
a. Understand the general requirements of the network security protocols.	PA1
b. Understand several real-world security protocols including SSL, IPSec and Kerberos.	PA2
c. Distinguish different ways to authenticate and establish a session key over a network.	PA2 PA3
d. Explain how to achieve perfect forward secrecy and the benefits (and potential drawbacks) of using timestamps.	PA2 PA3
7. IoT Systems and Security	
At the end of this section, students will be able to:	
a. Explain the scope of the Internet of Things.	PA1
b. Understand IoT network traffic and Web services.	PA1, PA2
c. Understand IoT technologies including Wi-Fi, Bluetooth Low Energy, Zigbee, and LoRa.	PA1, PA2
d. Understand the general IoT security attacks.	PA1, PA2, ET2

EVALUATION:

Name	% Worth	Assigned	Due Date	CEAB GAs ASSESSED
Laboratory Assignments (3)	30%	No	Posted on OWL	KB4 PA2 PA3 D2 D3 ET2 ET3
Midterm Exam	30%	No	Posted on OWL	KB4 I1 PA2 PA3 D2 D3 ET2 ET3
Final Exam	40%	Yes	Final Exam Period	KB4 I1 PA2 PA3 D2 D3 ET2 ET3

Note that the dates listed above are tentative and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness.

For this course, the following assessment has been designated as requiring supporting documentation:

- Final Exam, due during the final examination period

COURSE POLICIES:

Laboratory:
There will be three laboratory assignments, each spanning approximately three weeks. The three laboratory assignments will carry equal weight and together account for 30% of the final grade. Laboratory assignments may involve programming, and Python will be used in this course.

Late Submission Policy:
Submissions received within 48 hours after the posted deadline will not incur a late penalty. After the 48-hour grace period, a penalty of 10% per day will apply for up to three additional days. Submissions will not be accepted after this period.

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

Midterm Exam:
There will be one midterm exam worth 30% of the final grade. The midterm exam will be closed-book, will last two hours, and only non-programmable calculators will be permitted. If a student misses the midterm exam and is granted academic consideration, the weight of the midterm exam will be transferred to the final examination, making the final examination worth 70% of the final grade. If academic consideration is not granted, the student will receive a grade of zero for the missed midterm exam.

Final Examination:
The final examination is considered central to the learning objectives of this course. Students seeking academic consideration for the final examination must provide formal supporting documentation. The regular final examination will be two hours long, closed-book, and only non-programmable calculators will be permitted.

Students who are granted academic consideration for a missed final examination will be provided with an opportunity to complete a Special Examination. **The Special Examination will be conducted as an individual oral examination** and will assess the same course learning outcomes as the regular final examination.

Attendance:
Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

ABSENCE FROM MANDATORY COURSE COMMITMENTS:
Students must familiarize themselves with the Policy on Academic Consideration for Absences:
https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html

I. Missed/Late Accommodation Policy

1. Students missing a test/assignment/lab or examination you will report the absence by submitting Academic Consideration Request form through STUDENT ABSENCE PORTAL.
2. Documentation must be provided as soon as possible.
3. Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.

II. Exam Accommodation

1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through STUDENT ABSENCE PORTAL.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must submit an the Academic Consideration Request Form through STUDENT ABSENCE PORTAL.
   PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

III. LATE ASSIGNMENTS

IV. Medical Accommodation

1. Requests for Academic Consideration Request Form through STUDENT ABSENCE PORTAL.
2. Requests for academic consideration must include the following components:
   a. Self-attestation signed by the student (This is only accepted for the first/one absence)
   b. Medical note. Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.
   c. Indication of the course(s) and assessment(s) affected by the request
   d. Supporting documentation as relevant
3. Requests without supporting documentation are limited to one per term per course.
4. Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.
5. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline.

   Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Registration.
6. An instructor may deny academic consideration for any assessment that is not required in the calculation of the final grade (e.g., “8 of 10 quizzes”). Assessment flexibility must be indicated on the course outline.

7. An instructor may deny academic consideration relating to the timeframe submission of work where there is already flexibility in the submission timeframe (e.g., 72-hour submission window). This assessment flexibility must be indicated on the course outline.

V. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

VI. Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit Academic Integrity Western Engineering for more information

VII. Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.
Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com).
Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

VIII. Faculty of Engineering AI Policy

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.
GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

IX. Use of English Policy

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.

X. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the Accessibility Western University for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit Academic Support & Engagement -Academic Accommodation.

XI. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the Office of Equity, Diversity and Inclusion.

XII. Health and Well-Being

- Health & Wellness Services – Students - Offers appointment-based medical clinic for all registered part-time and full-time students.
- Mental Health Support - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistant, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click here.
- Gender-Based Violence and Survivor Support - Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, here. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Contacts

Engineering Undergraduate Services

Electrical and Computer Engineering

Office of the Registrar/Student Central

Important Links

- WESTERN ACADEMIC CALENDAR
- ACADEMIC RIGHTS AND RESPONSIBILITIES
- ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS
- UNIVERSITY STUDENTS' COUNCIL (USC) - SERVICES
- IMPORTANT DATES AND DEADLINES
- ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS
- ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS
- SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS

- STUDENT FORMS
- OFFICE OF THE REGISTRAR
- RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES (SYLLABI)
- ACADEMIC APPEALS
- STUDENT ABSENCE PORTAL