

Course Outline – Fall 2023

CS 4458A/CS 9636A: Network Security

1. General Course Information

Course Information

CS 4458A/9636A: Network Security

Lectures: Tuesday: 9:30am – 12:30pm [in-person lectures]

Location: Spencer Engineering Building – 2202 (SEB-2202)

Prerequisites

(Computer Science 3305A/B or Software Engineering 3313A/B) and (Computer Science 3357A/B or Electrical and Computer Engineering 4436A/B).

Antirequisite:

2020-2021: CS 4457A/CS 9657A, 2021-2022: CS 4454A

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may 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.

2. Instructor

Name: Dr. Anwar Haque

Office Location: Middlesex College (MC) 415

Phone Number: 519-661-2111 Ext. 87428

E-Mail: ahaque32@uwo.ca

Office Hours (Instructor): Monday 11:30am – 12:30pm [Zoom link will be announced on OWL]

Office hours (Teaching Assistants- TAs): TA names, hours, and Zoom links will be announced on OWL

Students must use their Western (@uwo.ca) email addresses when contacting their course instructor and TAs.

3. Course Description, schedule, and Delivery Mode

This course will aim at providing a comprehensive understanding of various security issues in today's advanced communication networks. The list of these topics includes message/user authentication, cryptographic key management, web security, TLS, wireless/5G security, e-mail security, DNS security, IPSec, VPN security, Malware, Firewall, network intrusion detection/prediction/prevention, DoS/DDoS, Cloud and IoT Security.

Course Schedule: A detailed course schedule is provided below in Table 1.

Table 1: CS4458A / CS 9636A Fall 2023 Course Schedule

Lec #	Date	Topics	Comments
1	Tue – Sept 12	Course Introduction Overview of ISP Network Architecture - I	
	Tue – Sept 19	Assignment #1 Available [4%] (ISP and network security)	
2	Tue – Sept 19	Overview of ISP Network Architecture – II	
	Tue – Sept 19	QUIZ #1 [1.25%] Quiz [OWL]: starts Sept 19 th 6pm – ends Sept 25 th 11:55pm	Lecture 1 and 2
3	Tue – Sept 26	Intro to Information and Network Security	
	Tue – Sept 26	QUIZ #2 [1.25%] Quiz [OWL]: starts Sept 26 th 6pm – ends Oct 2 nd 11:55pm	Lecture 3
	Tue – Sept 26	Assignment #2 Available [8%] (Authentication / Digital Signature / Certificate)	
4	Tue – Oct 3	Cryptography, Authentication, Digital Signature, & Certificate - I	
	Tue – Oct 3	QUIZ #3 [1.25%] Quiz [OWL]: starts Oct 3 rd 6pm – ends Oct 9 th 11:55pm	Lecture 4
	Thu – Oct 5	Assignment #1 is due Submission deadline: Oct 5 th 11:55pm	
5	Tue – Oct 10	Cryptography, Authentication, Digital Signature, & Certificate - II	
	Tue – Oct 10	QUIZ #4 [1.25%] Quiz [OWL]: starts Oct 10 th 6pm – ends Oct 16 th 6:00pm	Lecture 5
	Tue – Oct 10	Assignment #3 Available [6%] (Authentication / Digital Signature / Certificate)	
	Tue – Oct 17	MIDTERM [UG only, 15%] In-person exam (1 hour 30 mins)	Lecture 1-5
	Sun – Oct 22	Assignment #2 is due Submission deadline: Oct 22 nd 11:55pm	
6	Tue – Oct 24	Web Security, TLS, Wireless security – I	Lecture 6

	Tue – Oct 24	QUIZ #5 [1.25%] Quiz [OWL]: starts Oct 24 th 6pm – ends Nov 6 th 11:55pm	Lecture 6
	Tue – Oct 24	Assignment #4 Available [5%] (Network Traffic Anomalies)	
	Tue – Oct 24	Grad Research Project Proposal Report is due [10%] (OWL submission deadline 11:55pm)	
	Tue – Oct 31	READING WEEK – NO CLASSES	
7	Tue – Nov 7	Web Security, TLS, Wireless security - II	
	Tue – Nov 7	QUIZ #6 [1.25%] Quiz [OWL]: starts Nov 7 th 6pm – ends Nov 13 th 11:55pm	Lecture 7
	Tue – Nov 7	Assignment #3 is due Submission deadline: Nov 7 th 11:55pm	
8	Tue – Nov 14	E-mail Security, DNS, IPSec, VPN	
	Tue – Nov 14	QUIZ #7 [1.25%] Quiz [OWL]: starts Nov 14 th 6pm – ends Nov 20 th 11:55pm	Lecture 8
	Tue – Nov 14	Assignment #5 Available [7%] (Network Security Architecture and Design Principles)	
9	Tue – Nov 21	Malware, Firewall, NIDS, DoS/DDoS	
	Tue – Nov 21	QUIZ #8 [1.25%] Quiz [OWL]: starts Nov 21 st 6pm – ends Nov 27 th 11:55pm	Lecture 9
	Thu – Nov 23	Assignment #4 is due Submission deadline: Nov 23 rd 11:55pm	
10	Tue – Nov 28	Cloud Security	
	Tue – Nov 28	QUIZ #9 [1.25%] Quiz [OWL]: starts Nov 28 th 6pm – ends Dec 4 th 11:55pm	Lecture 10
	Wed – Dec 4	Assignment #5 is due Submission deadline: Dec 4 th 11:55pm	
11	Tue – Dec 5	IoT Security	
	Tue – Dec 5	QUIZ #10 [1.25%] Quiz [OWL]: starts Dec 5 th 6pm – ends Dec 7 th 11:55pm	Lecture 11
	TBA	UG FINAL EXAM [45%] In-person exam (3 Hours)	Lecture 5 – 11
	Dec 20 – 21	Grad Research project Presentations [5%]	
	Dec 22	Final Research Paper (Grad students) due [45%] (OWL submission deadline 11:55pm)	

Course Delivery Mode: The delivery mode of this course will be in-person. Lecture materials/slides will be made available on OWL prior to each lecture. The instructor's and TA office hours will be

offered over Zoom. Quizzes will be conducted via OWL's Test and Quizzes. Midterm and Final exams will be in-person. Assignments submissions will be via OWL's Assignments.

Important Sessional Dates:

Reading Week (no class): October 30 - November 5, 2023

Classes end: December 7, 2023

Contingency plan: Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change. Any assessments affected will be conducted online as determined by the course instructor.

4. Course Materials

Suggested Textbook: Following book is recommended for this course:

William Stallings, "Cryptography and Network Security: Principles and Practice", 8th edition, Pearson, 2020, Print ISBN: Print ISBN: 9780135764039, 0135764033

Lecture notes: Lecture notes will be made available on OWL prior to each class.

Students should check OWL (<https://owl.uwo.ca>) on a regular basis for news and updates. OWL course site will be the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

Undergraduate Students

There are four basic components (Assignments, Quizzes, Midterm, and Final Exam) that will be used to determine UG student's marks in the course:

- Five assignments worth **30%** of the overall mark
- Ten quizzes worth **10%** of the overall mark (the best 8 out of 10 Quizzes will be considered).
- One midterm exam worth **15%** of the overall mark
- A final exam worth **45%** of the overall mark

The following rules are designed to ensure that students meet certain minimum standards:

- To be eligible to pass the course, a student must receive **at least 40%** in the exam components (i.e., 40% of 70) and **at least 40%** in the assignments (i.e., 40% of 30).
- To be eligible to receive an overall grade of **60% or higher** in the course, a student must receive **at least 50%** in the exam component (i.e., 50% of 70) and **at least 50%** in the assignments (i.e., 50% of 30).

Graduate Students

There are three basic components (Assignments, Quizzes, and Research project) and that will be used to determine a graduate student's mark in the course:

- Ten quizzes worth **10%** of the overall mark (the best 8 out of 10 Quizzes will be considered).
- Five assignments worth **30%** of the overall mark
- A research project proposal worth **10%** of the overall mark
- A final research paper worth **50%** of the overall mark (45% research paper + 5% presentation)

The following rules are designed to ensure that students meet certain minimum standards:

- To be eligible to pass the course, a student must receive **at least 40%** in the exam (i.e., quizzes) components (i.e., 40% of 10), **at least a 40%** in the assignments (i.e., 40% of 30), and **at least 40%** in the research project components (i.e., 40% of 60).
- To be eligible to receive an overall grade of **60% or higher** in the course, a student must receive **at least 50%** in the exam (i.e., quizzes) component (i.e., 50% of 10), **at least 50%** in the assignments (i.e., 50% of 30), and **at least 50%** in the research project component (i.e., 50% of 60).

Tests / Exams [Undergraduate Students]

There is an in-person final exam that is scheduled by the Registrar. There is one in-person midterm (test date: **Tuesday Oct 17, 2023**). Please refer to Table 1 for the midterm schedule.

Quizzes [Undergraduate and Graduate Students]

There will be a total of ten quizzes, and **the best 8 out of 10 quizzes** will be considered. Owl's *tests and quizzes* will be used for this purpose. Please refer to Table 1 for the quizzes schedule.

Accommodated Evaluations [Undergraduate Students]

There will be no makeup for the Quizzes or the Midterm Exam. If you miss the Quiz or the Midterm Exam, follow the procedure for Academic Accommodation detailed in Section 6 below. If accommodation is approved by your Dean's office, your Final Exam mark will be reweighted to include the weight of the Quiz and Midterm Exam.

Accommodated Evaluations [Graduate Students]

There will be no makeup for the Quizzes. If you miss the Quiz, follow the procedure for Academic Accommodation detailed in Section 6 below.

Assignments [Undergraduate and Graduate Students]

- Students must submit five assignments (worth 30% of the final mark) through OWL systems (details will be available on OWL). Submission instructions will be provided for each assignment. Please see the Table 1 for Assignment due dates and other details.
- Assignments will be made available on OWL, and the students will be notified accordingly. Students are responsible for checking OWL on a regular basis.
- Assignments Due dates: Assignment 1 (**Oct 5**), Assignment 2 (**Oct 22**), Assignment 3 (**Nov 7**), Assignment 4 (**Nov 23**), and Assignment 5 (**Dec 4**). All assignments are due by midnight (electronically) of the due date. Late assignments may be handed in, but will be accepted for up to two days after the due date, with a **penalty of 20% a day**. Weekend will be counted as a single day.
- Assignment Late Coupons: Each student is given 2 “late coupons”. Each coupon can be thought of as a potential one-day assignment extension. It is entirely up to you to decide when to use your coupons; more than one coupon may be used per assignment. You will hand in the coupon(s) together with the assignment (you must mention this on OWL when you submit your assignment), and the number of coupons you use will be recorded. The rules for late coupons are the following:
 - Coupons are not transferable to another student.
 - Once a coupon has been used, you cannot “take it back” to use for another assignment instead.
 - Coupons cannot be redeemed retroactively. (If an assignment has been marked, a coupon cannot later be used to reduce the late penalty.)
 - Unused coupons are not redeemable for extra marks.
 - Using a late coupon does not change the final date on which an assignment will be accepted. Whether or not coupons are used, the assignment must be handed in within 2 days of the original due date.
- Every effort will be made to have assignments marked and handed back within ten business days of the hand-in date, preferably sooner.

A detailed course schedule is provided in Table 1 (Section 3) of this document, where a list of topics covered on each lecture is provided. Table 2 below provides a summary of the individual course components (both UG and Grad):

Table 2: Course grade components and weighting

Course Component	Student Group	Description	Grade weight %
Assignments	Undergrad/Grad	A total of five assignments. Individual effort. See note #1 below	30%

Quizzes	Undergrad/Grad	A total of ten quizzes (T/F, multiple choices)	10%
Midterm	Undergrad	Mixed Format	15%
Final Exam	Undergrad	Mixed format To be administered by Registrar's office	45%
Research Project Proposal	Grad	2-3 pages research project proposal. Group effort. See note #2 below	10%
Final Research Project	Grad	10-15 pages research paper. Group effort. Pls see note #3 below	45% + 5% = 50% (report + presentation)

Notes:

1. Assignment (both UG and Grad) must be submitted through OWL by the deadline specified on OWL. All assignments are due by midnight (electronically) of the due date. Late assignments may be handed in, but will be accepted for up to two days after the due date, with a penalty of 20% a day. Weekend will be counted as a single day. Late coupons can also be used as outlined in Section 5. Every effort will be made to have assignments marked and handed back within ten business days of the hand-in date, preferably sooner. Assignment Due Dates are: Assignment 1 (**Oct 5**), Assignment 2 (**Oct 22**), Assignment 3 (**Nov 7**), Assignment 4 (**Nov 23**), and Assignment 5 (**Dec 4**).

2. Grad Research Proposal: Graduate students are expected to write a research proposal to outline their final research papers. This proposal paper could be a 2-3 page that includes (a) the specific research problem that students planning to explore; (b) related work (other research works in this area); (c) scientific importance / significance of the proposed research plan (why this is an important area to explore); and (d) a brief outline of how they plan to approach the problem. Students are required to work in a group (with other graduate students) for their projects. A sample research proposal will be provided to the students.

3. Grad Final Research Project: Based on the research proposal submitted by the graduate students, they are expected to work on a full-fledge research paper of 10 to 15 pages in length (11 font times new roman, single spaced). This research paper should include: (a) the problem statement; (b) relevant/related work, (c) technical/scientific contribution i.e., why the proposed research will be interesting to the scientific community; (d) a detailed description of the proposed idea /solution/ framework; (e) validation of the proposed solution through some analysis; and (f) brief discussion on the main contribution of this paper in relevance to other major research works done so far.

Guideline on research proposal, final project, and presentations will be discussed in class, and the necessary information will be available on OWL. Graduate students will be allowed to submit their final research paper by December 22, 2023.

6. Student Absences

Assessments worth less than 10% of the overall course grade:

For quizzes, if you miss up to two quizzes, you will not lose any marks, as the best eight quizzes out of 10 will be considered. If you miss more than two quizzes due to illness or other serious

circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible.

For assignments, late assignments may be handed in, but will be accepted for up to two days after the due date, with a penalty of 20% a day. Weekend will be counted as a single day. In addition, you have 2 late coupons that will automatically give leniency with due dates. If you require additional time with assignments (after your late coupons run out) due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible.

Assessments worth 10% or more of the overall course grade:

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible.

For further information, please consult the University's medical illness policy at https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf

The Student Medical Certificate is available at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

Note: missed work can *only* be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is **not** sufficient on its own.

7. Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized

religious holidays (updated annually) at: <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

8. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Midterm and Final exams will be **closed book / closed notes** exams and **No electronic devices** will be permitted except **regular calculator**.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in 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>).

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating

In the event of a pandemic lock-down and in-person exam restrictions, the tests and examinations in this course may be conducted using a remote proctoring service. Under such circumstances, by taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: <https://remoteproctoring.uwo.ca>.

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

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 sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at https://www.uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at http://academicsupport.uwo.ca/accessible_education/index.html if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>. Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.