

## Course Outline – Fall 2024

### 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]

[REDACTED]

### 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's Designate (Department/Program Counsellors and Science Academic Advisors) 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

[REDACTED]

E-Mail: [ahaque32@uwo.ca](mailto:ahaque32@uwo.ca)

Office Hours (Instructor): Tuesday 1:00pm – 2:00pm [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 2024 Course Schedule**

Lec #	Date	Topics	Comments
1	Tue - Sept 10	Course Introduction Overview of ISP Network Architecture - I	
	Tue - Sept 17	Assignment #1 Available [4%] (ISP and network security)	
2	Tue - Sept 17	Overview of ISP Network Architecture - II	
	Tue - Sept 17	QUIZ #1 [1.25%] Quiz [OWL]: starts Sept 17 <sup>th</sup> 6pm - ends Sept 23 <sup>rd</sup> 11:55pm	Lecture 1 and 2
3	Tue - Sept 24	Intro to Information and Network Security	
	Tue - Sept 24	QUIZ #2 [1.25%] Quiz [OWL]: starts Sept 24 <sup>th</sup> 6pm - ends Sept 30 <sup>th</sup> 11:55pm	Lecture 3
	Tue - Sept 24	Assignment #2 Available [8%] (Authentication / Digital Signature / Certificate)	
4	Tue - Oct 1	Cryptography, Authentication, Digital Signature, & Certificate - I	
	Tue - Oct 1	QUIZ #3 [1.25%] Quiz [OWL]: starts Oct 1 <sup>st</sup> 6pm - ends Oct 7 <sup>th</sup> 11:55pm	Lecture 4
	Thu - Oct 3	Assignment #1 is due Submission deadline: Oct 3 <sup>rd</sup> 11:55pm	
5	Tue - Oct 8	Cryptography, Authentication, Digital Signature, & Certificate - II	
	Tue - Oct 8	QUIZ #4 [1.25%] Quiz [OWL]: starts Oct 8 <sup>th</sup> 6pm - ends Oct 11 <sup>th</sup> 5:00pm	Lecture 5
	Tue - Oct 8	Assignment #3 Available [6%] (Authentication / Digital Signature / Certificate)	
	Tue - Oct 15	<b>READING WEEK - NO CLASSES</b>	
	Tue - Oct 22	<b>MIDTERM [UG only, 15%, Room: TBA]</b> In-person exam (1 hour 30 mins)	Lecture 1-5
	Sun - Oct 27	Assignment #2 is due Submission deadline: Oct 27 <sup>th</sup> 11:55pm	
6	Tue - Oct 29	Web Security, TLS, Wireless security - I	Lecture 6

<b>Lec #</b>	<b>Date</b>	<b>Topics</b>	<b>Comments</b>
	Tue – Oct 29	QUIZ #5 [1.25%] Quiz [OWL]: starts Oct 29 <sup>th</sup> 6pm – ends Nov 4 <sup>th</sup> 11:55pm	Lecture 6
	Tue – Oct 29	Assignment #4 Available [5%] (Network Traffic Anomalies)	
	Tue – Oct 29	Grad Research Project Proposal Report is due [10%] (OWL submission deadline 11:55pm)	
<b>7</b>	<b>Tue – Nov 5</b>	Web Security, TLS, Wireless security - II	
	Tue – Nov 5	QUIZ #6 [1.25%] Quiz [OWL]: starts Nov 5 <sup>th</sup> 6pm – ends Nov 11 <sup>th</sup> 11:55pm	Lecture 7
	Tue – Nov 5	Assignment #3 is due Submission deadline: Nov 5 <sup>th</sup> 11:55pm	
<b>8</b>	<b>Tue – Nov 12</b>	E-mail Security, DNS, IPSec, VPN	
	Tue – Nov 12	QUIZ #7 [1.25%] Quiz [OWL]: starts Nov 12 <sup>th</sup> 6pm – ends Nov 18 <sup>th</sup> 11:55pm	Lecture 8
	Tue – Nov 12	Assignment #5 Available [7%] (Network Security Architecture and Design Principles)	
<b>9</b>	<b>Tue – Nov 19</b>	Malware, Firewall, NIDS, DoS/DDoS	
	Tue – Nov 19	QUIZ #8 [1.25%] Quiz [OWL]: starts Nov 19 <sup>th</sup> 6pm – ends Nov 25 <sup>th</sup> 11:55pm	Lecture 9
	Thu – Nov 21	Assignment #4 is due Submission deadline: Nov 21 <sup>st</sup> 11:55pm	
<b>10</b>	<b>Tue – Nov 26</b>	Cloud Security	
	Tue – Nov 26	QUIZ #9 [1.25%] Quiz [OWL]: starts Nov 26 <sup>th</sup> 6pm – ends Dec 2 <sup>nd</sup> 11:55pm	Lecture 10
<b>11</b>	<b>Tue – Dec 3</b>	IoT Security	
	Tue – Dec 3	QUIZ #10 [1.25%] Quiz [OWL]: starts Dec 3 <sup>rd</sup> 6pm – ends Dec 6 <sup>th</sup> 11:55pm	Lecture 11
	Wed – Dec 4	Assignment #5 is due Submission deadline: Dec 4 <sup>th</sup> 11:55pm	
	TBA	<b>UG FINAL EXAM [45%]</b> In-person exam (3 Hours)	Lecture 5 – 11
	Dec 19	Final Research Paper (Grad students) due [45%] (OWL submission deadline 11:55pm)	
	Dec 20	Grad Research project Presentations [5%]	

**Course Delivery Mode:** The delivery mode of this course will be in-person. Lecture materials/slides will be made available on OWL Brightspace 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 12 – October 20, 2024

Classes end: December 6, 2024

**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", 8<sup>th</sup> edition, Pearson, 2020, Print ISBN: Print ISBN: 9780135764039, 0135764033

**Lecture notes:** Lecture notes will be made available on OWL Brightspace (<https://westernu.brightspace.com/>) prior to each class.

All course material will be posted to OWL Brightspace <https://westernu.brightspace.com/>. OWL Brightspace course site will be the primary method by which information will be disseminated to all students in the class. Students should check OWL Brightspace on a regular basis for news and updates.

If students need assistance with the course OWL site, they can seek support on the [OWL Brightspace 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 22, 2024**). 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 Brightspace 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.

### **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 3**), Assignment 2 (**Oct 27**), Assignment 3 (**Nov 5**), Assignment 4 (**Nov 21**), 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 3**), Assignment 2 (**Oct 27**), Assignment 3 (**Nov 5**), Assignment 4 (**Nov 21**), 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 and why this is an important area to explore; (b) related work (other research works in this area); (c) proposed research plan (an outline of the solution to address the research 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) a detailed description of the proposed idea /solution/ framework; (e) validation of the proposed solution through experimental results and analysis; and (f) Conclusion, limitations, and future works.

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 19, 2024.

## 6. Missed Coursework

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Final examinations scheduled during official examination periods (Defined by policy)
- Midterm exam (Designated by the instructor as the one assessment that always requires documentation when requesting Academic Consideration)

For the Midterm, if you miss the midterm due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Advising Office of your home faculty as soon as possible. All requests for Academic Consideration must be made within 48 hours after the assessment date. If accommodation is approved by your Dean's office, your Final Exam mark will be reweighted to include the weight of the Midterm Exam.

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

### Coursework with Assessment Flexibility

By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:

**Quizzes:** 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. All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline. If accommodation is approved by your Dean's office, your missed Quiz mark will be calculated based on the average mark of the rest of the quizzes.

**Assignments:** For Assignments, late assignments may be handed in, but they 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. All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.



For further information, please consult the University's academic consideration policy at [https://uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration\\_Sep24.pdf](https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf)

The Student Medical Certificate is available at [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](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 conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays: <https://www.edi.uwo.ca>.

### **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/AcademicAccommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/AcademicAccommodation_disabilities.pdf)

## **8. Academic Policies**

The website for Registrar Services is <https://www.registrar.uwo.ca/>. In accordance with policy, [https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](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.

Both the midterm and final exams will be **closed book / closed note exams**. Students are not allowed to use any electronic devices, including calculators.

**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: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf) 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.

Remote Proctoring Software may be used in this course in the event of a health lock-down. 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 Advising 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](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](mailto: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](http://academicsupport.uwo.ca/accessible_education/index.html) if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (<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/>.