Advanced Computer Networks

Course Information

Code: COSC 4P14
Term/Year/Duration: Fall/2024/02
Credit hours: 36 hours
Couse web page: in D2L
TAs: TBA

Instructor

Name: Robson E. De Grande
E-mail: rdegrande@brocku.ca
Office: COSC – Brock University - Mackenzie Chown J311 / On-line on MS Teams
Office hours: weekly – during and around scheduled lecture hours (or by appointment)

Times and Locations

Location: Face-to-face (room TH244)
Time: Mondays (2:00pm – 3:30pm) and Wednesdays (2:00pm – 3:30pm)

Note: Classes at Brock University end ten minutes ahead of the hour or half hour to facilitate transfer time. A Student may make or share an audio or video recording of a lecture, presentation, or lesson, **only with the permission of the instructor**.

Prerequisites

Computer Systems (COSC 2P13) – Minimum of 60 percent.

Attention. The student is not required to know Linux Operating System. However, the course relies heavily on Linux and open networking&security applications that run on it. The student is assumed to be familiar with such an Operating System or capable of learning its basics to follow the course.

Course Description

The "Advanced Computer Networks" course provides a view of the whole spectrum of networking topics, including fundamentals and advanced topics of computer networks. More detailed coverage of the fundamentals of networking is provided. A common, and widely-known top-down approach is employed: Application, Transport, Networking, and Link layers are visited and systematically explained. Advanced elements in terms of mobile networks, such as protocols in ad-hoc networks, are explained. Moreover, the course describes the security aspects of the networking setting, such as symmetric and asymmetric encryption, SSL, firewalls, wireless security, secure login, DNS, and Routing. The practical component of the course is added through group/individual assignments and labs that involve solving the design of a subnetwork setting and the implementation of secured networked applications.

Important Dates

The most recent listing of Important Dates for all durations is here.

First day of classes: 4 September
Last day of lectures: 3 December
Snow/Reading days: 5 December
Reading Week: 14 – 18 October
Last day of exams: 19 December
Deadline for withdrawal without academic penalty: 5 November

Course Communications

All course communication will happen through posts/announcements in D2L, email messages from the instructor, and in-class announcements during lectures.
All important course information is described in the course syllabus, which is available in D2L.
Regular reminders of course activities, as well as their deadlines and changes, are provided at the beginning of lectures.
Emergency communication will take place through emails from the instructor and announcements in D2L. Such communications will notify students of unexpected events, such as class cancellations, inclement weather, and deadline extensions.
Please note that all email exchanges will arrive at the student Brock email; ensure you access your Brock email account regularly.

When communicating with the instructor(s) and TA(s), **make sure you keep your message polite, address the matter concisely and directly, include your student ID, and identify the course code in the email subject**. Please note that aggressive, unpolite language will not be tolerated.

Learning Outcomes

The learning outcomes of the course are described below:

1. **Mastery of Networking Layers:**
   - Systematically understand and explain the Application, Transport, Networking, and Link layers using a top-down approach, including the protocols and technologies associated with each layer.
2. **Advanced Mobile and Wireless Networks:**
   - Understand and analyze designs on advanced mobile and wireless networking protocols, including those used in ad-hoc networks, Wi-Fi, and cellular networks, including the challenges and solutions specific to these environments.
3. **Comprehensive Network Security:**
   - Understand and apply network security mechanisms, including symmetric and asymmetric encryption, SSL, firewalls, wireless security, secure login, DNS, and routing security, with a focus on securing wireless and mobile networks.
   - Understand and apply secure subnetwork settings and networked applications, particularly in wireless and mobile contexts, incorporating security best practices to ensure robust protection against potential threats.
4. **Application of Theoretical Concepts in Practice:**
   - Demonstrate the ability to apply theoretical concepts through group and individual assignments and labs, focusing on solving real-world networking problems, including the challenges of wireless and mobile network environments.
5. **Performance Analysis and Optimization:**

- Understand and conduct performance analysis of both wired and wireless networks, optimizing for factors such as throughput, latency, and jitter, including mobile and ad-hoc networking scenarios.

6. **Research and Critical Analysis:**
   - Engage in research and critical analysis of contemporary issues in advanced networking, including security protocols, mobile networks, wireless technologies, and other emerging trends in networking.
   - Properly use networking tools for monitoring and analysis.
7. **Problem-Solving and Practical Skills:**
   - Develop problem-solving skills in designing, configuring, and troubleshooting wired, wireless, and mobile networked systems, with a focus on secure and efficient network design.
8. **Collaboration and Technical Communication:**
   - Collaborate effectively in teams to tackle complex networking challenges, particularly in wireless and mobile networks, and communicate technical solutions clearly and concisely, both in writing and presentations.

References

Reference Books and Material::

1. *Computer Networking: A Top-Down Approach* (7th Edition) by James F. Kurose and Keith W. Ross. Publisher: Pearson; 6th edition (Apr. 26, 2016). ISBN-10: 9780133594140 & ISBN-13: 978-0133594140
2. *Network Security: Private Communication in a Public World* (2nd Edition) by Charlie Kaufman, Radia Perlman, and Mike Speciner. Publisher: Prentice Hall; 2nd edition (Apr. 22, 2002). ISBN-10: 0-13-046019-2 & ISBN-13: 978-0-13-046019-6
3. *Network Security Essentials: Applications and Standards* (6th Edition) by William Stallings. Publisher: Pearson; 6th edition. ISBN 978-93-528-6660-1 & eISBN: 9789353062996

Forms of Delivery

COSC 4P14 is completely face-to-face: all content are delivered physically (in classroom), and activities are on-line through the following tools:

- Face-to-face (in classroom):
  - Lectures.
- MS Teams:
  - Real-time / live lectures (if needed for social distancing) + interactive sessions (discussions);
  - Office hours;
- BrightSpace:
  - Lecture notes, short videos, codes, documents (syllabus);
  - Assessments: quizzes, assignments, tests, and exams (if needed);
  - Grades and announcements.
- E-mail: Q&A and discussions.

Topic Outline

The course extends over twelve weeks, and its topics will be covered following the plan described in Table 1.

Table 1: Topic Outline

Week	Dates	Content	Book Reference
1	Sep 04 – Sep 09	**Introduction**	1.1
2	Sep 11 – Sep 16	**Application Layer**	1.2
3	Sep 18 – Sep 23	**Transport Layer**	1.3
4	Sep 25 – Sep 30	**Transport Layer**	1.3
5	Oct 02 – Oct 07	**Network Data Plane**	1.4
	Oct 14 – 18	Reading week	
6	Oct 09 – Oct 21	**Network Control Plane**	1.5
7	Oct 23 – Oct 28	**Link Layer and LANs**	1.6
8	Oct 30 – Nov 04	**Wireless and Mobile Networks**	1.7
9	Nov 06 – Nov 11	**Wireless and Mobile Networks**	1.7
10	Nov 13 – Nov 18	**Wireless and Mobile Networks**	1.7
11	Nov 20 – Nov 25	**Secure Network - Introduction**	1.8, 2.1-6
12	Nov 27 – Dec 02	**Secure Network - Attacks & Measures**	2.17-18, 2.20-23, 2.25

Grading

The course is composed of the following activities: Assignments, Quizzes, a Midterm, and a Final Exam. The Grading Schema of the course, which includes all these activities, is described in Table 2.

Table 2: Grading Schema

Activity	Marks
Assignments	40%
Quizzes *	10%
Midterm	20%
Final Exam **	30%

** 40% of the exam is required to pass the course

Midterm Test

There will be one midterm test in this course. The midterm will test students on the initial topics of the course. It will be held during one of the scheduled lectures. Tentative midterm date: **October 9th, 2024**.

Assignments

There will be four assignments throughout the term. The Assignment Mark will be the average of the marks of the four assignments. The Tentative Schedule of the Assignments is defined in Table 3

Table 3: Tentative Assignment Schedule

Assignment	Due
1	October 7st @ 11:59pm
2	October 28nd @ 11:59pm
3	November 18th @ 11:59pm
4	December 6th @ 11:59pm

Quizzes

There will be six scheduled quizzes throughout the term. The four top marks out of the six quizzes will be considered when calculating the Quiz average in the final course grade. The tentative quiz schedule is defined in Table 4.

Table 4: Tentative Quiz Schedule

Quiz	Date
1	Sep 16 (W2)
2	Sep 30 (W4)
3	Oct 21 (W6)
4	Nov 04 (W8)
5	Nov 18 (W10)
6	Dec 02 (W12)

Attendance

Attendance and participation in on-line (real-time) activities is strongly recommended. Lectures cover more content than in the textbook or examples, as well as study cases, other than presented in text books and lecture notes.

Absence

Students must notify the instructor their absence as early as possible. In case of health emergencies, students must provide a proof, a doctor's notice or a copy of a medical prescription, so they area allowed to re-take exams or postpone "deliverables".
Students who fail to complete a course activity within its respective deadline will receive zero marks for it.

Assignment Delivery and Late Assignment Policy *

Unless the delivery methods and time are explicitly specified in class by the instructor, Assignments and Reports must be delivered through D2L until 11:59 pm of the due date.
Late submissions are not accepted. However, deadline extensions may be granted under extenuating circumstances, such as medical or physical conditions; please note that granting the extension is under the instructor's discretion.

Academic Integrity

Academic misconduct is a serious offence. The principle of academic integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should consult Section VII, "Academic Misconduct", in the "Academic Regulations and University Policies" entry in the Undergraduate Calendar to view a fuller description of prohibited actions, and the procedures and penalties. Information on what constitutes academic integrity is available at Brock University Academic Integrity Website.

Plagiarism software

This course may use Turnitin.com, phrase-matching software. If you object to uploading your assignments to Turnitin.com for any reason, please notify the instructor to discuss alternative submissions.

Penalties for Academic Misconduct in the Faculty of Mathematics and Science

The following are penalties usually imposed in academic misconduct cases in FMS. Please be aware that the Associate Dean, Undergraduate Programs, may assign different penalties than those listed here, depending on the details of individual cases.

First offence: Zero grade on assignment, additional penalty of 100% of the weight of the assignment to be subtracted from the final grade, mandatory completion of the AZLS Academic Integrity workshop.

Second offence: Zero grade on assignment, 4-month suspension.

Third or additional offence: Zero grade in course, 1-year suspension, permanent removal from major program.

Cheating on exams: Zero grade in course, including for first offences.

Intellectual Property Notice

All slides, presentations, handouts, tests, exams, and other course materials created by the instructor in this course are the intellectual property of the instructor. A student who publicly posts or sells an instructor's work, without the instructor's express consent, may be charged with misconduct under Brock's Academic Integrity Policy and/or Code of Conduct, and may also face adverse legal consequences for infringement of intellectual property rights.

Accommodations

The University is committed to fostering an inclusive and supportive environment for all students and will adhere to the Human Rights principles that ensure respect for dignity, individualized accommodation, inclusion and full participation. The University provides a wide range of resources to assist students, as follows:

- If you require academic accommodation because of a disability or an ongoing health or mental health condition, please contact Student Accessibility Services at askSAS@brocku.ca or 905 688 5550 ext. 3240.
- Medical Self-Declaration Forms (brief absence up to 72 hours)
  In the case of a short-term medical circumstance, if a student wishes to seek an academic consideration, please use the Medical Self-Declaration Form. The request is to be made in good faith by the student requesting the academic consideration due to a short-term condition that impacts their academic activities (e.g., participation in academic classes, delay in assignments, etc.).
  The period of this short-term medical condition for academic consideration must fall within a 72-hour (3 day) period. The form must be submitted to the instructor either during your brief absence or if you are too unwell, within 24 hours of the end of your 3 day brief absence.
  Medical Verification Form (extended duration)
  In cases where a student requests academic consideration due to a medical circumstance that exceeds 72 hours (three days) and will impact their academic activities (e.g., participation in academic classes, delay in assignments, etc.), or in the case of a final exam deferral, the medical verification form must be signed by the student and the health professional as per process set out in the Faculty Handbook III:9.4.1.
- If you are experiencing mental health concerns, contact the Student Wellness and Accessibility Centre. Good2Talk is a service specifically for post-secondary students, available 24/7, 365 days a year, and provides anonymous assistance: Good 2 Talk or call **1-866-925-5454**. For information on wellness, coping and resiliency, visit: Brock University (Mental Health)
- If you require academic accommodation on religious grounds, you should make a formal, written request to your instructor(s) for alternative dates and/or means of satisfying requirements. Such requests should be made during the first two weeks of any given academic term, or as soon as possible after a need for accommodation is known to exist.
- If you have been affected by sexual violence, the Human Rights & Equity Office offers support, information, reasonable accommodations, and resources through the Sexual Violence Support & Education Coordinator. For information on sexual violence, visit Brock's Sexual Assault and Harassment Policy or contact the Sexual Violence Support & Response Coordinator at humanrights@brocku.ca or 905 688 5550 ext. 4387.
- If you have experienced discrimination or harassment on any of the above grounds, including racial, gender or other forms of discrimination, contact the Human Rights and Equity Office at humanrights@brocku.ca.

How to succeed in this course

This course covers a extensive amount of content and is very demanding on off-class activities. Students must keep up with their readings, assignments, as well as any other required activity.
In case you feel that you may lagging behind, please do not hesitate in contacting a TA and me as soon as possible, so we have enough time to correct the issue that is affecting your progress in the course.
This course requires problem-solving and critical thinking to apply the content delivered in class. Students are encouraged to talk and help each other to understand concepts, problems, and solutions. However, students are no allowed to help writing programs, assignments, and quizzes. Copies of pieces of code or text from class colleagues are considered acts of plagiarism!