

ECE416: Advanced Topics in Networking

Winter 2021

Instructor: Dr. Kaige Qu, k2qu@uwaterloo.ca

Lecture schedule: Jan 11 -Apr 14, 2021, excluding Reading Week, Mar 16, and Apr 14; totally 24 virtual lectures, 1h and 20 mins for each, with lecture slides and video recordings available at LEARN

TA: TBD

Office hour: Please email at uwece416@gmail.com for any questions about the course contents whenever necessary. The instructor or TA will directly answer your questions or arrange online discussions if necessary.

Course description:

This course introduces advanced topics in networking including:

1. Introduction and review of ECE 358
2. Wireless (WiFi) and Cellular networks (2G, 3G, 4G and beyond)
3. Applications (HTTP, SMTP, DNS, P2P, etc.) and socket programming
5. Multimedia networking and protocols for multimedia support (DASH, Voice over IP, RTP, SIP, Quality-of-Service)
5. Network security (cryptography, integrity, authentication, TLS, IPsec, security in wireless networks)
6. Emerging technologies (e.g., software defined networks)

Prereq: ECE 358; Level at least 4A Computer Engineering or Electrical Engineering.

Antireqs: CS 456

Text: Jim Kurose, Keith Ross, Computer Networking: A Top Down Approach, 6th/7th/8th edition.

Project: Each student will select a topic in advanced networking, obtain consent from the instructor and prepare a short survey paper (4 pages) on the topic. The topics should be related to the topics covered in our lectures. Taking the cellular network topic as an example, you may select a topic on 5G and beyond (6G) networks. A survey paper is a paper that summarizes and organizes recent research results in a novel way that **integrates** and **adds understanding** to work in the field. Remember to not only summarize the existing works but also include your own understanding and thinking on your selected topic. Please refer to the journal of *IEEE Communications Surveys & Tutorials* at *IEEE Explore* to see what a survey paper is. At least ten papers should be included in the reference of your short survey paper. You may need to read

more than ten papers to determine which ten you will select as references. Among the ten papers, at least a half should be published in recent five years. The font size of your survey paper should be no larger than 12-pt. The page margins should be normal. Even though it is a survey paper, you should write every sentence by your own. No plagiarism is accepted. A submission with plagiarism will receive no score.

Grading: The course grade will be based on 4 homework assignments, 3 quizzes, a project, and a final examination which will be held during the official examination schedule. The breakdown is as follows:

Homework	15% (4% + 4% + 4% + 3%)
Quiz	40% (14% + 13% + 13%)
Project	15%
Final exam	30%

Schedule:

Week	Date	Due Time	Event	Note
Week 1 (Jan 11-Jan 15)	Jan 12 (Tue)		Lecture 1	ECE 358 review
	Jan 13 (Wed)		Lecture 2	Wireless LAN
Week 2 (Jan 18-Jan 22)	Jan 19 (Tue)		Lecture 3	Cellular networks
	Jan 20 (Wed)		Lecture 4	Mobility management
Week 3 (Jan 25-Jan 29)	Jan 26 (Tue)		Lecture 5	Tutorial for Lectures 2~4
	Jan 27 (Wed)		Lecture 6	Application layer overview
	Jan 29 (Fri)	11pm	Assignment 1	For Lectures 2-5
Week 4 (Feb 1- Feb 5)	Feb 1 (Mon)		Quiz 1	For Lectures 2-5
	Feb 2 (Tue)		Lecture 7	Persistent/non-persistent HTTP and HTTP message formats

	Feb 3 (Wed)		Lecture 8	Cookies, Web caching
Week 5 (Feb 8- Feb 12)	Feb 9 (Tue)		Lecture 9	Email application
	Feb 10 (Wed)		Lecture 10	DNS (Note: Assignment 2 will be posted.)
Week 6 (Feb 15- Feb 19)				Reading week
Week 7 (Feb 22- Feb 26)	Feb 22 (Mon)		Assignment 2	For Lectures 6-10
	Feb 23 (Tue)		Lecture 11	Tutorial for Lectures 6~10
	Feb 24 (Wed)		Lecture 12	Socket programming, P2P
Week 8 (Mar 1- Mar 5)	Mar 1 (Mon)		Quiz 2	For Lectures 6-11
	Mar 2 (Tue)		Lecture 13	P2P, multimedia overview
	Mar 3 (Wed)		Lecture 14	Streaming stored video
Week 9 (Mar 8- Mar 12)	Mar 9 (Tue)		Lecture 15	VoIP
	Mar 10 (Wed)		Lecture 16	RTP, SIP (Note: Assignment 3 will be posted.)
Week 10 (Mar 15-Mar 19)	Mar 17 (Wed)		Lecture 17	Tutorial for Lectures 12~16
Week 11 (Mar 22-Mar 26)	Mar 22 (Mon)		Assignment 3	For Lectures 12-16
	Mar 23 (Tue)		Lecture 18	Network security overview, symmetric key cryptography, RSA
	Mar 24 (Wed)		Lecture 19	Message integrity, digital signature, end-point authentication
Week 12 (Mar 29-Apr 2)	Mar 29 (Mon)		Quiz 3	For Lectures 12-17
	Mar 30 (Tue)		Lecture 20	Public key certification, Security in email, TLS
	Mar 31 (Wed)		Lecture 21	IPsec, security on wireless links
Week 13	Apr 6 (Tue)		Lecture 22	Tutorial for Lectures 6~10

(Apr 5 -Apr 9)	Apr 7 (Wed)		Lecture 23	Review
Week 14 (Apr 12-Apr 16)	Apr 12 (Mon)			
	Apr 13 (Tue)		Lecture 24	Review
	Apr 14 (Wed)		Assignment 4	For Lectures 18-21
The final exam will be held during the final exam period. The project is due on April 26, which is the last day of the final exam period.				

Assignment Submission and Lateness Penalties: Proper academic performance depends on students doing their work not only well, but on time. (Not writing a quiz/exam will result in a grade of zero; 10% deduction per day for late homework.) Each assignment is due by 11pm on its due date and you are required to upload your assignment online via a unique submission link sent to your uwaterloo email account from [Crowdmark](#). Unless otherwise indicated, emailed assignments will not be accepted. An assignment is considered LATE if uploaded after 11:00pm on the due date. Late assignments will be penalized with a 10% grade reduction per day, unless they are accompanied by a doctor's or by other official documentation detailing a serious matter.

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [the Office of Academic Integrity](#) for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read [Policy 70, Student Petitions and Grievances, Section 4](#). When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check [the Office of Academic Integrity](#) for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to [Policy 71, Student Discipline](#). For typical penalties, check [Guidelines for the Assessment of Penalties](#).

Appeals: A decision made or penalty imposed under [Policy 70, Student Petitions and Grievances](#) (other than a petition) or [Policy 71, Student Discipline](#) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to [Policy 72, Student Appeals](#).

Note for students with disabilities: [AccessAbility Services](#), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with [AccessAbility Services](#) at the beginning of each academic term.