

Syllabus for ECE 4112 / 6612: Computer Network Security

(Last Revision: TBD)

Instruction Information

Instructor Name:	Prof. Frank Li
Lecture Hours:	TBD (3 Unit Course)
Lecture Mode:	TBD
Instructor Office Hours:	TBD
Instructor Email:	frankli@gatech.edu
Course TAs:	TBD
TA Emails:	TBD
TA Office Hours:	TBD

General Information

Course Overview

The vast majority of today's computing devices support network connectivity, from your laptops and desktops, to web servers, to Internet-of-Things devices. This connectivity is essential for enhancing the capabilities of computer technology. However, it has also fostered an environment rampant with network security and privacy concerns.

This course aims to provide a thorough grounding in network security suitable for those interested in working in or conducting research in the area, as well as students more generally interested in either security or networking. We will examine core network protocols and their security, as well as broader issues relating to Internet security for which networking plays a role. Through this course, you should learn the fundamentals of how computer networks should operate, and what can and does go wrong.

Course Instruction Mode (Due to COVID-19)

TBD

Pre- &/or Co-Requisites

You are expected to have some familiarity with core computer security and computer networking concepts.

(Expected) ECE 3076 Computer Communications / ECE 4410 Internetwork Programming / ECE 6607 Computer Communication Networks / CS 3251 Computer Networking *or equivalent*

(Helpful But Not Expected) ECE 4115 Introduction to Computer Security / CS 4235 Introduction to Information Security / CS 6035 Introduction to Information Security *or equivalent*

Course Goals and Learning Outcomes

The goals of this course are to teach you the fundamentals of computer network security and prepare you to:

- Understand how data is securely communicate across the Internet
- Recognize security and privacy concerns with Internet communication methods
- Identify countermeasures to network security concerns
- Leverage common tools to investigate real-world network security characteristics

- [ECE 6612 Only] Write about and present a network security research project conforming to the security research community's standards

[ECE 6612 Only] Strategic Performance Indicators (SPIs)

Outcome 1: Students will demonstrate expertise in a subfield of study chosen from the fields of electrical engineering or computer engineering. Upon successful completion of the course, the student should be able to:

- Explain the key security considerations with common network protocols
- Explain potential network defenses and their benefits and costs

Outcome 2: Students will demonstrate the ability to identify and formulate advanced problems and apply knowledge of mathematics and science to solve those problems. Upon successful completion of the course, the student should be able to:

- Analyze a networking scenario to identify the security concerns present
- Apply cryptographic primitives for securing network protocols

Outcome 3: Students will demonstrate the ability to utilize current knowledge, technology, or techniques within their chosen subfield. Upon successful completion of the course, the student should be able to:

- Demonstrate the exploitation of network vulnerabilities in realistic settings
- Apply common networking tools to analyze network communication characteristics

Course Requirements & Grading

The class will consist of lectures, homework assignments, quizzes, and a semester-long project.

Assignment	Weight	Description
Homeworks	20%	Throughout the semester, there will be 4 assignments for you to gain hands-on experience with common networking and security tools, applying what you learn in lecture into practice. Each assignment will be 5% of your grade.
Quizzes	30%	There will be 3 quizzes throughout the semester, each accounting for 10% of your grade.
Final Project	50% Total	Semester-long project. For ECE 6612, this will be a research-oriented project. For ECE 4112, this will be a well-defined applied project.
- Project Proposal	10%	Submit a 1-page project proposal for feedback.
- Project Presentation	10%	Present a talk and/or demo on your final project.
- Project Writeup	30%	[ECE 6612] Submit a research-style paper on your final project. [ECE 4112] Submit a report on your final project + data/code.

There are no extra credit opportunities.

Note for GT ShenZhen (QSZ Section) and GT Professional Education Distance Learning (Q Section) students: Due to the remote nature of your class participation, your project presentations should be recorded and submitted online, instead of presented live.

Additional Note for GT Professional Education Distance Learning (Q Section) students: Per your program's recommendations, you will have adapted deadlines for course deliverables, as outlined in the "Communication Form (between Online Learning Student and Instructor)," accessible in Canvas.

Grading Scale

The course will not be graded on a curve. Your final grade will be assigned as a letter grade according to the following scales:

ECE 6612 (Graduate Students):

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

ECE 4112 (Undergraduate Students):

A	85-100%
B	70-84%
C	55-69%
D	40-54%
F	0-39%

Accommodations for undergraduates in this course:

The learning objectives for undergraduate teams' semester projects will differ from graduate student teams. The focus for undergraduates will be on predefined tasks (unless they wish to pursue their own projects), such as extending existing network security tools or conducting a well-defined network security measurement, rather than novel research development. For example, an undergraduate team's project may be to evaluate the HTTPS configurations of the top 100K websites in an automated fashion or extend existing network pentesting tools to add support for additional vulnerability detection. Meanwhile, graduate teams should pursue novel research that could in theory lead to workshop publications.

In addition, the homework assignments will be constructed with clearly delineated components, the most advanced of which will be required for graduate students but marked as optional for undergraduates. Lastly, undergraduates will have a more lenient grading scale (shown above).

Course Materials

Course Text

There is no required course textbook.

For optional supplemental or background reading, we recommend: Charlie Kaufman, Radia Perlman and Mike Speciner, *Network Security - Private Communication in a Public World*, 2nd Edition, Prentice Hall, 2002.

Course Website and Other Classroom Management Tools

We will use Canvas for course organization and classwide communication, and Piazza for discussion. Lecture slides and recordings will appear in Canvas, as well as all assignments and quizzes.

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

Any student suspected of cheating or plagiarizing on an assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

There are no attendance or participation requirements for lectures. Quizzes and project presentations must be during the allotted time period.

Note for GT ShenZhen (QSZ Section) and GT Professional Education Distance Learning (Q Section) students: See the "Course Requirements & Grading" syllabus section for more details on participation.

You may need to miss a portion of the course for valid reasons (e.g., sick, onsite interviews). For illnesses or personal emergencies, contact the Office of Student Life, as described in the policies at <http://www.catalog.gatech.edu/policies/student-absence-regulations/>. For Institute Approved Absences, we adhere to the Institute policies at <https://registrar.gatech.edu/info/institute-approved-absence-form-for-students>.

Collaboration & Group Work

Homework submissions should be written and submitted separately by each student, but discussion with other students is allowed and encouraged within reason (e.g., students should still independently complete the work).

Quizzes must be done individually. Any collaboration on quizzes will be considered cheating (see the Academic Integrity section).

Semester projects will be done in groups of 3-4 people (depending on class size). Students are able to choose their own groups, and for those without a full group, I will randomly assign students together.

Note for GT Professional Education Distance Learning (Q Section) Students: You are welcome to form a group with other students if you can meaningfully engage with the group project. You are allowed to also work on the project yourself.

Extensions & Late Assignments

Assignments are due at the time listed in the schedule. There are no undocumented exceptions. **If you have an emergency situation or a school sanctioned exception, please contact me before the due date so we can adjust your assignment deadlines (some documentation may be needed).**

Note for GT Professional Education Distance Learning (Q Section) students: You have an adjusted schedule, as specified in the "Communication Form (between Online Learning Student and Instructor)," available in Canvas.

Health-Related Considerations

Current USG Language for Cloth Face Coverings

Effective July 15, 2020, University System of Georgia (USG) institutions will require all faculty, staff, students, and visitors to wear an appropriate face covering while inside campus facilities/buildings where six feet social distancing may not always be possible. All members of the campus community will be provided reusable cloth face coverings.

Face covering use will be in addition to and is not a substitute for social distancing. Anyone not using a face covering when required will be asked to wear one or must leave the area. Refusal to comply with the requirement may result in discipline through the applicable conduct code for faculty, staff or students.

There are a few exemptions. Reasonable accommodations may also be made for those who are unable to wear a face covering for documented health reasons.

For more information about face masks and coverings, review the [guidelines from Human Resources](#).

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Course Schedule

Below is the current course schedule, which is subject to some change as the semester progresses. Homework deadlines are still to be determined, but will be shortly before the quizzes.

Date	Session Topic
	Course Overview + Logistics
	Network Protocols Overview
	Cryptography: Symmetric Crypto
	Cryptography: Message Digests
	Cryptography: Public-Key Crypto
	Link Layer: LAN + wireless security
	Quiz 1
	Internet Layer: IP + BGP security
	Transport Layer: TCP / UDP security

	Application Layer: DNS security
	Application Layer: DNSSEC
	Application Layer: E2E Encryption (TLS)
	Network Access Control
	Quiz2
	Web security Part 1: Web attacks and defenses
	Web security Part 2: Web attacks and defenses
	Web security Part 3: Web attacks and defenses
	Malware, Botnets
	DoS attacks and defenses
	Email Security (Spam, Phishing)
	Censorship, Surveillance, and Anonymous Communication
	Quiz 3
	Project: Final Presentations
	Project: Final Presentations