



RUTGERS
UNIVERSITY | CAMDEN

NETWORK SECURITY

DEPARTMENT OF COMPUTER SCIENCE

INSTRUCTOR INFORMATION

- **Instructor:** Sheikh Rabiul Islam, Ph.D.
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- **Email:** sheikh.islam@rutgers.edu
- **Office Hours:**
 - Monday and Wednesday 1:00-2:00 p.m.
 - Please feel free to send me an email to schedule an appointment at another time.
 - Please don't hesitate to visit at any time to check if I am available to assist you.

COURSE INFORMATION

- **Course:** Network Security (Undergraduate: 50:198:447; Graduate: 56:198:547)
Semester: Spring 2024; **Credits:** 3.00.
- **Location:** BSB - 416; **Day:** Monday and Wednesday; **Time:** 2:05 pm - 3:25 pm

COURSE DESCRIPTION

This course provides a practical survey of network security applications and standards. The emphasis is on applications that are widely used on the Internet and for corporate networks, and on standards (especially Internet standards) that have been widely deployed. The course contents are organized into three parts: A) Cryptography – which covers different cryptographic algorithms and protocols underlying network security applications, including encryption, hash functions, message authentication, and digital signatures, B) Network Security Applications – which covers important network security tools and applications, including key distribution, Kerberos, digital certificates, authentication protocol, IP security, SSL/TLS, wireless security, and cloud security, and C) System Security – which looks at system-level security issues, including the threat of and countermeasures for malicious software and intruders, and the use of firewalls.

COURSE OBJECTIVES/STUDENT LEARNING OUTCOMES

The learning objectives are:

- Understanding of computer and network security concepts and objectives, OSI security architecture, and secure design principles.
- Analyze and evaluate different cryptographic algorithms and protocols underlying network security applications.
- Systematically evaluate different network security tools and applications.
- Explore system-level security issues, including the threat of and countermeasures for malicious software and intruders.
- Explore legal and ethical issues with network security.
- Explore recent research and development on network security.

- Critique classical and contemporary research papers on network security.

MAJOR TEACHING METHODS

Lectures, Demonstrations, Assignments, and Reading. Expect to spend at least 9 hours/week on this course, including class meeting times.

TOPICS AND SCHEDULE

Tentative course schedule:

Schedule	Topics	Subtopics	Note
Week 1 <i>January</i>	Security	Computer security concepts and objectives, OSI security architecture, secure design principles	Ch 1
Week 2	Cryptography (Symmetric)	Symmetric encryption principles and message confidentiality, cryptanalysis, Data Encryption Standard, random and pseudorandom numbers, block encryption algorithms,	Ch 2
Week 2	Cryptography (Asymmetric)	Message authentication, secure hash function, public-key cryptography principles and algorithms, digital signatures	Ch 3
Week 3	Key distribution and user authentication	Remote user authentication principles, key distribution, Kerberos, federated identity management	Ch 4
Week 4 <i>February</i>	Network access control and cloud security	Network access control, cloud computing, cloud security risks and countermeasures, data protection in the cloud, cloud security as a service	Ch 5 Quiz 1
Week 5	Transport-level security	Web security considerations, transport layer security, HTTPS, secure shell, port forwarding	Ch 6 Assignment 1
Week 6-7	Wireless network security	Wireless network security and threats, securing wireless access points and networks, mobile device security, wireless LAN overview and security	Ch 7
Week 8 <i>March</i>	Electronic mail security	Email format protocols threats and mitigation, DNS	Ch 8, Test-1,
Week 9	IP Security	IP security overview and policy, encapsulating security payload, tunnel mode and transport mode, combining security associations, internet key exchange	Ch 9
Week 10	Malicious software	Types of malicious software (Malware), advanced persistent threat, propagation and vulnerability exploit, social engineering (spam email, trojans), system corruption, attack agent (zombie, bots), information theft (keylogger, phishing, spyware), stealthing (backdoors, rootkits)	Ch 10 Assignment-2
Week 11	Intruders	Intruders (behavior patterns, intrusion techniques), intrusion detection (audit records, statistical anomaly detection, rule-based intrusion detection, distributed intrusion detection, honeypots), password management	Ch 11 Quiz 2
Week 12	Firewalls	The need for firewalls, firewall characteristics access policy expectations and limitations, types of firewalls, firewall basing, firewall location and configurations	Ch 12

Week 13 <i>April</i>	Network management security	SNMP, network management architecture, access policy, proxy service	Ch 13 Assignment-3
Week 14	Legal and Ethical Issues	Cybercrime and computer crime, intellectual property, privacy, ethical issues, information privacy	Ch 14 Test-2, Term Project;

REQUIRED MATERIALS

1. Book

Network Security Essentials – Applications and Standards – 6th edition by William Stallings

2. Canvas: <https://canvas.rutgers.edu/>

Used for accessing course syllabus, materials, and grades, and turning in assignments.

3. Software: Oracle Virtual Box, Wireshark, Snort IDPS, Burp Suit.

GRADES

- All grades will be posted in Canvas.
- If you have an issue with a grade you receive on ANY assignment or exam, you must email the instructor within THREE days of the grade being released to the class.
- Grade Scale:
89.5–100 = A (Outstanding)
84.5–89.49 = B+, 79.5–84.49 = B (Good),
74.5–79.49 = C+, 69.5–74.49 = C (Satisfactory),
59.5–69.49 = D (Poor),
0–59.49 = F (Failing).

A grade of C or better is usually required for Major or Minor courses, while General Requirement courses must only be passed with a D or better. The grade of D is not valid for graduate-level courses. Students may only receive a C or better, F or IN for graduate courses.

Grades in this course are **earned** using the following distribution:

Item	Percentage
Assignments 3 assignments (25%)	25%
Exams 2 exams (40%) 2 quizzes (10%)	50%
Term Report/Project	20%
Participation Responsiveness (5%)	5%

ASSIGNMENTS (25% OF GRADE)

There will be three assignments for gaining practical experience on the covered concepts.

EXAMS (50% OF GRADE)

- There will be two exams containing 40% of the total grade combined.
- The last exam is not comprehensive.
- There will be two quizzes containing 10% of the grade.

TERM REPORT (20% OF GRADE)

- The term report will be on exploring or solving a security-related issue. You can survey the state-of-the-art techniques, and tools on the selected topic or work on a real-world security-related problem.
- Projects involving implementation and coding can be done in groups consisting of two members.
- Within the fourth week of the semester, you need to get approval of the proposed project/topic in written format.
- A student will need to submit a term report (at least 4 pages for undergraduate, 8 pages for graduate, single-spaced page) on the project or selected topic. The page requirement for projects/reports containing implementation or programming to solve a real-world problem is half.
- The expectations for graduate students are relatively higher when it comes to the term project/report, and a team consisting of graduate and undergraduate students will get 2% of the total grade as a bonus point.

PARTICIPATION (5% OF GRADE)

- This is based on your responsiveness in the lecture sessions and discussions.

POLICY

- All students should follow the Academic Integrity Policy as mentioned at:
<https://deanofstudents.camden.rutgers.edu/sites/deanofstudents/files/Academic%20Integrity%20Policy.pdf>
- Whenever you submit any work, **you must acknowledge the source** if any part of the submitted **content is not originally yours**.

SERVICES AND RESOURCES

- A comprehensive list of student services and resources are listed here:
<https://studentaffairs.camden.rutgers.edu/student-resource-list>
- Here are some crucial student services and resources:
 - The Center for Learning and Student Success (CLASS) provides academic support and enrichment services for students, at no additional cost, including one-on-one tutoring, small-group tutoring and workshops, online tutoring, writing assistance, student success coaching, learning assessment, and metacognition training. Learn more about this service here: <https://class.camden.rutgers.edu/>
 - Office of Disability Services (ODS)—Students with Disabilities: If you need academic support for your courses, accommodation can be provided as indicated in the accommodation letter. If you have not registered with ODS and you have or think you have a disability (learning, sensory, physical, chronic health, mental health, or attentional), please visit the ODS website:
<https://success.camden.rutgers.edu/disability-services>

- Dean of Students Office—CARES Team: For some students, personal, emotional, psychological, academic, or other challenges may hinder their ability to succeed both in and outside of the classroom. The Dean of Students Office serves as your initial contact if you need assistance with these challenges. You can learn more about the free services by visiting the Dean of Students website <http://deanofstudents.camden.rutgers.edu/>