



ECE 696, Hardware-Based Cybersecurity, Spring, 2024

(Hardware-Based Computer Security and Security Engineering)

- Instructor: Abu Asaduzzaman (DRZ)
- Department: Electrical and Computer Engineering (ECE)
- Office Location: 303 Wallace Hall (WH) building
- Telephone: +1-316-978-5261
- Email: abu.asaduzzaman@wichita.edu
- Preferred Method of Contact: In-person during student/office hours or via email
- Student/Office Hours: Tuesday & Thursday 12:30-01:30 PM
- Classroom, Day/Time: 226JB, Tuesday & Thursday 11:00AM-12:45PM
- Prerequisites: ECE 394 or instructor's consent
- Teaching Assistant (TA): Grading – To Be Decided (TBD)
- TA Contact: Grading – tbd@shockers.wichita.edu

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. Any changes should be shared via lecture and/or Blackboard.

University Policies and Procedures

The Wichita State University Policies and Procedures Manual can be found at:
<https://www.wichita.edu/about/policy/>.

Academic Integrity

Students at Wichita State University are expected to uphold high academic standards. WSU will not tolerate a lack of academic integrity. Students are responsible for knowing and following the Student Code of Conduct http://webs.wichita.edu/inaudit/ch8_05.htm and the Student Academic Honesty policy http://webs.wichita.edu/inaudit/ch2_17.htm. When the faculty member determines sanctions are warranted for violations of academic integrity, regardless of severity, the faculty member must report the infraction to the Office of Student Conduct and Community Standards. If you need more information about the process or wish to appeal a decision, please visit https://www.wichita.edu/about/student_conduct/ai.php

If there are homework assignments (HWAs) in this course, each HWA will be an individual assignment (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one submission (wording/coding) should be reasonably different from other submissions. "Collaboration is good, cheating is not!" There will be severe consequences for academic dishonesty. Cheating (such as copying word-for-word from other sources) in any test will automatically result a 'Fail' grade in this course; this grading policy applies to all parties involved (including the ones who help/show).

Course Description

Intended for seniors and graduate students who want to study and explore the role of hardware in improving computer security and security engineering. Topics covered include elements of computer security, secure distributed systems, hardware as a cybersecurity solution, physical unclonable function, and security engineering. Special attention is given to team-based research activities.

Measurable Student Learning Outcomes

Measurable Student Learning Outcomes: Undergraduate Level

After passing this course, understand students will experience:

- (SO: EAC 1) an ability to identify and solve security engineering problems by applying principles of engineering, science, and mathematics
- (SO: EAC 2) an ability to apply hardware-based security engineering to produce solutions that meet specified needs with consideration of public safety and economic factors

Measurable Student Learning Outcomes: Graduate Level

After passing this course, graduate students will experience:

- (SO: EAC 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use security engineering judgment to draw conclusions
- (SO: EAC 7) an ability to acquire and apply new security engineering knowledge as needed, using appropriate learning strategies

Required Texts/Readings Textbook

Please talk to the instructor before buying books for this course.

Textbook: Security Engineering: A Guide to Building Dependable Distributed Systems, Ross Anderson, Wiley, 3rd Edition, 2020.

Reference Book: HARDWARE-BASED COMPUTER SECURITY Techniques to Defeat Hackers from Biometrics to Quantum Cryptography, Roger R. Dube, Wiley, 2008.

Other Readings

Class notes and other reading materials (such as Physical Unclonable Functions and Applications, etc.) will be made available via WSU Blackboard.

Other Equipment/Materials

More information will be provided during class lectures as/if needed.

Class Protocol

There are points on class performance. It is expected that students join the instructor and/or TA before classes start. Students are always encouraged to ask questions, especially if they find ambiguity in assignments and materials covered.

Contact Policy

Email communication is preferred. Feel free to email me any questions or concerns following these guidelines:

- **Always** email me from your WSU email address. Email sent from personal email servers like Gmail, Yahoo, etc., have a tendency to end up in my spam folder, and I never see them. You may also email me through Blackboard via the Email My Instructor tab. I also offer a Discussion Forum on Blackboard which allows common questions to be seen and responded to publicly.
- Always use the course name in the subject line of the email.
- Remember to sign your name.
- If you have a problem with accessing or uploading assignments, you should let me know as soon as possible before the assignment is due. You will also have to accompany this notification with the file in question, so I can verify that it is completed by the due date/time.
- You **should NOT** contact me for tech support.
 - Any technical problems involving your computer, or issues regarding file uploading or sharing, should go through the OneStop. You can contact them at 316-978-3909. You can also fill out a request for help form at their [website](https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelfHelpHome.seam?inst_name=wichita):
https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelfHelpHome.seam?inst_name=wichita

Response Time

To Email and Discussion Forum Questions:

As soon as possible within 24 hours. If you do not receive reply to your email within 24 hours, please re-send me the email, probably the email did not arrive to my Inbox.

Feedback on Assignments:

As soon as possible after the due date including the late submission date/time. Answer key will be discussed in lecture sessions and/or shared via Blackboard.

Grading Scale

WSU uses a +/- grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. (Other classes might assign grades differently: Be sure to understand the different grading scales in all of your classes.)

Points/Percentage	Letter Grade	Grade Points	Interpretation
93 and up	A	4.00	A range denotes excellent performance
90 – less than 93	A-	3.70	
87 – less than 90	B+	3.30	
83 – less than 87	B	3.00	B range denotes good performance
80 – less than 83	B-	2.70	
77 – less than 80	C+	2.30	
73 – less than 76	C	2.00	C range denotes satisfactory performance
70 – less than 73	C-	1.70	
67 – less than 70	D+	1.30	
63 – less than 67	D	1.00	D range denotes unsatisfactory performance
60 – less than 63	D-	0.70	
0 – less than 60	F	0.00	

Grading Assignments

List of grading assignments/components and values toward final grades are shown below. For exams and project, different grading scales will be used for undergraduate and graduate students. Graduate students will have additional activities in the project

assignments that have higher weightage. The same grading scale will be used for all students on pop quiz, homework, and quiz. Homework assignments and their due dates will be announced in class and/or made available via Blackboard. Similarly, the due dates for Quiz, Exam, and Project will be announced in class and/or made available via Blackboard.

<u>Grading Assignments/Components</u>	<u>Undergraduate</u>	<u>Graduate</u>
Pop Quiz (random, individual)	10%	10%
Homework (five of six, take home)	10%	10%
Quiz (two of three, 30-minute, class-time)	10%	10%
Exam-1 (~ Week 5, 65-minute, class-time)	15%	12%
Exam-2 (~ Week 10, 65-minute, class-time)	15%	12%
Exam-3 (cumulative, 65-minute, class-time)	20%	16%
Project (Proposal, Presentation, and Report)	20% (2+8+10)	30% (3+12+15)

Late Assignments

For homework assignments and project proposal, late submissions will not be accepted/graded after five days from the original due date/time. Up to 50% points may be subtracted for any late submission. No late submission for quiz and exam tests.

Exceptions include documented emergency situations and prior consents.

Missed Tests and Labs

Makeup for missed tests (quiz and exam) will be given only when there is a genuine reason, with clear proof. It is students' responsibility to provide the proof; if the reason for missing a test is illness, a doctor's note will be required. Students should contact the instructor before any makeup test. (Note: There is no makeup for homework assignments and project report.)

Teaching Assistants

Grading TA:

TBD <tbdb@shockers.wichita.edu>

Office Hours/Room: TBD

The Grading TA is not allowed to solve problems. The TA should grade test papers and provide feedback to students for any missing points. If students have any questions regarding assignments, they should immediately contact the course instructor.

Syllabus Policies and Student Resources

All students should familiarize themselves with the course-related policies and student resources that can be found at: www.wichita.edu/syllabuspolicies

These include, but may not be limited to:

- Academic Integrity
- CARE Team
- Concealed Carry Policy
- Counseling and Prevention Services
- COVID-19 Conditions
- Definition of a credit hour
- Disability Services
- First Generation Students
- Heskett Center and Campus Recreation
- Important Academic Dates
- Inclusive Excellence and Respect for Diversity
- Intellectual Property
- Names and Pronouns
- Shocker Alert System
- Student Health Services
- Title IX
- Video and Audio recording

Students with Disabilities

A disability is something that affects a major life activity. These life activities include, but are not limited to, learning, walking, breathing, hearing, and seeing, in addition to many other physical, sensory functions, and psychological disabilities.

If you are a student with a disability, or believe you might have a disability, which requires accommodations, please contact the Office of Disability Services (ODS) www.wichita.edu/ods to discuss reasonable and appropriate accommodations and eligibility requirements. It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability ODS will review your concerns and determine, with you, what academic accommodations are necessary and appropriate for you. For example, adaptations of teaching methods, class materials or testing may be made on a case-by-case basis if warranted, as required by the Americans with Disabilities Act (ADA). All information and documentation of your disability is confidential and will not be released by ODS without your written permission.

Respect for Diversity

Wichita State University is committed to being an inclusive campus that reflects the evolving diversity of society. To further that goal, Wichita State University does not discriminate in its employment practices, educational programs or activities on the basis of age (40 years or older), ancestry, color, disability, gender, gender expression, gender identity, genetic information, marital status, national origin, political affiliation, pregnancy, race, religion, sex, sexual orientation, or status as a veteran. Retaliation against an individual filing or cooperating in a complaint process is also prohibited.

Students from all diverse backgrounds and perspectives are welcome in this Course and the diversity that students bring to this course should be viewed as a resource, strength and benefit. All materials and activities are presented with the intent to be respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Laboratory Information

No laboratory is assigned to this course. However, students are welcome to use the Computer Architecture and Parallel Programming Laboratory (CAPPLab) for class project. CAPPLab is physically located in room 312 Wallace Hall (you may visit online at <https://www.wichita.edu/academics/engineering/CAPPLab/index.php>). CAPPLab is used for teaching/research in computer architecture, high performance computing, machine learning, and related fields.

Tentative Brief List of Topics to Cover

Introduction and Motivation

- Hardware-Based Computer Security
- Computer-Based Security Engineering

The Elements of Computer Security

- Passwords and Keys; Cryptography
- Random-Number Generation: Software Vs Hardware

The Qualities of Workable Security Solutions

- Secure Coprocessors; Secure Memory Management
- Hardware-Based Authentication

Physical Unclonable Function (PUF)

- Theory, Architectures, Applications, and Examples

Security Engineering

- Access Control; Physical Protection; Distributed Systems
- Multilevel Security; Managing Secure Systems

Research Interests (as/if time allows)

- Understanding Security Challenges
- Developing Computer-Based Security Solutions

Tentative Schedule for 16-Week Classes

Week Tue	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
W-01 01/16		ECE 696: Hardware-Based Cybersecurity; Syllabus; K-probe; Project: Components, Grading ; HW-1 discussion;
W-02 01/23	HW-1	Security Engineering; Elements of Computer Security; HW-1 (due Bb); Project: Groups, Topics, due on Week 6 ;
W-03 01/30	HW-2	Password/Keys; Cryptography; Random-Number Generation; HW-2 (due Bb); The Qualities of Workable Security Solutions;
W-04 02/06	Quiz-1	Software Vs Hardware; Quiz-1 discussion; Quiz-1 (class test, 30-min, 30 pts, Closed book);
W-05 02/13	Exam-1	Secure Coprocessors; Exam-1 discussion; EXAM-1 (class test, 65 minutes, 65 points, Closed book);
W-06 02/20	Project	Project: Technical reading, writing, and presentation ; Project: Proposal (due) ;
W-07 02/27	HW-3	Secure Memory Management; HW-3 (due b); Hardware-Based Authentication;
W-08 03/05	Mid-Pt HW-4	Physical Unclonable Function; Mid-Term Point Updates; HW-4 (due Bb); Quiz-2 discussion;
NA	Spr-Brk	03/11-3/17 (Spring Break) No Class/Lab ;
W-09 03/19	Quiz-2	Security Engineering: Access Control; Quiz-2 discussion; Quiz-2 (class test, 30-min, 30 pts, Closed book);
W-10 03/26	Exam-2	Security Engineering: Cryptography; Exam-2 discussion; EXAM-2 (class test, 65 minutes, 65 points, Closed book);
W-11 04/02	Update	Security Engineering: Distributed Systems; Project: Report, Presentation, Templates ;

Week Tue	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
W-12 04/09	HW-5	Security Engineering: Physical Protection; HW-5 (due Bb); Project: Report, Presentation, Templates ;
W-13 04/16	HW-6	Security Engineering: Multilevel Security; HW-6 (due Bb); Security Engineering: Multilateral Security;
W-14 04/23	Quiz-3	Security Engineering: System Evaluation; Quiz-3 discussion; Quiz-3 (class test, 30-min, 30 pts, Closed book);
W-15 04/30	Project	Project Presentation: Team-work, PPT slides ; Final Report: Team-work, via Blackboard on Study day ;
W-16 05/07	Exam-3	Security Engineering: Managing Secure Sys; Exam-3 discussion; EXAM-3 (class test, 65 minutes, 65 points, Closed book);
Finals		None!
Note: A date in Column 1 indicates the Tuesday of that week. Here, 05/07 is the Tuesday of Week 16.		

1) Jan. 2, 2024; prepared/updated for Spring 2024 term; DRZ

Definition of a Credit Hour (<https://www.wichita.edu/faculty/development/syllabuspolicies.php>)

Example for 3 credit hour class: Success in this 3 credit-hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities for a total of 135 hours.

Go to 4.08 / Definition and Assignment of Credit Hours for the policy and examples for different types of courses and credit hour offerings.