ECE 477G, Introduction to Hardware Security, Spring, 2026

(Hardware to Strengthen Computing Security and Foster Trust)

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- Preferred Method of Contact: In person during office hours or e-mail
- Classroom, Day/Time: 215 Wallace Hall, Tuesday & Thursday 2:00-3:15 PM
- Student Office Hours: Tuesday 12:30-1:30 PM & Wednesday 9:30-11:30 AM
- Prerequisites: ECE 194
- Teaching Assistant (TA): Grading – TBD
- TA Contacts: 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.

Student Office Hours

My student office hours are listed on page one of the course syllabus. Please utilize my student office hours to meet with me for course-related discussions: asking for extra help, seeking further clarification of material presented in class, and following up on aspects of the class they are interested in. These hours are not required for the course, but are available to help support you on your path to success.

Course Description

Introduces the role of hardware solutions to enhance computing security and build trust. Important topics include fundamentals of hardware security for integrated circuits and systems, cryptographic hardware, invasive and non-invasive attacks, side-channel attacks, true random number generation, physically unclonable functions, secure processor architecture, and secure distributed systems.

Definition of a Credit Hour

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 lectures) for instruction and preparation/studying or course-related activities for a total of 135 hours.

The policy and examples for different types of courses and credit hour offerings are available at https://www.wichita.edu/about/policy/ch_04/ch4_08.php (4.08 / Definition and Assignment of Credit Hours).

Honors Distinction Option

Not Available.

Measurable Student Learning Outcomes

Upon successful completion of this course, the student will be able to:

- Understand common hardware security threats (e.g., hardware Trojans and invasive/non-invasive attacks) and evaluate their impact on integrated circuits and computing systems
- Design hardware-based security mechanisms (e.g., cryptographic hardware modules, or PUFs) to address identified security vulnerabilities
- Apply principles of hardware security primitives and secure processor architectures to solve real-world security problems in embedded systems and computing platforms
- Conduct and interpret hands-on experiments involving hardware Trojan insertion, detection, or mitigation
- Collaborate effectively in a team-based project to develop, document, and present a hardware security solution, demonstrating technical competence

The following ABET Engineering Accreditation Commission (EAC) Student Outcomes (SOs) are aligned to this course:

- (EAC: SO-1) analyze computer security issues and apply the hardware-based solutions (e.g., true random number generation and cryptographic hardware) to solve real-world engineering problems.
- (EAC: SO-2) design and implement hardware-based security solutions for building trust through strengthening computer security.

Required Texts/Readings Textbook

Note: Please consult with the instructor before purchasing books for this course.

Textbook: “Hardware Security: A Hands-on Training Approach” by S. Bhunia and M. Tehranipoor, Morgan Kauffman, 2018, Edition 1.

Reference: “Principles of Secure Processor Architecture Design” by J. Szefer, Morgan & Claypool, 2018, Edition 1.

Other Readings
Class notes, project topics, and related/reading materials (on hardware security) will be made available via WSU Blackboard.

Other Equipment/Materials/Proctored Exams
If needed, more information will be provided during class lectures.

Class Protocol, Conduct, and Decorum
In this course, all students are expected to contribute to a learning environment that is respectful and conducive to the free exchange of ideas. Respect for one another's identities, perspectives, and contributions is essential to our academic community.

Students are expected to engage with peers, instructors, and course material in a manner that reflects professionalism and mutual respect. This includes:

- Using respectful language at all times.
- Listening actively and allowing others to speak without interruption.
- Engaging in dialogue that values differing viewpoints without personal attacks or derogatory remarks.

Unprofessional conduct, e.g., off-topic activities, may affect your grades or even your academic career. Be respectful at all times. Students demonstrating confrontational, disruptive, or threatening behavior may be asked to leave the classroom immediately and may not be allowed to return to the classroom for the remainder of the class period. Consequences of this behavior may also include (and are not limited to): Suspension from class for a minimum of one additional class period and report or referral to the WSU police department, Student Conduct, and the WSU Care Team.

Inclement Weather Event and Emergency Event (5.17)
In the event of an Inclement Weather Event and/or an Emergency Event, the University shall take all reasonable measures to protect the health and safety of students, faculty, and staff. Should such an event occur, the University may implement a temporary adjustment to its class and/or operations, including late start and moving class instruction and Non-Critical Campus Operations to remote delivery, when possible. Learn more about *Keeping Our Community Safe During Severe Weather* at *https://www.wichita.edu/services/emergency/weather_response.php*.

Contact Policy
Although you may attempt to reach me by phone, email communication is always preferred. Feel free to email me any questions or concerns following these guidelines:

- Always use the course name in the subject line of the email
- Remember to sign your name.
- **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 an Ask My Instructor forum on

Blackboard which allows common questions to be seen and responded to publicly.

- 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 Blackboard Support. You can contact them at 316-978-3909. You can also fill out a request for help form at their website: https://wichita.edu/BbSupport
    - However, if you have a problem with access or uploading assignments, you *should* let me know before your 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.

Response Time

To Email and Ask My Instructor Questions:

I will answer your questions as soon as possible, within 24 hours. If you do not receive a reply to your email within 24 hours, it may not have reached my Inbox; please resend your email.

Feedback on Assignments:

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

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 Academic Integrity Policy 2.17 (https://www.wichita.edu/about/policy/ch_02/ch2_17.php).

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

Unauthorized Use of Generative AI

Please note in particular that *Unauthorized Use or Possession of Materials or Resources* (Policy 2.17, item IV.B.2) includes unauthorized use of generative AI like ChatGPT or GPT4. In this course, all use of generative AI is prohibited except as may be specified in assignment instructions. Any student suspected of unauthorized use of generative AI may be asked to demonstrate their mastery of the assignment learning outcomes in an alternate format, such as a verbal interview or an additional problem set, before a determination is made as to whether an academic integrity violation report is warranted. Contact course instructors to learn more about the Unauthorized Use of Generative AI in this course.

Sexual Harassment, Discrimination and Retaliation

Wichita State University is committed to creating a safe and healthy environment for all of our community members. This includes the elimination of sexual misconduct,

relationship violence, and stalking within the University community. These incidents may interfere with or limit an individual's ability to benefit from or fully participate in the University's educational programs.

Students are asked to immediately report incidents to the University Police Department, (316) 978-3450 or students may contact the Title IX Coordinator at (316) 978-5177 or submit a report to the Office of Civil Rights, Title IX & ADA Compliance at Office of Civil Rights, Title IX & ADA Compliance (CTAC) Report Form (maxient.com).

Students may also report incidents to an instructor, faculty, or staff member, who is required by law to notify the Title IX Coordinator. If a student wishes to keep the information confidential, the student may speak with staff members of the Counseling and Psychological Services (316) 978-3440 or Student Health Services (316) 978-3620.

Sexual assault prevention training is required of all students, faculty, and staff. These training, in addition to being highly interactive and engaging, is based on research around the best practices for healthy communities. Students will need to complete this training in the fall semester before being able to enroll for the spring. For more information regarding the training, visit the CTAC website at: https://www.wichita.edu/administration/ctac/training.php.

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 that requires accommodations, please contact the Office of Student Accommodations and Testing (OSAT) at https://www.wichita.edu/services/accommodations/index.php 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, OSAT 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 OSAT without your written permission.

The Office of Student Accommodations and Testing (OSAT) is located in the Shocker Success Center, room 118, (316) 978-3309 (voice/tty) (316-854-3032 videophone). Students seeking an accommodation must complete the online application at: https://hunter.accessiblelearning.com/Wichita/ApplicationStudent.aspx.

Prohibition on Discrimination

Wichita State University is committed to being a welcoming campus for all students, staff, and faculty. Wichita State University Policy 3.06 / Sexual Harassment,

Discrimination and Retaliation for Employees, Students and Visitors prohibits discrimination on the basis of federal and state protected categories. 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 all students regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, or culture. 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.

Complaints or concerns related to alleged discrimination may be directed to the Office of Civil Rights, Title IX & ADA Compliance (CTAC), Wichita State University, 316-978-3187, ctac@wichita.edu.

Personal Identity Updates

Wichita State University provides an avenue for students to update their personal identity. For more information, please visit: www.wichita.edu/name. To update your personal identity information, please go to myWSU Home tab, Student Tools channel, and click on "View and Update Personal Information" link.

Concealed Carry Policy

The Kansas Legislature has legalized concealed carry on public university campuses. Guns must be out of view, concealed either on the body of the carrier, or backpack, purse or bag that remains under the immediate control of the carrier.

Gun owners must familiarize themselves with WSU policy 11.19 / Weapons on University Property and the Kansas Board of Regent's weapons policy. If you believe that there has been a violation of these policies, please contact the University Police Department at (316) 978-3450.

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:

- Important Academic Dates
- Video and Audio recording
- Shocker Alert System
- Intellectual Property
- CARE Team
- Counseling and Prevention Services

- The Office of the Student Advocate
- Academic Appeals
- Student Health Services
- Heskett Center and Campus Recreation
- First Generation Students
- Tobacco Free Campus

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 your classes.)

Points/Percentage	Letter Grade	Grade Points	Interpretation
	A	4.00	A range denotes excellent performance
	A-	3.70	
	B+	3.30	
	B	3.00	B range denotes good performance
	B-	2.70	
	C+	2.30	
	C	2.00	C range denotes satisfactory performance
	C-	1.70	
	D+	1.30	
	D	1.00	D range denotes unsatisfactory performance
	D-	0.70	
	F	0.00	

Assignments

List of grading assignments/components and values toward the final letter grade are shown below. Homework/programming assignment due dates will be announced in class and/or made available via Blackboard. Similarly, the dates for Quiz and Exam will also be announced in class and/or made available via Blackboard.

Grading Assignments/Components	Values
Class Performance (pop quiz, individual)	5%
Homework (five of six, individual)	15%
Quiz (two of three, 30-minute, individual)	16%
Exam-1 (65-minute, individual)	25%
Project (one, teamwork)	14%
Exam-2 (cumulative, 65-minute, individual)	25%

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. Homework scores will not be considered for letter grades. Exceptions include documented emergencies and prior consents.

Missed Assignments and Exams

Makeup for missed tests (Quiz and Exam) and Labs/Projects will be given only when there is a genuine reason, with clear proof. It is the 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.

Extra Credit

Extra credit is possible depending on class performance after Week 10. As required, extra credit assignments and their due dates will be shared via Blackboard.

Tentative Brief List of Topics to Cover

1. ECE 477G: Introduction to Hardware Security
    a) Syllabus and Knowledge-Probe
    b) Computer Attacks: Hardware Security and Trust
2. Integrated Circuits and Systems
    a) Digital Logic, Circuit Theory, ASIC, FPGA, PCB
    b) Embedded Systems, Internet of Things (IoT)
3. Hardware Trojans
    a) Hardware Trojan Structures: Designing SoC and FPGA
    b) Hands-on Experiments: Hardware Trojan Attacks
4. Computer/Side-Channel Attacks
    a) Invasive and Non-invasive Attacks
    b) Side-Channel Attacks
5. Electronics Supply Chain and Trust Issues

a) Electronics Supply Chain
b) Trust Issues

6. Hardware Security Primitives
   a) Physical Unclonable Function (PUF)
   b) True Random Number Generator
7. Secure Architecture and Systems
   a) Secure Processor Architecture
   b) Multiprocessor and Many-Core Protections

Tentative Schedule for 16-Week Classes

Week Tue	Note	Important topics, readings, assignments, deadlines, and reminders are listed here so that you can organize your time
1 01/20	😊	ECE 477G: Introduction to Hardware Security Syllabus – HW, Grading; K-probe; Hardware Security and Trust
2 01/27	HW-1	Integrated Circuit (IC) and Systems: Digital Logic, Circuit Theory HW-1 (submit via Blackboard)
3 02/03	HW-2	IC and Systems: ASIC, FPGA, PCB; HW-2 (Blackboard) HW-2 (submit via Blackboard); Quiz-1 discussion
4 02/10	Quiz-1	Projects: Groups, Topics, Grading Quiz-1 (class test, 30m/30p, closed book)
5 02/17	Update	ICs and Systems: Embedded Systems ICs and Systems: Internet of Things (IoT)
6 02/24	HW-3	Hardware Trojan Structures: Designing SoC and FPGA HW-3 (submit via Blackboard); Project Discussion
7 03/03	HW-4	Hardware Trojans: Hands-on Experiments: Hardware Trojan Attacks HW-4 (submit via Blackboard); Quiz-2 discussion
8 03/10	Quiz-2	Computer Attacks: Invasive, Non-invasive, and Side-Channel Attacks Quiz-2 (class test, 30m/30p, closed book)
9 03/17	Spr-Brk	Semester Break (No Classes)
10 03/24	Exam-1	Exam-1 discussion EXAM-1 (class test, 65 minutes, 65 points, Closed book)
11 03/31	Update	Trust Issues: Hardware Intellectual Property (IP) Project Discussion
12 04/7	HW-5	Trust Issues: Hardware Trojan Detection and Prevention HW-5 (submit via Blackboard)

Week Tue	Note	Important topics, readings, assignments, deadlines, and reminders are listed here so that you can organize your time
13 04/14	HW-6	Hardware Security Primitives: Physical Unclonable Function (PUF) HW-6 (submit via Blackboard); Quiz-3 discussion
14 04/21	Quiz-3	Hardware Security Primitives: True Random Number Generator Quiz-3 (class test, 30m/30p, closed book); Project Discussion
15 04/28	Project	Secure Processors and Multiprocessor/Many-Core Protections Project Submission (via Blackboard)
16 05/05	Exam-2	Exam-2 discussion EXAM-2 (class test, 65 minutes, 65 points, Closed book)
Finals		None!
Note: A date in Column 1 indicates the Tuesday of that week. Here, 05/05 is the Tuesday of Week 16.		

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1) *May 17, 2025; prepared for spring 2026 term; DRZ*
2) *Sept. 2, 2025; updated using the newly revised syllabus template; DRZ*
3) *Dec. 12, 2025; updated homework, quiz, exam, and project information; DRZ*
4) *Jan. 07, 2026; updated classroom information, etc.; DRZ*

Laboratory/Programming Information

There is no teaching/research laboratory associated with this course; however, we will provide support to help you complete the programming assignments. Students may access BeoShock, WSU's High-Performance Computing (HPC) cluster, for their programming needs. Information about BeoShock (such as how to log in and how to run programs) will be provided via lectures as required. If possible, we may meet in the Computer Architecture and Parallel Programming Laboratory (CAPPLab) in 312 Wallace Hall for additional help.