

**Hardware Security Lab****EEL 5934 Two Sections**

Class Periods: Tuesday 3-6 PM (Section 1) and 6-9PM (Section 2)

Location: NEB 213 (Lab)

Academic Term: Fall 2017

Instructor:

Name: Dr. Swarup Bhunia

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Telephone: 352-392-5989

Office Hours: Tuesday 2-3PM or by Appointment

Office Location: MAE 226C (601 Gale Lemerand Dr., Gainesville, FL 32603)

Teaching Assistants:

- Shuo Yang, [sy@ufl.edu \(mailto:sy@ufl.edu\)](mailto:sy@ufl.edu), Friday 4-5pm, MAE228
- Sarah Amir, [sarah.amir@ufl.edu \(mailto:sarah.amir@ufl.edu\)](mailto:sarah.amir@ufl.edu), Monday 12:30-1:00pm, MAE228
- Kai Yang, [kyang84@ufl.edu \(mailto:kyang84@ufl.edu\)](mailto:kyang84@ufl.edu), Wednesday 2-2:30pm, MAE228

Course Description

This lab course focuses on the hands-on learning of computer hardware security. The course will follow a distinctive hands-on teaching approach using a well-designed set of experiments as learning tool. Students will be able to “hack” a system at different levels and analyze different countermeasures for major hardware attacks.

Course Pre-Requisites / Co-Requisites

- EEL4930/EEL5934: Intro to Hardware Security and Trust

Course Objectives

This is an upper-level undergraduate and graduate-level course that intends to help students

- Understand the basic concepts of computer system security which integrates network and information security, software security, and hardware security.
- Learn the innards of computer hardware and its security vulnerabilities through hands-on experience
- Learn and design not only new solutions against known attacks but also learn to hack into hardware and come up with a new threat models and defense mechanisms against them.
- Analyze and validate computer hardware security issues and build secure computer system for trustworthy computing.

Key Concepts

Introduction to computer security issues - information and network, software, hardware securities. Understand information

security through data encryption and decryption to protect data and systems. Learn buffer overflow attacks – stack overflow, heap overflow, and array indexing errors. Learn bus snooping attacks and protection schemes through bus encryption. Learn hardware tampering attacks (e.g. mod-chip attacks) in field. Understand side-channel attacks including fault injection and power analysis attacks, and hardware Trojan attacks of different forms and sizes triggered by rare events. Understand various countermeasures against hardware attacks including hardware authentication. Be able to reverse engineer a printed circuit board (PCB) to figure out how the hardware components function.

Materials and Supply Fees

N/A

Recommended Textbooks and Software

There is no required textbook for the course. The following books serve as reference for concepts explored in this course:

2012. M. Tehranipoor and C. Wang (Eds.). "Introduction to Hardware Security and Trust", Springer, ISBN: 978-1-4419-8079-3, 2012.
2013. Erickson, Jon. "Hacking: The Art of Exploitation." No Starch Press, San Francisco, 2008. ISBN: 1-59327-144-2.
- Huang, Andrew. "Hacking the Xbox: An Introduction to Reverse Engineering." No Starch Press, San Francisco, 2003. ISBN: 1-59327-029-1
2000. Petzold, Charles. "Code: The Hidden Language of Computer Hardware and Software." Microsoft Press, Redmond, 2000. ISBN: 0-7356-1131-9
2001. The course will use the Facebook "Hardware Security" Group created by Dr. Bhunia for sharing and discussing new developments in hardware security.
2002. Software: Altera Quartus and Atmel Studio

Course Schedule

| Week | Date | Class | Exp. No. | Topics | Report Due |
|-------------|-------------|--------------|-----------------|--|-------------------|
| 1 | 8/21-8/25 | 08/22 | 1 | Buffer Overflow attacks | 08/28 |
| 2 | 8/28-9/1 | 08/29 | 2 | Information Security: Encryption/Decryption | 09/04 |
| 3 | 9/4-9/8 | 09/05 | 3 | Reverse Engineering (RE) | 09/18 |
| 4 | 9/11-9/15 | 09/12 | | | |
| 5 | 9/18-9/22 | 09/19 | 4 | Hardware Obfuscation | 09/25 |
| 6 | 9/25-9/29 | 09/26 | 5 | Hardware Trojan Attack I | 10/02 |
| 7 | 10/2-10/5 | 10/03 | 6 | Hardware Trojan Attack II | 10/09 |
| 8 | 10/9-10/13 | 10/10 | 7 | Side Channel Attacks | 10/23 |
| 9 | 10/16-10/20 | 10/17 | | | |

| | | | | | |
|----|-------------|-------|----|--|-------|
| 10 | 10/23-10/27 | 10/24 | 8 | Bus Snooping attacks | 10/30 |
| 11 | 10/30-11/3 | 10/31 | 9 | Physical Tampering of Hardware (i.e. Mod Chip attacks) | 11/06 |
| 12 | 11/6-11/9 | 11/07 | | | |
| 13 | 11/13-11/17 | 11/14 | 10 | Physical Unclonable Function (PUF) | 11/21 |
| 14 | 11/20-11/24 | 11/21 | | | |
| | 11/22-11/25 | | | THANKSGIVING HOLIDAYS | |
| 15 | 11/27-12/1 | 11/28 | 11 | Fault Injection Attacks | 12/06 |

Attendance Policy, Class Expectations, and Make-Up Policy

Make sure you meet the following criteria. These are essential for you to be able to complete this course successfully.

- **Lab Assignments** – All lab assignments are to be performed as a group – not individually. Each group will comprise of 2 students, unless an exception is made by the instructor. 10 group lab assignments will be given throughout the semester and one grand group project **“Can You Hack It?”** will be assigned after completing all lab experiments. For graduate students, there will be advanced options for select experiments. These options will be described in the lab instructions.
- **Report Format** – All reports for lab assignments are to be completed by computer - handwritten assignments will not be accepted. One report per group. A common report format for all assignment will be provided to the students.
- **Late Assignment/Projects** – Late assignment/lab report will receive a penalty of 10% per day, unless excused. No late submission is accepted after one week of the due date.
- **Exams and Make-up Exam** – There will be 2 quizzes throughout the semester. Make-up quizzes will be given only in the case of serious need and only when the instructor is notified PRIOR to the quiz time. In case of a missed quiz, valid reason must be provided along with supporting document (e.g. doctor's note). Without proper documentation, no points will be given for a missed quiz.

Evaluation of Grades

Your course grade is based on your overall performance through the entire semester. The relative weights for the final grade are the following:

- Reports for all Lab Assignments 60%
- Project Demo (Video or Live) 40%

Grading Policy

| Percent | Grade | Grade Points |
|-------------|-------|--------------|
| 93.4 - 100 | A | 4.00 |
| 90.0 - 93.3 | A- | 3.67 |

| | | |
|-------------|----|------|
| 86.7 - 89.9 | B+ | 3.33 |
| 83.4 - 86.6 | B | 3.00 |
| 80.0 - 83.3 | B- | 2.67 |
| 76.7 - 79.9 | C+ | 2.33 |
| 73.4 - 76.6 | C | 2.00 |
| 70.0 - 73.3 | C- | 1.67 |
| 66.7 - 69.9 | D+ | 1.33 |
| 63.4 - 66.6 | D | 1.00 |
| 60.0 - 63.3 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

More information on UF grading policy may be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>
[\(https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx\)](https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx)

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc> [\(https://www.dso.ufl.edu/drc\)](https://www.dso.ufl.edu/drc)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals> [\(https://evaluations.ufl.edu/evals\)](https://evaluations.ufl.edu/evals). Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/> [\(https://evaluations.ufl.edu/results/\)](https://evaluations.ufl.edu/results/).

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/> [\(https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/\)](https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/)) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc> (<http://www.counseling.ufl.edu/cwc>), and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu> (<http://www.police.ufl.edu>).

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml> (<https://lss.at.ufl.edu/help.shtml>).

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu> (<https://www.crc.ufl.edu>).

Library Support, <http://cms.uflib.ufl.edu/ask> (<http://cms.uflib.ufl.edu/ask>). Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu> (<https://teachingcenter.ufl.edu>).

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/> (<https://writing.ufl.edu/writing-studio/>).

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf (https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process> (<http://www.distance.ufl.edu/student-complaint-process>).

