

**E&C-ENG 371 -Introduction to Security Engineering
Fall 2021**

**Department of Electrical and Computer Engineering
University of Massachusetts Amherst**

Syllabus

Prerequisites:

- E&C-ENG 241 Programming
- E&C-ENG 231 Embedded Systems
- E&C-ENG 214 Probability and Statistics
- CompSci 250 Intro to Computation
- **Co-Req:** E&C-ENG 322 System Software & Networking

Instructor: Wayne Burleson, burleson@umass.edu,

Office Hours TBD: Knowles Engineering Building 309B.

Zoom (by appointment) <https://umass-amherst.zoom.us/j/8126709795>

Course Credits: 4

Course Format: Two 75 minute lectures per week, with Labs on your own time. Expect 12-15 hours/week total for this course.

Textbooks:

Required: *Security Engineering*, Ross Anderson, Wiley, 2021, 3rd edition.

Recommended: *Network Security Essentials*, William Stallings, 2017, 6th edition.

Course Description:

Security is playing an increasing role in computer engineering and society at large. Security engineering crosses several disciplines of computer engineering including hardware, software, cryptography, experimental methods as well as broader topics such as management, economics, risk analysis, forensics, policy and human factors.

This new course presents an introduction to the topic of security engineering by building on analytical and experimental computer engineering techniques, and then applying them to security problems. Five labs make up a hands-on aspect of the course which is critical to capture the essence of security engineering. Each lab is preceded by the necessary lectures on security concepts and methods. Contemporary events in the news are used to motivate each section.

Learning Objectives:

- Understand the importance, context, principles and terminology of Computer and Network security
- Ability to model threats and vulnerabilities in software, network and hardware levels
- Experience with several countermeasures and their costs and efficacy in protecting systems
- Lab experience with analyzing, exposing, measuring and repairing vulnerabilities in software and hardware

Grading policy: In-class Quizzes/Attendance, 10%
Assignments 10%
5 Labs, 40%.
Mid-term, 20%
Final Exam 20%
Extra Credits for Participation in Discussions, Slack, and several optional seminars with essays.

Course Schedule:

- Week 1 Security engineering, models, attacks, services, mechanisms, history
- Week 2 Lab: Intro to Security: Buffer Overflow
- Week 3 Private-key encryption and authentication
- Week 4 Lab: AES encryption of Images
- Week 5 Public-key cryptography and Network Security
- Week 6 Digital signatures and Secure Hashing, Block-Chain
- Week 7 Lab: Secure Hashing
- Week 8 Malware and Software vulnerabilities , Ransomware
- Week 10 Lab: SSL and Network security
- Week 11 Hardware security: primitives, Trojan and Side-channels
- Week 12 Lab: reverse engineering, power side channel analysis
- Week 13 Security systems, management, economics, policy

Justification: Security has become an increasingly important topic in the area of computer engineering. It spans the hardware, software, systems and human factors. Unlike other system metrics, security is more complex and involves the interaction of bad actors in a myriad of existing and not yet conceived threats. Security technologies build on a rigorous body of mathematics, both classical and evolving. They also involve experimental techniques in both hardware and software. By introducing Security in the 5th semester, the course provides an important connection between fundamental engineering techniques and real-world problem solving. It also provides an exciting and motivating topic for students of all backgrounds with a very compelling career path. Furthermore, there is an increasing job market and advanced research positions in Security areas.

Accommodation Statement:

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

Academic Honesty Statement:

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).

Inclusivity and Diversity:

The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with the instructor privately. If you wish to communicate anonymously, you may do so in writing or speak with Dr. Paula Rees, Director of Engineering Diversity Programs (rees@umass.edu, 413.545.6324, Marston 128). We are all members of an academic community where it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.