The University of Texas at El Paso

COURSE NUMBER AND TITLE: ECE 5370 - Security in Cyber Physical Systems

COURSE DESCRIPTION/COURSE OVERVIEW:

In this course students will be introduced to emerging threats and defenses in cyber physical systems. This course explores the growing challenges in securing sensitive data, networks, hardware devices, and applications with different security and privacy controls to defend against malicious attacks from a system perspective. The course is designed to introduce real-time cyber security techniques and methods in various applications such as cloud computing, IoT, smart grids and other next generation systems. The course focuses on system impact under interception of control signals, attacks on system components and manipulation of monitoring data. It also covers security and privacy concerns in current systems during data analysis, and discusses trends in secure and private machine learning. Students gain in-depth understanding of current trends in cybersecurity, get familiar with risks and vulnerabilities inherent in CPS architectures and have the opportunity to work on hands-on CPS projects.

COURSE TOPICS: This course covers in depth the following key focus areas:

1. Introduction to Cyber Physical Systems (CPS)
2. CPS Platforms and Architectures
3. Distributed Networking in CPS
4. Vulnerabilities and Threats in CPS landscape
5. Confidentiality, Integrity, Authentication in CPS
6. Access Control, Non-repudiation, Availability in CPS
7. Attacks on System Components and their Detection
8. Intrusion Detection and Prevention in CPS
9. Light Weight Encryption (for Low Power Devices) in CPS
10. Interception and Manipulation of Control Systems
11. Need of Privacy-preserving Operations in CPS and Privacy in CPS Data Analytics
12. Security and Privacy in Cloud Computing, Internet of Things (IoT) and Smart Grids

COURSE PRE-REQUISITES: EE 4377 - Introduction to Cybersecurity

GENERAL INFORMATION

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Email: serrapotu@utep.edu
Office Hours: Wed 9-10 am (Microsoft Teams or in-person)

CREDIT ALLOCATION: 3

TEXTBOOKS:

Reference books (not mandatory):

- IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition (ISBN-13: 978-1839214806, ISBN-10: 1839214805)
- Security and Privacy in Cyber-Physical Systems: Foundations, Principles, and Applications, 1st Edition (ISBN-13: 978-1119226048, ISBN-10: 9781119226048)
- Network Security Essentials, Prentice Hall, 5th Ed. (ISBN-13: 8-0133370430, ISBN-10: 013337043)
- Computer Security: Principles and Practice (ISBN-13: 3773922)

Other Supplemental References:

- Network Security, Private Communication in a Public World (2nd edition), Pearson Publishers. (ISBN-13: 978-0130460196, ISBN-10: 0130460192)
- Understanding Cryptography, Christof Paar and Jan Pelzl (ISBN-13: 978-3642041006 ISBN-10: 3642041000)

SPECIFIC OBJECTIVES FOR THE COURSE:

Cyber-physical systems (CPS) often referred as "next generation of engineered systems" are sensing and communication systems that offer tight integration of computation and networking capabilities to monitor and control entities in the physical world. The advent of cloud computing technologies, artificial intelligence and machine learning models has extensively contributed to these multidimensional and complex systems by facilitating a systematic transformation of massive data into information. The primary goal of the course is to introduce students to security and privacy issues emerging in various CPS applications from hardware perspective. Because of their numerous advantages, CPS and its communication networks inevitably become the targets of attackers and malicious users either during data collection, data monitoring, data transmission, or computation, keeping users' information and the system at risk. Students in this course develop an understanding of these challenges and solutions to mitigate such threats. The course discusses about the impact on system under interception of control signals, attacks on system components and manipulation of monitoring data This course provides students with an opportunity to work on realistic projects and use cases incorporating cutting-edge technology and current trends; and provides the knowledge and skills they will need as working professionals. Specific goals for the course include:

- Students will gain an understanding of CPS platforms and architectures.
- Students will learn the fundamental security mechanisms within CPS realms.
- Students will gain understanding of advanced concepts in software and hardware architecture and their integration.
- Students will learn about CPS from 'security and privacy in design' perspective.
- Students will understand about authentication, IDP and digital forensics in CPS.
- Students will learn about hardware and cyber interconnect in CPS applications such as smart grids, and IoT.

- Students will learn about working with sensors, PLCs, smart home devices and the connecting communication protocols.
- Students will demonstrate the ability to develop security solutions for CPS applications.

GRADING POLICY AND STRUCTURE

Time Stamps LMS

- Attendance, participation, and all LMS (Blackboard LMS) postings are counted in Mountain Time (MST). The time stamps in the computer represent MST, regardless of your actual time zone.

Discussion Boards

- Students should participate in discussion boards that are based on the content from the weekly modules. Grading rubric for discussion boards vary, please check the grading rubric and guidelines for every discussion board.
- Additional discussion boards will be available if there are any common questions for most of the students in the class.
- Students should follow netiquette rules while participating in discussion boards.

Attendance

- Attendance will be counted in grading.
- If lecture mode changes to online, then Attendance will be considered from online class lecture report. Students need to participate in the online lecture and respond to instructor's questions during the lecture.

Assignments

- Assignments are due by **11:59pm (MST)** on the day of deadline. Assignments **will not be accepted after the due date**. This is done in fairness to those students who turn in their assignments on time. The only exception is with extenuating circumstances or events that have been discussed with the instructor PRIOR to the deadline.

Quizzes

- Quizzes will be available for a specific timeframe (as indicated on the class calendar). There will be **1 attempt** for each quiz for the quizzes posted in blackboard. Only some quizzes have 2 attempts. For quizzes with 2 attempts, the grading criteria varies. Late quizzes will not be accepted. If you would like specific feedback based on your quiz responses, please contact the instructor for an appointment to review your quiz or contact during office hours.

In the case of emergencies when you are prevented from logging on, please contact the Course Faculty as soon as possible by phone and/or email. If you know you will be out of town or

otherwise prevented from submitting assignments on the due date, make every effort to turn them in early. Anytime you feel that you are falling behind in the course, it is best to contact the Course Faculty immediately to discuss your situation. In regards to dropping the course with a "W", it is the **student's responsibility** to make arrangements with the UTEP Registrar and drop by the "withdrawal date" located on UTEP Registrar website.

Project

- This course constitutes of a final project. You will be working on the project in the second half of the semester. The project grade comprises of the **project idea submission and project review reports (1 and 2)**. Submissions will not be accepted after due date. This is done in fairness to those students who do timely reviews and turn in their reports on time. The only exception is with extenuating circumstances or events that have been discussed with the instructor PRIOR to the deadline.

GRADING SCALE:

Weightage:

5%	Attendance
25%	Quizzes and Discussion Boards
20%	Assignments
25%	Mid Exam
25%	Final Project

Grading scale:

90 - 100	= A
80 – 89	= B
75 – 79	= C
60 – 74	= D
< 60	= F

Assignments, Discussion Boards, Project Reports and Quizzes are always due on Sunday 11:59 pm (MST) ***total 100 points***

Expectations of the Class

What should you expect from me as the Lead Faculty?

- I will provide you clear instructions on class expectations
- I will check my **Email and Teams** at least once a day and will get back to you within 24 hours.
- I will provide graded feedback on your performance within 14 days of the due date.
- I will keep you informed about your graded progress in the class at all times and will make time to discuss your needs.

- I will leave myself open to suggestions about improvement of the class and class related activities.
- I will do all I can to ensure your learning and success in this class.
- If any changes in the course are to be implemented, I will ensure that the class is notified via announcements in a timely manner.

What Faculty expect of their Students:

- At the beginning of each course, students should review the syllabus, course calendar and other introductory items located in the **"Week One - Getting Started"** folder.
- Students will be expected to complete a **mock assignment and syllabus quiz** on blackboard shell in the first week of class.
- All students are to **review the rules of etiquette, netiquette and follow in their interaction** with fellow students and faculty for any discussions in class or discussion boards on course topics.
- If the class modality changes to online under any circumstances (like Covid), students need to ensure their internet connection is reliable to timely attend lectures and check class modules.
- Students are expected to strictly follow the deadlines for quizzes, discussion boards and assignments. Please contact the instructor immediately in case of queries or concerns. If online office hours collide with your schedule, email the instructor to schedule alternate time to clarify your queries.

COURSE POLICIES:

Academic Regulations:
Review in UT El Paso Student Handbook the following policies: ***Religious Observance, Ethical and Responsible Use of Social Media, Policy on Academic Integrity, Progression Policy, and Statement on Disability.***

Attendance: Students are expected to attend the online class, log-in and check the weekly modules course shell on blackboard (at minimum) **every week** to keep up. Email messages are sent to your **UTEP email address,** so you will want to check your UTEP email everyday as well.

Blackboard:

- Students are required to subscribe to and access the course Blackboard site. Blackboard is the main source of communication between faculty and students. Students are encouraged to access this site daily. Course syllabus, calendar, topical outline of scheduled lectures, and assigned readings are posted on this site. Grades of assignments will be made available ONLY through this site.
- **Email messages/Teams Messages will be sent to notify you of any changes/missing details. Please check email and teams frequently (at minimum) every other day for any communication.**

Communication:

- Communication is the responsibility of both students and faculty. The faculty will keep students informed of progress in theory. Students with questions or concerns should first contact faculty member.
- **Online Office Hours, UTEP Email, Teams messages** are major mediums for interaction. Please feel free to contact the instructor to schedule meetings outside office hours if online office hours collide with your schedule.

Policy on Scholastic Dishonesty:

- Students are expected to be above reproach in all scholastic activities. Students who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the College of Engineering and/or university. Scholastic dishonesty includes but is not limited to reproducing test or quiz materials from memory, copy/paste or Xerox, cheating, plagiarism, collusion, the submission for credit or any work or materials that are attributable in whole or in part to another person, taking an examination for another person, and any act designed to give unfair advantage to a student or the attempt to commit such acts. Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22.
- Since scholastic dishonesty harms the individual, all students, and the integrity of the College of Engineering and the university, policies on scholastic dishonesty will be strictly enforced. See detailed procedure in the Handbook of Operating Procedures (HOP) available in the Office of the Dean of Students.

Policy relating to Disability / Pregnancy/ CASS:

- Instructor will provide support and help in better understanding the course content, inform the instructor PRIOR to the start of course or during first week of classes to request for additional needs and succeed in the class.
- **Disability**: In Section 504 of the Vocational Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990, if a student needs an accommodation then the Office of Disabled Student Services located at UTEP need to be contacted. If you have a condition, which may affect your ability to perform successfully in this course, you are encouraged to discuss this in confidence with the instructor and/or the director of the Disabled Student Services. Written guidelines r/t accommodations from CASS must be submitted to the course manager PRIOR to the start of the course. If you have a disability and need classroom accommodations, please contact CASS at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass. *CASS' Staff are the only individuals who can validate and if need be, authorize accommodations for students with disabilities.*
- **Pregnancy**: It is the responsibility of the student to inform the instructor of pregnancy limitations. Written guidelines r/t accommodations from The Center for Accommodations

and Support Services (CASS) must be submitted to the course manager PRIOR to the start of the course.

Professional Behavior:

- Students are expected to behave professionally ***at all times*** with faculty, peers, preceptors, and clients **and** in any setting in which the student is a representative of UTEP. Bullying, verbal abuse, insubordination, or personal attacks will not be tolerated in any form. Any behavior deemed inappropriate by faculty and/or preceptors will result in faculty conference(s), and completion of a Student Opting for Success (SOS) plan that addresses the student's areas of needed improvement. Possible activities available to assist the student in attaining the SOS objectives include stress and/or anger management counseling sessions. Inappropriate behaviors may result in an administrative withdrawal from the course and/or dismissal from the program.

Retention: Students Opting for Success (SOS):

- When a student is not progressing in the course as expected, or is not successful on an examination, they will be required to meet with the instructor to discuss strategies for success as outline on the SOS form. The SOS plan will identify recommendations for improving the student's success potential and will specify time lines for completion of these recommendations. The SOS form (with all recommendations completed and all signatures in place) must be submitted to the course manager by due date. *Students who are not successful in the course should be aware that non-compliance with SOS recommendations jeopardizes eligibility for the opportunity to repeat the course in the subsequent semester.* See respective Blackboard home page for SOS form.

Netiquette

"Netiquette" stands for "Internet Etiquette", and refers to the set of practices developed over the years to make the Internet experience pleasant for everyone. Please review some of the **Netiquette** rules.

- At this point in the course, it is also important to share a word of caution, so we can become wiser about interpersonal distance learning communications. As you may know, when communicating electronically, many of the feelings or impressions that are transmitted via body language in face-to- face communications are lost. Consequently, interpreting emotions and innuendoes is far more difficult. Only what is written, or drawn, carries the message. Often excitement can easily be misinterpreted as anger or an insult. It is important that everyone keep this in mind when communicating electronically. Words in print may appear harmless; however, they can emotionally injure the person reading them. More information can be found at http://www.albion.com/netiquette.

Other BB Learn Student Resources

Technical Assistance

This **class** is hosted by UT El Paso. If you have computer, Blackboard problems, or any other kind of technical questions, please contact the UTEP Help Desk via email at **helpdesk@utep.edu** or by phone at (915) 747-5257. The HELP desk hours are: Mon-Fri 7:00am - 8:00pm (Mountain Time), Sat 9:00am - 1:00pm (Mountain Time), Sun CLOSED.

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