Fall 2022 - Course Information

Course Number: ESET 415/ESET 689 <mark>(Stacked)</mark>
Course Title: Advanced Network Systems & Security
Lecture Time: 8:00am to 8:50am (Face-to-face)
Lab Sections: 501 (M 4:30pm to 7pm), 502 (T 8:00am to 10:30am), 503 (T 4:30pm to 7pm) 504 (R 1:30pm to 4:00pm), 505 (R 4:30pm to 7:00pm)
Classroom Location: ZACH 441
Laboratory: THOM 105
Credit Hours: 3: 2 lecture hours, 3 lab hours
Course website: https://canvas.tamu.edu

Instructor Details

Instructor: Ana Goulart, Ph.D.
Office: Fermier 011
Phone: 979 845 4948
E-Mail: goulart@tamu.edu (please use Canvas' Inbox app to email me)

Office Hours: Wednesdays 9 to 10am, or by appointment
Link to office hours (notify me if you plan to attend it via Zoom):
https://tamu.zoom.us/j/96484125190?pwd=NnBQQUxXV0ptUDVUNUN5TnFGcTZ2QT09
Meeting ID: 964 8412 5190
Passcode: 273151

Teaching assistant: Ross Baldridge, E-mail: ross_baldridge12@tamu.edu

Course Description

"Advanced topics of the network systems and security including network design and protocol (Border Gateway Protocol (BGP), Internet Protocol (IP) Routing, Internet Protocol Version 6 (IPv6), Network Address Translation (NAT), Domain Name System (DNS)); network security (Access Control Lists (ACLs), Transmission Control Protocol/Internet Protocol (TCP/IP) security, and Virtual Private Networks (VPN)); socket programming and cryptographic protocols."

ESET 415 Course Prerequisites

Grade of C or better in ESET 315; junior or senior classification

ESET 689 Course Prerequisites

None (instructor approval)

Course Learning Outcomes

At the end of this course, students will be able to:

1. *Configure and explain inter and intra-domain IP routing protocols, network address translation (NAT), IPv6, and advanced network topics used in the global Internet.*
2. *Perform network security configuration such as access control lists (ACLs) and virtual private networks (VPNs), including packet inspection and troubleshooting.*
3. *Describe traditional cryptographic protocols as mathematical functions, and explain a mathematical algorithm that generates public and private keys.*
4. *Write software that implements symmetric and public key encryption, digital signature and oneway hash functions, and analyze their vulnerabilities to active and passive security attacks.*
5. *Discuss ethical issues on Internet user privacy and cybersecurity.*
6. *Research security in Internet of Things (IoT) communication systems and perform simulation experiments on that topic (ESET 689 students only)*

Textbook and/or Resource Materials

Peterson, L. and Davie, B., Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann, 2011. (ISBN-13: 9 78-0123850591). (Required – This is the same textbook we used in ESET 315)
Schneier, Bruce, Applied Cryptography: Protocols, Algorithms, and Source Code in C, John Wiley & Sons, Inc., 1996 (2nd Edition) (Required)

Grading Policy for ESET 415 students

Midterm Exams (2)	*30%*
Final Exam	*20%*
Laboratory	*15%*
Final Project	*10%*
Homework	*15%*
Class participation (in-class exercises, quizzes)	*10%*
Total	**100%**

Grading Policy for ESET 689 students

Additional work for the 3-credit hour ESET 615 students includes the 3-hour weekly laboratory work and the semester-long research project on course learning outcome 6, on "researching security in Internet of Things (IoT) communication systems and perform simulation experiments on that topic." Also, a heavier weight of 20% will be given to the independent research project. The changes are highlighted below:

Midterm Exams (2)	*30%*
Final Exam	*10%*
Laboratory	*15%*
Projects (2)	*20%*
Homework	*15%*
Class participation (in-class exercises, quizzes)	*10%*
Total	**100%**

Grading Scale for both ESET 415 and ESET 689:

      A: 90 and above
      B: 80 to 89.99
      C: 70 to 79.99
      D: 60 to 69.99
      F: less than 60, incomplete Lab, or an F score in Lab

There is no curving and no extra credit given in this course.

IMPORTANT DATES
Midterm exams:
Exam 1: Wed, Sept 28
Exam 2: Wed, Nov 9
Final Project Report and Demonstrations due on Dec 07 (last day of classes)

Final Exam on Friday, Dec 9 (10am to 12pm)

QUIZZES + CLASS PARTICIPATION It
is very important that you:

- **arrive on time to the classroom,**
- **do not miss classes***,*
- **participate during class***.*

We will be doing many activities (examples, in-class exercises, homework reviews, individual and group quizzes) during class that will help you achieve the course objectives. Please always review the lecture material before coming to class.

HOMEWORK ASSIGNMENTS
Homework will be assigned on a regular basis. The homework assignments are due at the beginning of class. Except in the case on excused absence, late homework is NOT accepted.

If you understand the homework problems, you will do well in the periodic exams. They will have similar questions as the homework, so please make sure to do the homework on your own, use the course materials and textbook as a reference, and attend office hours if you need help.

LABORATORY REQUIREMENTS
Please remember that all laboratory work must be completed to meet the minimum requirements for a passing grade in the course. You should not miss any labs and you must have all the lab reports completed.

We will use a Bring Your Own Device (BYOD) concept in the lab. Please make sure to bring your laptop to every lab because we will need it to configure the routers and switches in the lab, and also to test the networks we build. We will also be using a lot of Cisco Packet Tracer in the labs.

Lab Reports Format

Lab reports can be done in **groups of 2 to 3 students** and will be due one week after you complete the lab.

Here are some guidelines for your lab report:

1) **Section 1 - Introduction** - What is this lab about? What tasks you did in the lab? Please write a summary ==in your own words== of what you had to do in the lab; a description of the main tasks

2) **Section 2 – Results and answers to questions** – describe results from the lab tasks (e.g., any screenshots to show your work, tables, graphs) with a good explanation. Make sure to answer all post-lab questions. Remember all figure need to have a caption, and they need to be referenced in the text.

3) **Section 3 – Discussions (Conclusions)** – What are the key concepts that you learned in this lab? After completing the lab, please reflect on the lessons learned, if it helped you understand the topic, or any issues you had during the lab

4) **Appendix (cumulative)** - Reference list of formulas/commands used in the lab (to be appended after every lab)

The formatting and presentation of the lab report is very important. Make sure to
- Include one cover page,
- number your sections (1.Introduction, 2.Results, etc.)
- use captions in all figures, and explain the figures in the text,
- define all acronyms,
- use English language and grammar appropriate to a technical report

In case of illness or an emergency and you cannot attend the lab, please follow the university's attendance policy described in the next pages.

Late Work Policy

- Late homework, quizzes and in-class assignments will not be accepted.
- Late lab reports will receive partial credit (10% will be deducted per day for a minimum of 60% of the total grade)

What constitutes late work is submitting a deliverable after the established deadline. Work submitted by a student as makeup work for an excused absence is not considered late work and is exempted from the late work policy. (See Student Rule 7.)

Course Schedule

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Date	Week	Exams/Holidays	Topic	Laboratory Schedule	Lab Topic	Readings
24-Aug	Week1		Overview of the course, Introduction to Cryptography			
29-Aug	Week2		Foundations of Cryptography, Substitution ciphers, Block vs Stream Ciphers, Intro to TCP/UDP sockets	M, T, TR: Lab1	Lab 1: Simple Substitution Cipher in Python	Schneier, Section 1.1, pp. 1-9, Section 1.3 - pp. 10-13, Section 1.5 and 1.6 - pp.15-17
5-Sep	Week3	Sept. 5 -Labor Day. Faculty and Staff Holiday, no classes	More on TCP and UDP sockets	M: No lab, T, TR: Lab2	Lab 2: Socket programming and sending encrypted data using Caesar cipher	Peterson, Section 1.4 - Implementing Network Software - pp. 36-44, Ch. 5 - pp.391-393, Section 5.1 - Simple Demultiplexer pp.393-396,
12-Sep	Week 4		One-time pads, Intro to Ligthweight symmetric encryption algorithm, Talk about sharing key	M: Lab2, T, TR: Lab3	Lab 3: Polyalphabetic cipher	Schneier, Section 1.5 and 1.6 - pp.15-17
19-Sep	Week5		Ligthweight symmetric protocol (example PRESENT algorithm), Symmetric vs. Asymmetric encryption, Arbitrated Protocols, Certificates, Intro to RSA (a public key algorithm)	M: Lab 3, T, TR: Lab4	Lab 4: Ligthweight Symmetric cipher for IoT	Schneier, Section 2.1-2.7, pp
26-Sep	Week6	Review, Exam 1 - Wed, Sept 28	Review for exam 1	M: Lab 4, T, TR: Lab make-ups		
3-Oct	Week7	Project will be assigned	RSA algorithm and the math behind it	M, T, TR: Lab5	Lab 5: Hash functions and public key encryption (RSA)	Schneier, Section 3.3 - Authentication and Key Exchange, pp.56-65, Section 19.3, pp.466-469
10-Oct	Week8	Monday Oct10 - Tuesday Oct 11, Fall break, no classes.	Kanpsack Algorithms	M, T: No lab, TR:Lab make-ups	Individual Project Assigned on using encryption on a Client/Server application.	Schneier, Section 19.2, pp.462-466
17-Oct	Week9		Security at the Application Layer (Transport Layer Security - TLS)	M, T, TR: Lab6	Lab 6: TLS packet inspection	TLS reading, IP tunnels - Peterson, Section 3.29 - Virtual Networks and Tunnels, pp. 235-240
24-Oct	Week10		Security at the network layer (Ipsec - VPNs), IPv6 tunnels	M, T, TR: Lab7	Lab 7: Ipsec lab (VPN)	Peterson, Section 8.5 - Firewalls, pp. 681-684, Section 8.5.1 - Strenghts and Weaknesses of Firewalls, pp.684-686, Cisco Handout on ACL
31-Oct	Week11		Security at the network layer (Firewalls - Sandard access control lists)	M, T, TR: Lab8	Lab 8: Standard ACL lab	
7-Nov	Week12	Exam 2 - Wed, Nov 9	Review for Exam 2	M, T, TR: Lab9	Lab 9: Extended ACL lab	
14-Nov	Week13		Security at the network layer (Firewalls - Extended access control lists)	M, T, TR: Lab10	Lab 10: NAT Lab	Peterson, Section 4.1.3 - IP Version 6 (IPv6) and NAT - pp 324 - 336,
21-Nov	Week14	Wednesday Nov.23 , Reading day, no classes. Thanksgiving holiday on Nov 24	Security at the network layer (Network Address Translation - NAT)	M, T: Lab make-ups, TR: No labs (Thanksgiving)		
28-Nov	Week15		Inter-domain routing (Border Gateway Protocol)	M, T, TR: Lab11	Lab 11: BGP	Peterson, Section 4.1 - The Global Internet - pp 308-310, Section 4.1.2 - Interdomain Routing (BGP) - pp. 313-322
5-Dec	Week16	Re-defined Monday, last day of classes, Final Exam on Friday, Dec 09, at 10am	Review for final exam on Dec 7	Project due on Dec 7 (last day of classes)	Project due on Dec 7 (last day of classes)	

University Policies

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.
Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (Student Rule 7, Section 7.4.1).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below) Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see University Rule 08.01.01.M1):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with Counseling and Psychological Services (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's Title IX webpage.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy selfcare by utilizing available resources and services on your campus

Texas A&M College Station
Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at suicidepreventionlifeline.org.

COVID-19 Safety Measures

To help protect Aggieland and stop the spread of COVID-19, Texas A&M University urges students to be vaccinated and to wear masks in classrooms and all other academic facilities on campus, including labs. Doing so exemplifies the Aggie Core Values of respect, leadership, integrity, and selfless service by putting community concerns above individual preferences. COVID-19 vaccines and masking — regardless of vaccination status — have been shown to be safe and effective at reducing spread to others, infection, hospitalization, and death.