SYST 659
CYBER SECURITY SYSTEMS ENGINEERING

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George Mason University
http://mason.gmu.edu/~pcosta

Course Description
Fall 2017

This course addresses cyber security from the standpoint of systems engineers. It introduces core principles for the design and management of resilient and robust systems throughout their complete lifecycle. Topics include but are not limited to lifecycle assurance of systems, risk analysis, models for secure systems development and management, gap analysis, quantitative methods for cybersecurity, and special topics in cyber security. The course also covers distinct technologies for assessing system vulnerabilities, measuring and modeling risk, reducing uncertainty in risk management, and others related to the application of engineering concepts to cyber security. Target audience consists of engineers who want to expand their skill sets to better align with the demands of current cyber security jobs, as well as those who intent to work on cyber security research. Cyber security professionals would also benefit from the course by being exposed to a systems engineering, holistic perspective on cyber security design, development, and management.

Class Details

Classes
 * *Room 1108 of the Nguyen Engineering Building.*
 * *Thursdays, from 4:30 p.m. to 7:10 p.m.*

Office hours
 * *Room 2227 of the Nguyen Engineering Building.*
 * *Thursdays, from 3:00 p.m. to 4:00 p.m., or by appointment.*
 * *Dr. Costa's contact data: (703) 993-9989 / pcosta@gmu.edu*

Administrative
 * *Registration and drop without tuition penalty deadline: Sep 5th.*
 * *Drop with 33% tuition penalty: Sep 19th.*
 * *Final Drop deadline (66% tuition penalty): Sep 29th.*

Course Logistics

1. All course communication will be done via the Blackboard system. Students are expected to have access and be able to use the system before classes start. Blackboard is accessible via the MyMason portal at https://mymasonportal.gmu.edu/. Instructions for using the Blackboard system are provided in the "resources" link at the bottom of the portal page.

2. Volgenau School Computing Resources has answers to many questions about school systems on their web site: http://labs.vse.gmu.edu and will try to help you if have problems connecting to school computing systems. However, they will not provide assistance with general computing questions or course assignments. Please contact me if you have any questions about how to use software to complete your assignments.

3. Accommodations for disability: If you have a documented learning disability or other condition that may affect your academic performance you should: a) make sure this documentation is on file with Office for Disability Services (SUB I, Rm. 4205; 993-2474; http://ods.gmu.edu) to determine the accommodations you need; and b) let me know about your accommodation needs as soon as possible. If you have contacted the Center for Disability Services and are waiting to hear from a counselor, please keep me updated during the whole process.

4. Inclement weather: Class sessions may be held remotely (via Blackboard Collaborate) due to inclement weather or other University emergencies. Check the Announcements area of the course website for updates.

5. Students are expected to be able to attend classes held online via Blackboard Collaborate, as well as quizzes or other activities associated with such classes (e.g. snow days).

Expected Behavior

1. Attendance in class is essential. If you need to miss a class, you must contact me in advance.

2. You are allowed to enter or leave at any time, provided you do your best to avoid disrupting the activity going on.

3. Please make sure you have your cell phone, tablet, pager, etc., in silent mode. Should you find yourself in *extreme* need to answer an incoming call, just leave the room to do so.

4. With a few exceptions, almost all of the course deliverables are submitted electronically (e.g. class-work and homework), scheduled in advance, and with some flexibility for students to change. Should any scheduled event impact a student's participation in class activities and assignments, it is the student's responsibility to coordinate with me in advance.

5. Students are permitted to interact on homework assignments, but your write-up must be your own. Assignments are intended to provide practical, hands-on experience with the ideas presented in the course.

6. Late assignments, when properly justified, will receive reduced credit in accordance with the late assignment policy (below in this document). No points will be awarded if the assignment is turned in after solutions have been posted.

7. Religious observances are one common example of events that might impact students' activities. Students are responsible for planning ahead. Please, refer to the GMU's calendar of religious holidays at http://ulife.gmu.edu/calendar/religious-holiday-calendar/.

8. Academic Policy: All academic policies as given in the Honor System and code will be strictly followed. These are available at http://catalog.gmu.edu/content.php?catoid=19&navoid=4113.

9. General Policies: All general policies defined in the University Catalog are in place for this course. You can access those at http://catalog.gmu.edu/content.php?catoid=19&navoid=4114.

10. George Mason University is an Honor Code university. Please see the Office of Academic Integrity website (http://oai.gmu.edu/the-mason-honor-code-2/) for a full description of the honor code and the honor committee process.

> **Exercise planning, be proactive and do your best to stay ahead of schedule.**

Course Outline:

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Week 1	8/31	Unit 1: Introduction to cyber security systems engineering.	
Week 2	9/7	Unit 2: Risk analysis.	
Week 3	9/14	Unit 2: Risk analysis.	
Week 4	9/21	Unit 3: Secure systems development and management.	
Week 5	9/28	Unit 3: Secure systems development and management.	
Week 6	10/5	Unit 3: Secure systems development and management.	
Week 7	10/12	Unit 4: Gap analysis.	
Week 8	10/19	Unit 4: Gap analysis. **Midterm Exam**	
Week 9	10/26	Unit 5: Quantitative methods for cybersecurity.	
Week 10	11/2	Unit 5: Quantitative methods for cybersecurity.	
Week 11	11/9	Unit 5: Quantitative methods for cybersecurity.	
Week 12	11/16	Unit 6: Special topics in cyber security.	
Thanksgiving	11/23	No Classes	
Week 13	11/30	Unit 6: Special topics in cyber security.	
Week 14	12/7	Course review. **Final Exam**	

Textbook

The course will cover a variety of techniques and subjects that will be mostly based on class notes provided by the instructor. However, the following book will be necessary for a large part of the reading assignments:
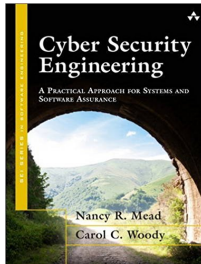
Cyber Security Engineering
Nancy R. Mead, Carol C. Woody
Addison-Wesley Professional; 1 edition (November 10, 2016).
384 pp.
ISBN-10: 0134189809
ISBN-13: 978-0134189802

## Supplementary Material (Optional)

The following references will be used during the course in different levels of intensity. However, the instructor will provide class notes on the topics extracted from it. Therefore, although recommended, none of the references below is necessary for passing the course:
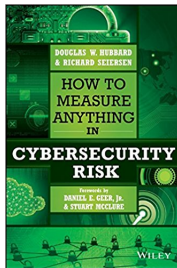
How to Measure Anything in Cybersecurity Risk
Daniel E. Geer, Jr.; Stuart McClure
Wiley; 1 edition (July 25, 2016); 304 pp.
ISBN-10: 1119085292
ISBN-13: 978-1119085294
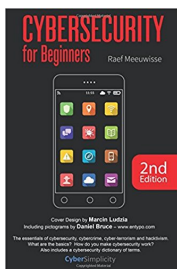
Cybersecurity for Beginners
Raef Meeuwisse
Cyber Simplicity Ltd; 2 edition (March 14, 2017); 224 pp.
ISBN-10: 1911452037
ISBN-13: 978-1911452034
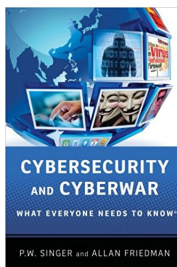
Cybersecurity and Cyberwar
P.W. Singer; Allan Friedman
Oxford University Press; 1 edition (January 3, 2014); 320 pp.
ISBN-10: 0199918112
ISBN-13: 978-0199918119

Grading

The grading structure of this course is as follows:

- Assignments (25% of grade)
- Midterm Exam (25% of course grade)
- Paper Review (25% of grade)
- Final Exam (25% of course grade)

Assignments

There will be assignments posted via Blackboard during the course. Each assignment will have its respective due date defined during the announcement.

You are not prevented from working with your peers on the assignments, and are even encouraged to do so. However, ***each student must provide his/her own answers***, and I might verify whether he/she actually worked in his/her respective exercise and understood the solution provided. In any case, past experience consistently shows that students who did not keep up with the assignments had a less than stellar performance with their grades.

Assignments <u>must be submitted via Blackboard</u>.

Paper Review

Each student will choose an article from a peer-reviewed source (conference or academic journal) related to the field of data fusion. Students are expected to present their respective assessment and conclusions about the paper to the class via 20 min oral presentation followed by a 5-min questioning session; as well as to provide fair, well-founded peer reviews of some of their peer's paper presentations. The Paper Review grading will include both your presentation and the quality of your evaluations.

Oral presentation. The presenter must upload his slides to the Blackboard system no later than 2 p.m. Eastern Time *<u>of **the day before** his/her presentation</u>*. Minor changes to the submitted slides are allowed, but the submitted version must be very close to the actual presentation. All students are expected to read the abstracts and view the slides prior to each presentation. However, those really interested in maximizing their learning experience are advised to read the actual paper before the presentation and fully use their participation rights at the questioning session.

Peer Evaluations. During the paper evaluation phase a schedule of reviews will be posted. Each student is expected to provide a number of professional, well founded, and impartial critique. The goal is to exercise your critical side, and demonstrate your ability to provide proper support your evaluations, being it positive or not.

Weak or empty evaluations ***will be returned, and may deduct from your grade***. You will be evaluated on your ability to provide a thoughtful and well-supported review.

Paper choices are up to each student, but must be approved by the instructor. ***Students must choose their paper by week 3*** of the course. Students that did not submit their choices will be assigned to a paper by the instructor and are subjected to grade deductions if no plausible justification is offered.

Exams

Both exams will be in-class. These are the tentative dates:

- Midterm: October 19, 2017.
- Final: December 7, 2017.

BEST WISHES FOR A GREAT SEMESTER!!!

Monday, August 29th, 2017.