

FLORIDA ATLANTIC UNIVERSITY™

Graduate Programs—NEW COURSE PROPOSAL¹

UGPC APPROVAL _____
 UFS APPROVAL _____
 SCNS SUBMITTAL _____
 CONFIRMED _____
 BANNER POSTED _____
 CATALOG _____

DEPARTMENT: DEPARTMENT OF COMPUTER &
ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

COLLEGE: ENGINEERING AND COMPUTER SCIENCE

RECOMMENDED COURSE IDENTIFICATION:

PREFIX CTS COURSE NUMBER 6319 LAB CODE (L or C) _____

(TO OBTAIN A COURSE NUMBER, CONTACT NMALDONADO@FAU.EDU)

COMPLETE COURSE TITLE: **CYBER SECURITY: MEASUREMENT AND DATA ANALYSIS**

EFFECTIVE DATE

(first term course will be offered)

SPRING 2016

CREDITS²: 3

TEXTBOOK INFORMATION:

Required:

- Research Papers from the cyber security community will be supplied and required.

Recommended:

- Cybersecurity and Cyberwar: What Everyone Needs to Know, by P.W. Singer and Allan Friedman, ISBN-10: 0199918090, 1st Edition, 2014.
- Data Analysis for Network Cyber-Security, by Niall Adams and Nicholas Heard, ISBN: 978-1-78326-374-5, 2014.
- Communication Networks: Fundamental Concepts and Key Architectures, by Alberto Leon- Garcia and Indra Widjaja, ISBN-10: 007246352X, 2nd Edition, 2004.

GRADING (SELECT ONLY ONE GRADING OPTION): REGULAR X SATISFACTORY/UNSATISFACTORY _____

COURSE DESCRIPTION, NO MORE THAN THREE LINES:

This course explores techniques and considerations for conducting cyber security research rooted in empirical observation. Topics include Internet measurement methodologies and data analytics for inferring and characterizing cyber attacks. The ultimate goal of this course is to foster analysis of empirical data that is both sound and insightful.

PREREQUISITES*:

GRADUATE LEVEL STATUS OR
PERMISSION OF THE INSTRUCTOR

COREQUISITES*:

REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL)*:

* PREREQUISITES, COREQUISITES AND REGISTRATION CONTROLS WILL BE ENFORCED FOR ALL COURSE SECTIONS.

MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:

MEMBER OF THE GRADUATE FACULTY OF FAU AND HAS A TERMINAL DEGREE IN THE SUBJECT AREA (OR A CLOSELY RELATED FIELD)

Faculty contact, email and complete phone number:
Nurgun Erdol, erdol@fau.edu, 561-297-3409

Please consult and list departments that might be affected by the new course and attach comments.³

Mathematical Sciences (College of Science)

Approved by:

Department Chair: Nurgun Erdol

College Curriculum Chair: [Signature]

College Dean: [Signature]

UGPC Chair: [Signature]

Graduate College Dean: [Signature]

UFS President: _____

Provost: _____

Date:

10/13/2015

10/19/2015

10/19/2015

10-29-15

10-30-15

1. Syllabus must be attached: see guidelines for requirements: www.fau.edu/provost/files/course_syllabus.2011.pdf

2. Review Provost Memorandum: Definition of a Credit Hour www.fau.edu/provost/files/Definition_Credit_Hour_Memo_2012.pdf

3. Consent from affected departments (attach if necessary)

Email this form and syllabus to UGPC@fau.edu one week before the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting.

**Department of Computer & Electrical Engineering
and Computer Science
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Course Syllabus**

1. Course title/number, number of credit hours	
Cyber Security: Measurement and Data Analysis CTS 6319	3 credit hours
2. Course prerequisites, corequisites, and where the course fits in the program of study	
Prerequisites: Graduate level status or permission of the instructor	
3. Course logistics	
Term: Spring 2016 Class location and time: TBA	
4. Instructor contact information	
Instructor's name Office address Office Hours Contact telephone number Email address	Dr. Nurgun Erdol Engineering East Building, Room 403A TBA 561-297-3409 erdol@fau.edu
5. TA contact information	
TA's name Office address Office Hours Contact telephone number Email address	TBA
6. Course description	
This course explores techniques and considerations for conducting cyber security research rooted in empirical observation. Topics include Internet measurement methodologies and data analytics for inferring and characterizing cyber attacks. The ultimate goal of this course is to foster analysis of empirical data that is both sound and insightful. This course introduces data science to the field of cyber security. Digital investigation approaches for cyber security will be discussed. Further, data analytics and traffic analysis methodologies will be presented. Data acquisition and sound analysis methods will also be elaborated. Approaches for inferring and attributing various types of cyber attacks will be presented.	
7. Course objectives/student learning outcomes/program outcomes	
Course objectives	<ol style="list-style-type: none"> 1. Provide a background of networking concepts and how they can be leveraged in cyber security 2. Provide practical and sound methods for the acquisition and measurement of Internet traffic for cyber security 3. Demonstrate real corporate and Internet attacks 4. Compare and contrast probabilistic, statistical and heuristical approaches to infer and attribute cyber security attacks through traffic analysis 5. Provides practical techniques to geolocate and report cyber security incidents <p>Students will come away with applicable skills in employing data science techniques to infer, characterize, attribute and provide evidence of corporate</p>

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	and Internet cyber security incidents by analyzing network traffic.
8. Course evaluation method	
Assignments 40 % Project 40% Project Presentation 10% Active participation and research interest 10%	The project necessitates building a tool/system that achieves some cyber security goal. Examples: Building a tool to investigate and report on a rare malicious network activity or a tool to mine phishing emails to infer and label phishing campaigns.
9. Course grading scale	
Grading Scale: 90 and above: "A", 87-89: "A-", 83-86: "B+", 80-82: "B", 77-79: "B-", 73-76: "C+", 70-72: "C", 67-69: "C-", 63-66: "D+", 60-62: "D", 51-59: "D-", 50 and below: "F."	
10. Policy on makeup tests, late work, and incompletes	
<p>Makeup exams are given only if there is solid evidence of a medical or otherwise serious emergency that prevents the student of participating in the exam. Makeup exams will be administered and proctored by department personnel unless there are other pre-approved arrangements.</p> <p>A grade of incomplete will be assigned only in the case of solid evidence of medical or otherwise serious emergency situation.</p> <p>Must turn in homework, reports and projects on time. One point per working day will be deducted from the late assignment. Will not accept your work after 3 working days or the solution has been provided.</p>	
11. Special course requirements	
N/A	
12. Classroom etiquette policy	
University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.	
13. Disability policy statement	
In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) located in Boca Raton campus, SU 133 (561) 297-3880 and follow all OSD procedures.	
14. Honor code policy	
Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with	

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academic dishonesty. See University Regulation 4.001 at www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf

15. Required texts/reading

Research Papers from the cyber security community will be supplied and required.

16. Supplementary/recommended readings

- Cybersecurity and Cyberwar: What Everyone Needs to Know, by P.W. Singer and Allan Friedman, ISBN-10: 0199918090, 1st Edition, 2014.
- Data Analysis for Network Cyber-Security, by Niall Adams and Nicholas Heard, ISBN: 978-1-78326-374-5, 2014.
- Communication Networks: Fundamental Concepts and Key Architectures, by Alberto Leon- Garcia and Indra Widjaja, ISBN-10: 007246352X, 2nd Edition, 2004.

17. Course topical outline, including dates for exams/quizzes, papers, completion of reading

Date	Topic	Reading
Week 1	Overview and Logistics	N/A
Week 2	TCP/IP	N/A
Week 3	Internet Measurement	Paper 1
Week 4	Denial of Service	Paper 2
Week 5	Denial of Service (cont.) HW1 due Project Description	Paper 3
Week 6	Denial of Service (cont.)	Paper 4
Week 7	Probing	Paper 5
Week 8	Botnets HW2 due	Paper 6
Week 9	Network intrusion detection systems (NIDS)	Paper 7
Week 10	NIDS Issues HW3 Due	Paper 8
Week 11	Spam	Paper 9
Week 12	Censorship	Paper 10
Week 13	Legality and Ethics HW4 due	Paper 11
Week 14	Underground Economy Project Presentations	N/A
Week 15	Project Presentations	N/A

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Research Papers

Paper 1:

Paxson, Vern. "Strategies for sound internet measurement." *Proceedings of the 4th ACM SIGCOMM conference on Internet measurement*. ACM, 2004.

Paper 2:

Moore, David, et al. "Inferring internet denial-of-service activity." *ACM Transactions on Computer Systems (TOCS)* 24.2 (2006): 115-139.

Paper 3:

Paxson, Vern. "An analysis of using reflectors for distributed denial-of-service attacks." *ACM SIGCOMM Computer Communication Review* 31.3 (2001): 38-47.

Paper 4:

Fayaz, Seyed K., et al. "Bohatei: flexible and elastic DDoS defense." *arXiv preprint arXiv:1506.08501* (2015).

Paper 5:

Bou-Harb, Elias, Mourad Debbabi, and Chadi Assi. "Cyber scanning: a comprehensive survey." *Communications Surveys & Tutorials, IEEE* 16.3 (2013): 1496-1519.

Paper 6:

Stone-Gross, Brett, et al. "Your botnet is my botnet: analysis of a botnet takeover." *Proceedings of the 16th ACM conference on Computer and communications security*. ACM, 2009.

Paper 7:

Paxson, Vern. "Bro: a system for detecting network intruders in real-time." *Computer networks* 31.23 (1999): 2435-2463.

Paper 8:

Handley, Mark, Vern Paxson, and Christian Kreibich. "Network Intrusion Detection: Evasion, Traffic Normalization, and End-to-End Protocol Semantics." *USENIX Security Symposium*. 2001.

Paper 9:

Xie, Yinglian, et al. "Spamming botnets: signatures and characteristics." *ACM SIGCOMM Computer Communication Review*. Vol. 38. No. 4. ACM, 2008.

Paper 10:

Dainotti, Alberto, et al. "Analysis of country-wide internet outages caused by censorship." *Proceedings of the 2011 ACM SIGCOMM conference on Internet measurement conference*. ACM, 2011.

Paper 11:

Burstein, Aaron J. "Conducting Cybersecurity Research Legally and Ethically." *LEET 8* (2008): 1-8.

Note: this list may be updated in the future.

Re: Request for approval -- new courses

Rainer Steinwandt [srainer@math.fau.edu]



To: Mihaela Cardei
Cc: Yuan Wang, Nurgun Erdol

Monday, October 12, 2015 4:28 PM

Good afternoon,

Thank you for your email. Both courses look very fine, and there are no objections from the Department of Mathematical Sciences.

Kind regards,
Rainer

From: "Mihaela Cardei" <mcardei@fau.edu>
To: "Rainer Steinwandt" <srainer@math.fau.edu>
Cc: "Yuan Wang" <YWANG@fau.edu>, "Nurgun Erdol" <erdol@fau.edu>
Sent: Monday, October 12, 2015 9:27:37 AM
Subject: Request for approval -- new courses

Dear Dr. Steinwandt,

The Department of Computer & Electrical Engineering and Computer Science (CEECS) is proposing 2 new courses:
COT 6116 - Secret Sharing Protocols
CTS 6319 - Cyber Security: Measurement and Data Analysis

Please find attached the syllabi and cover pages.

We need your approval that the Department of Mathematical Sciences supports these course proposals. Could you please review the material and email me your approval decision?

Thank you,

Mihaela Cardei, PhD
Professor
Computer & Electrical Engineering and Computer Science Department
College of Engineering and Computer Science
Florida Atlantic University
<http://www.cse.fau.edu/~mihaela>