New Mexico Research Spotlight Forum

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UNM ECE Space Systems Online Program Overview

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NM STATE UNIVERSITY

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

SAND2018-14303 O

Managed Online Program in M.Sc. EE or ME with Concentration on Space Systems Engineering

- Launched Fall 2018: https://eespaceonline.unm.edu or https://mespaceonline.unm.edu
- 8-week courses offered in carousel format, starting up to 5 times a year
- Requires 34 credit hours for ME or 31 hours for EE degree
- Class quality reviewed and certified through UNM online
- Requires bachelor's degree in an engineering-related field from an accredited university.
- Requires proficiency in proficiency in English (reading and writing), programming and mathematics.
- Available to ALL UNM students as Online courses
- Advisor to ECE MOP students: Prof. Marios S. Pattichis

Keywords:

Online program, M.Sc. in EE, M.Sc. in ME, Space Systems Engineering.

Certified MOP ECE Courses for Internet of Things (IoT) and Space Systems Engineering

ECE 595 – Introduction to the Internet of Things
ECE 522 – Hardware/Software Codesign with FPGAs
ECE 517 – Machine Learning
ECE 540 – Advanced Networking
ECE 529 – Introduction to Cybersecurity
ECE 537 – Foundations of Computing
ECE 514 – Nonlinear and Adaptive Control

Certified MOP Courses for M.Sc. in Space Systems Eng

EE and ME Degree Requirements

ME 595 – Orbital Mechanics
ME 596 – Spacecraft Altitude Dynamics and Control
ME 594 – Space Situational Awareness
ME 597 – Small Spacecraft Design I
ECE 595 – Satellite Communications

ME Degree Only

ME 542 – Deformation Analysis and Modeling (reviewed through the Golden Paw process)
ME 500 – Numerical Methods in Mechanical Engineering
ME 530 – Theoretical Fluid Mechanics I
ME 501 – Advanced Mechanics of Materials

More MOP Courses for 2019-2020

MOP Version Development (ITV and f2f available now)

ECE 500 Theory of Linear Systems
ECE 541 Probability Theory and Stochastic Processes
ECE 439 Introduction to Digital Signal Processing
ECE 522 Hardware/Software Codesign with FPGAs
ME 559 Design Project
ECE 590/ME 591/ME 592 Graduate Seminar in Space Systems

New MOP Courses (Courses previously offered)

ECE 5xx Radiation Effects on Space Electronics
ECE 5xx Foundations of Cybersecurity
Additional courses in Cybersecurity …

FUNDING SOURCES

Funding originated from UNM Provost office

Heavily subsidized by UNM ECE and ME Departments

MS EE Focus on Cyber Security* – Can Relate to Space Systems

- MS focus with a certificate option would give students a unique understanding of offensive cybersecurity software and systems development.
- This kind of program is currently not offered in the United States, though the material is covered within inhouse programs privately and through other organizations, though not in the depth proposed.
- This program is modeled on a program offered in China to select members of the PRA. This is based on expanding and unmet demand for offensive cybersecurity experts by various US Government organizations, including but not limited to USCYBERCOM2.
- MS Program Structure: Core classes are required, for a total of 9 credit hours.
- Certificate Structure: A certificate would include 9-12 credit hours of coursework focused on Cybersecurity.

* Proposal by Chris Lamb, SNL

Cybersecurity Focus – Online or On Campus

Existing Required Classes:

ECE 536: Computer System Software

ECE 538: Advanced Computer Architecture

ECE 540: Advanced Networking Topics

Cybersecurity Core Classes, In Order of Completion:

- (Completed) Foundations of Cybersecurity: An introduction to cybersecurity topics and existing tools including but not limited to Metasploit, Powershell, NMAP, and Masscan.
- Analysis & Exploitation: Studying static and dynamic analysis of programs, various kinds of stack exploits, heap exploits, return-oriented-programming, web exploits, and other initial penetration vectors.
- Payload Development & Communication: Ways to develop malware to avoid detection and removal, and how to effectively hide command and control traffic.

Cybersecurity Focus – Optional Courses

- Web Exploitation: Exploiting and using web browsers as initial system entry points, for reconnaissance, and for command and control communication.

- Applied Cryptology: Cryptography algorithms, details of implementation, how to use them, and how to attack them.

ECE@UNM PROGRAM NEEDS

- Need help recruiting students from Sandia, AFRL, LANL, and Aerospace industry.
- Collaborate to create and offer additional courses as needed.
- Additional instructors from Sandia, AFRL, and LANL.
- Internships as part of partnership would enhance impact and visibility.
- We would love to offer jointly-funded Design Projects.