Progress Report to Advisory Board

Undergraduate Education

Mel Gomez, Associate Chair for UG Education

- ABET Accreditation
- Increasing CpE Graduation Rates
- Minor in Machine Learning
- B.S. Embedded Systems and IoT

ABET Accreditation

- Accreditation Process started with completion of self study report for both undergraduate programs in June 2017

- ABET Team site visit took place in October 28-31, 2017.

- Site visit evaluation:
  - Tour of ECE lab facilities (showcased Hughes and TI Labs)
  - Review of assessment and class materials
  - Interviews with faculty, lab/IT support, advising staff,

ABET Accreditation

Assessment from ABET Program Evaluators (unofficial):

Program Strengths:
- Strong commitment to undergraduate education by faculty and staff.
- Students share sense of community with ECE Department.
- Involvement of Advisory Board and corporate partners is commendable.
- Support staff for labs are exceptional, lab improvements are impressive
- Academic advising staff and system is superb, (TI) Peer Mentoring is impressive
- Outstanding onboarding for first year faculty,

Weaknesses: None, Zero, Zip, Zilch, Nada! (1st time in 4 ABET cycles).

Suggestions: Minor changes in accreditation language in undergraduate catalog.

ABET Accreditation

Members of the ECE Departments involved with ABET Process and Site Visit:

- Dr. Donald Yeung and the Undergraduate Affairs Committee
- Neruh Ramirez and the ECE Undergraduate Office
- Bryan Quinn and Technical Operations Staff
- Jeff McKinney and Engineering IT Staff
- Amanda Stein and External Relations Staff
- Faculty members, student leaders, and alumni.

Special thanks to board members for meeting with evaluators during the site visit: **Jim Cantor, Greg Lyons, Ben Pontono, Milan Vlajnic**

Graduation Rates

- Low graduation rate of Computer Engineering (CpE) student who start in the program as freshmen students
  - 4-Year Graduation Rate Example
    - Fall 2013 Cohort: 67.1% graduated from UMD by 4th year.
    - Fall 2013 Cohort: 47.4% graduated with a CpE degree – 19.7% graduated with another UMD degree (i.e. CS, ME, etc., etc.).
  - 5-Year Graduation Rate Example
    - Fall 2012 Cohort: 82% graduated from UMD by 5th year.
    - Fall 2012 Cohort: 38% graduated with a CpE degree – 44% graduated with another UMD degree (i.e. CS, ME, etc., etc.).
  - 6-Year Graduation Rate Example
    - Fall 2011 Cohort: 83% graduated from UMD by 6th year.
    - Fall 2011 Cohort: 45.3% graduated with CpE degree; 37.7% graduated with another UMD degree (i.e. CS, ME, etc., etc.).
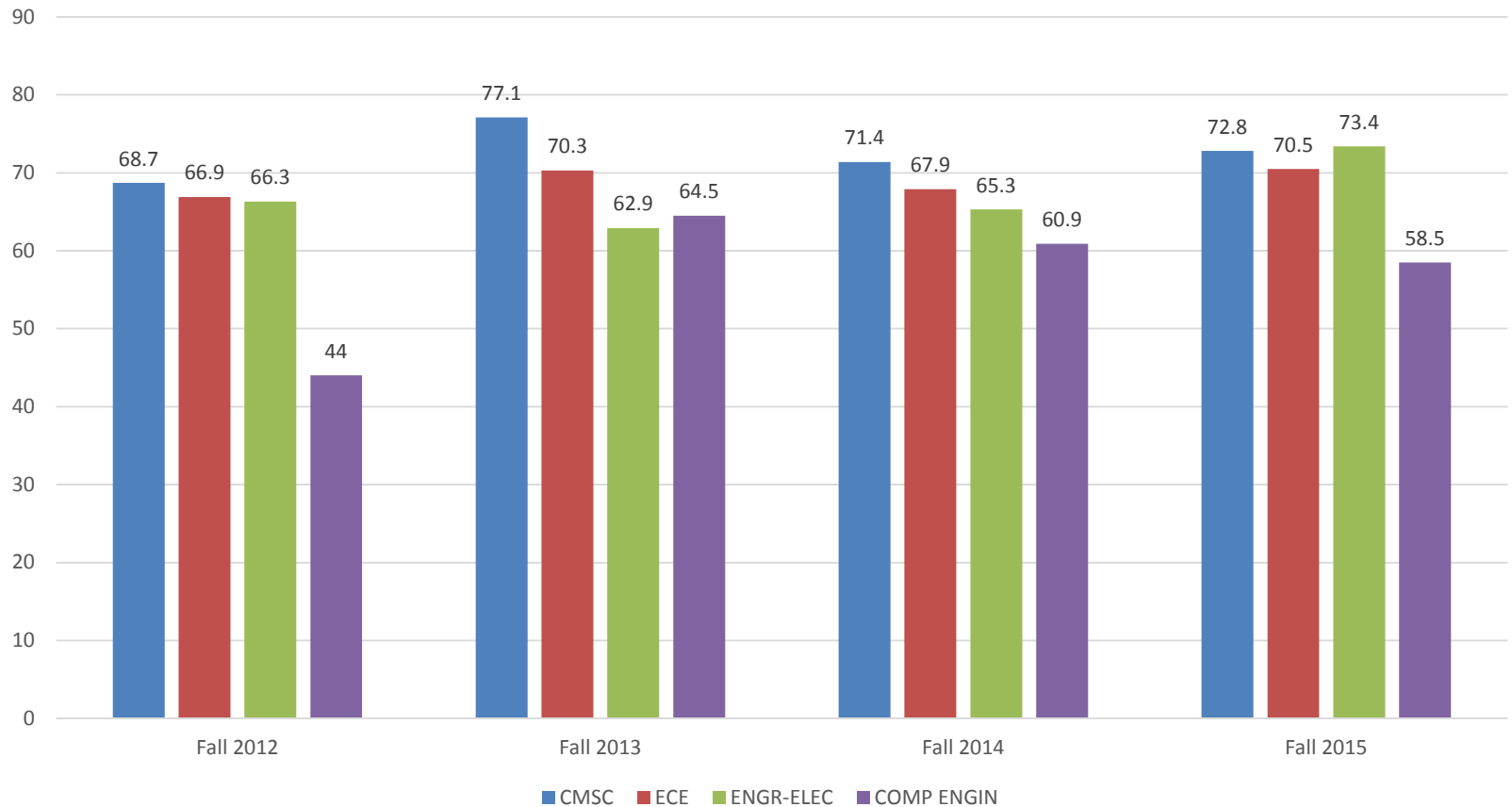
1ˢᵗ Year Retention

1st Year Retention - Freshman Cohorts

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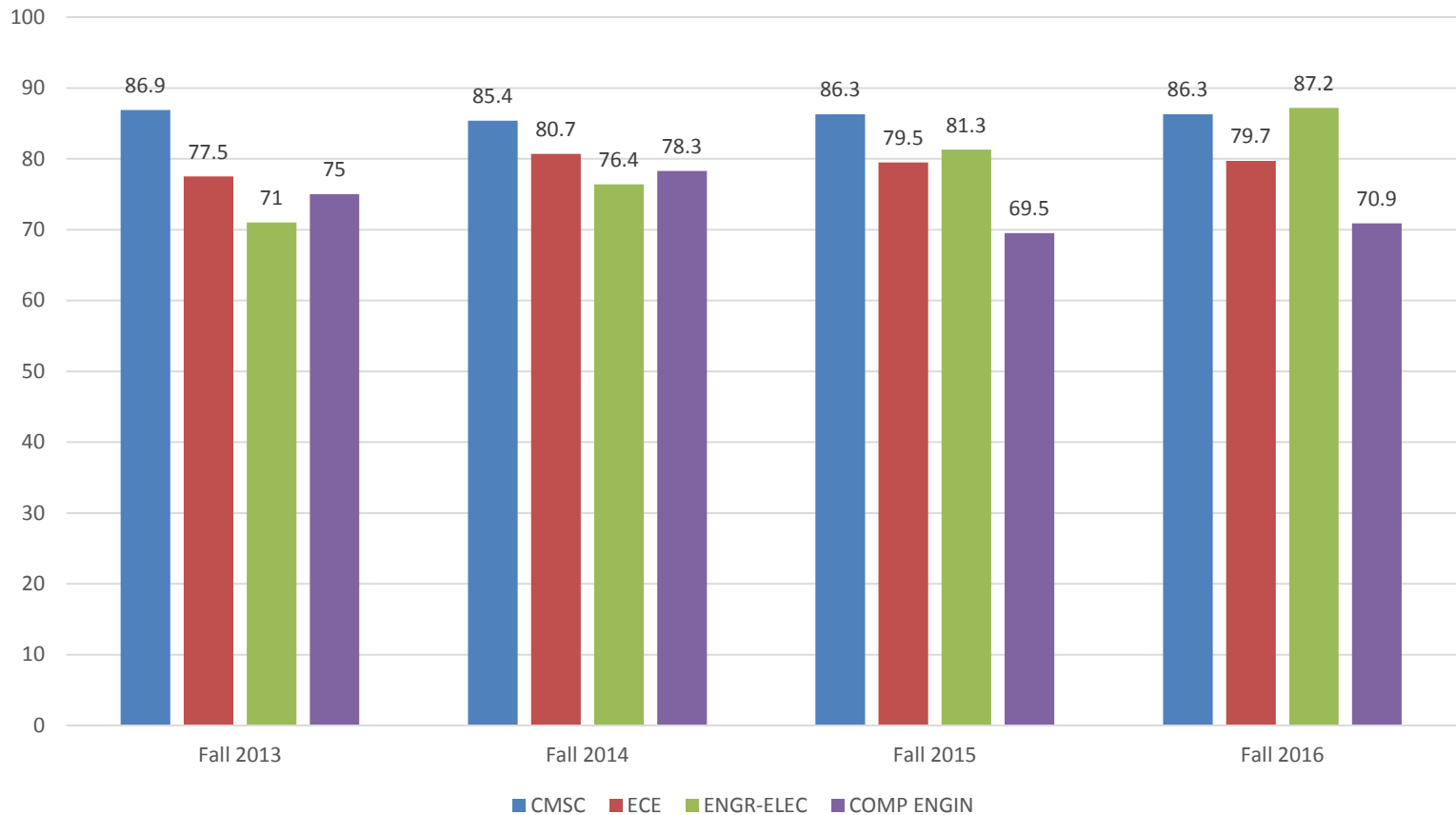
2ⁿᵈ Year Retention

2nd Year Retention - Freshman Cohorts

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4-Year Graduation Rate

4-Year Graduation - Freshman Cohorts

5-year Graduation Rate

5-Year Graduation Freshman Cohorts

CMSC | ECE | ENGR-ELEC | COMP ENGIN

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Low Graduation Rate for CpE

- Possible reasons for low graduation rates for freshmen cohorts:
  - Balancing two types of challenging courses: Engineering & Computer Science
  - Courses with high DWF rates in curriculum:
    - CMSC330 Org of Programming Lang (16% DWF rate in Fall 2016)
    - CMSC351 Algorithms (23% DWF rate in Spring 2016)
    - ENEE322 Signals & Systems (21% DWF rate in Fall 2016)
    - ENEE324 Engineering Probability (24% DWF rate in Fall 2015)
  - More credits per semester
    - Fall 2017: CpE Average Credits = 14.6; EE Average Credits = 14
  - Structure of CpE curriculum (more required courses, less electives, required courses typically not included in other CpE programs).

CpE Curriculum UMD vs UIUC
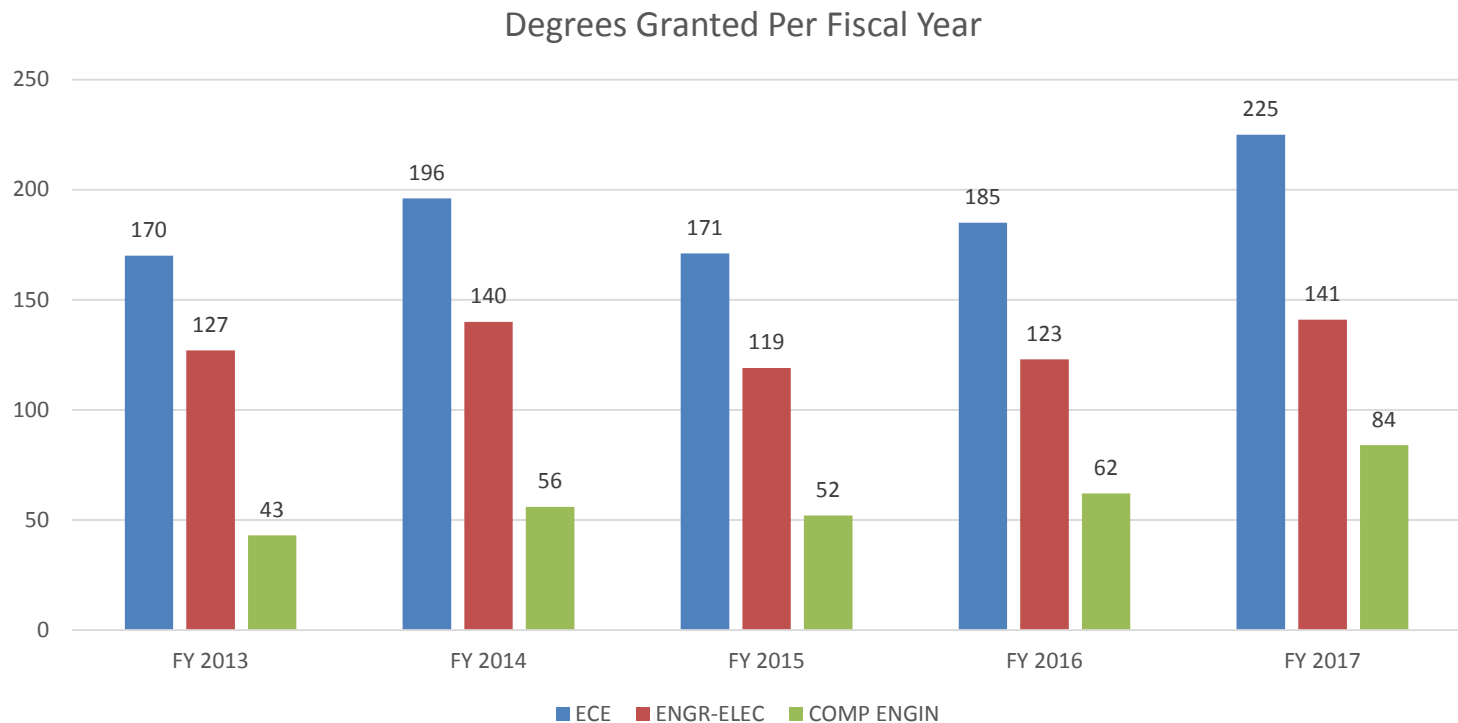
University of Maryland

- MATH140: Calculus I (4 credits)
- MATH141: Calculus II (4 credits)
- MATH246: Differential Equations for Scientists & Engineers (3 credits)
- CMSC250: Discrete Structures (4 credits)
- PHYS161: General Physics, Mechanics and Particles Dynamics (3 credits)
- PHYS260/261: General Physics, Vibrations, Waves, Heat, and E/M (4 credits)
- CHEM135: General Chemistry for Engineers (3 credits)
- ENES100: Introduction to Design (3 credits)
- ENEE101: Introduction to ECE (3 credits)
- ENEE205: Electric Circuits (4 credits)
- ENEE222: Elements of Discrete Signal Analysis (4 credits)
- ENEE244: Digital Logic Design (3 credits)
- ENEE245: Fundamental Digital Circuits and Systems Lab (2 credits)
- ENEE303: Analog and Digital Electronics (3 credits)
- ENEE307: Electronic Circuit Design Laboratory (2 credits)
- ENEE322: Signal and System Theory (3 credits)
- ENEE324: Engineering Probability (3 credits)
- ENEE350: Computer Organization (3 credits)
- ENEE446: Digital Computer Design (3 credits)
- CMSC132: Object Oriented Programming II (4 credits)*
- CMSC216: Introduction to Computer Systems (4 credits)
- CMSC330: Organization of Programming Languages (3 credits)
- CMSC351: Algorithms (3 credits)
- CMSC412: Operating Systems (4 credits)
- Category A: Mathematics and Basic Sciences (Minimum 6 credits)
- Category B: Computer Science Theory and Applications (Minimum 3 credits)
- Category C: Electrical Engineering Theory and Applications (Minimum 3 credits)
- Category D: Advanced Laboratory (Minimum 2 credits)
- Category E: Capstone Design (Minimum 3 credits)
- Category F: General Technical Electives (Minimum 3 credits)

- 4 MATH 221 - Calculus I
- 3 MATH 231 - Calculus II
- 4 MATH 241 - Calculus III
- 4 MATH 286 - Introduction to Differential Equations
- 4 PHYS 211 - Univ Physics, Mechanics
- 4 PHYS 212 - Univ Physics, Elec & Mag
- 2 PHYS 213 - Univ Physics, Thermal Physics
- 2 PHYS 214 - Univ Physics, Quantum Physics
- 3 CHEM 102 - General Chemistry I
- 1 CHEM 103 - General Chemistry Lab I
- 3 ECE 110 - Introduction to Electronics
- 4 ECE 120 - Introduction to Computing
- 4 ECE 220 - Computer Systems & Programming
- 4 ECE 210 - Analog Signal Processing
- 3 CS 173 - Discrete Structures (or MATH 213)
- 3 ECE 385 - Digital Systems Laboratory
- 3 ECE 313 - Probability with Engr Appl (or STAT 410)
- 4 CS 225 - Data Structure & Software Principles
- 4 ECE 391 - Computer Systems Engineering
- 4 CS 374 – Algorithms
- 3 EE Foundational Course
- 9 Advanced Computer Electives
- 3 Senior Design

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Increasing Degrees Awarded

- Despite low retention among CpE freshman cohorts, both programs are awarding more degrees; therefore increasing freshman grad rates can result in even more degrees granted:

Degrees Granted Per Fiscal Year

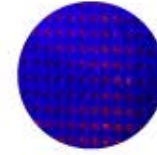| Fiscal Year	ECE	ENGR-ELEC	COMP ENGIN
FY 2013	170	127	43
FY 2014	196	140	56
FY 2015	171	119	52
FY 2016	185	123	62
FY 2017	225	141	84

Advisory Board: Action Item

- Does the Advisory Board feel that the CpE curriculum needs to be revised?
- Does the Advisory Board feel that the prerequisites be modified?
- Other suggestions?
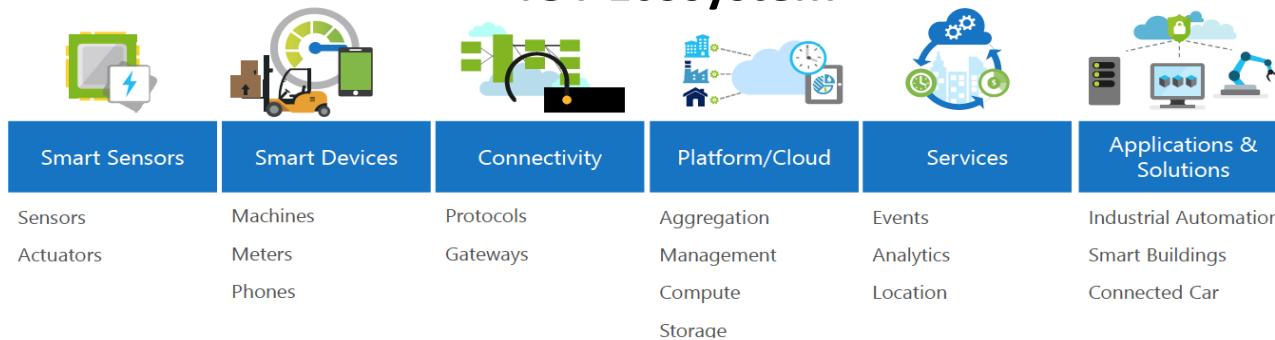
Machine Learning Minor

- Tentative curriculum for program:
  - Core Courses:
    - ENEE324 Engineering Probability
    - ENEE351 Algorithms & Data Structures
    - ENEE439M Intro to Machine Learning
  - Elective courses (3) in topics such as Optimization, Artificial Intelligence, etc., etc.
- Minor Structure
  - Selective admissions into minor (similar to Computer Engineering Minor)
  - Geared towards ECE, Engineering, and Computer Science students.

Proposal for **B.S. in Embedded Systems and IOT Shady Grove**

The original B.S. in Embedded Systems and Mixed Signals is being modified to focus on Internet of Things (2+2 year program).

IOT Ecosystem

Smart Sensors	Smart Devices	Connectivity	Platform/Cloud	Services	Applications & Solutions
Sensors	Machines	Protocols	Aggregation	Events	Industrial Automation
Actuators	Meters	Gateways	Management	Analytics	Smart Buildings
	Phones		Compute	Location	Connected Car
			Storage		

Program Objectives: Graduates of the program will have

1. A solid foundation on key emerging technologies of IOT, it's usage and future trends
2. An ability to integrate devices into complete IoT systems
3. An understanding of how IoT fits within the wider context of information and communications technology
4. An understanding of the role of data analytics, machine learning and cloud computing in an IoT system

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Curriculum

Junior Year 1st Semester (all required)

- ENEE 305SG Circuits I (4)
- ENEE 341SG Introduction to Internet of Things (4)
- ENEE 340SG Programming Concepts for Engineers (C/C++) 3
- ENEE 344SG Digital Circuits Using PSoC 3
- ENGL 393/ENGL394 Technical Writing/Business Writing 3

Junior Year 2nd Semester (all required)

- ENEE 303SG Circuits II 3
- ENEE 307SG Microelectronics Design and Sensors and Laboratory 3
- ENEE 332SG Intro to JAVA 3
- ENEE 350SG Computer Organization 3
- ENEE356SG Computing Using Python 3
- ENEE454G Engineering Math 3

Senior Year 1st Semester (Capstone I required, 3 electives)

- ENEE 408V Capstone Design Lab I 3
- ENEE 449X (elective) Web Based Applications Development 3
- ENEE 459F-SG(elective) Advanced FPGA System Design using Verilog 3
- ENEE 459V-SG(elective) Embedded Systems 3
- ENEE 459X(elective) Low Power System-on-Chip Architecture 3
- ENEE459Q(elective) Data science 3
- ENEE422SG(elective) Signal and Systems Processing 3
- ENEE426SG(elective) Communications Networks 3

Senior Year 2nd Semester ((Capstone II required, 3 electives)

- ENEE 408V(elective) Capstone Design Lab II 3
- ENEE 411G (elective) Analog & Digital Electronics 3
- ENEE 459H(elective) Advanced Software for Embedded Systems – Connected Systems 3
- ENEE 459S (elective) Hardware/Software Security for Embedded Systems 3
- ENEE Technical Elective/Engineering Practice 3
- ENEE457SG(elective) Network Security 3

Action Item Notes

- Adv Board unanimously approved proposal to take a look at CpE curriculum to address issue of low graduation rates
- Ensure adequate exposure to software engineering – Milan
- More industry talks – Sunny
- Make curriculum more relevant – Ciena
- Make some courses optional to increase flexibility
- Look at reasons why 322/324 have high DWF rate
  - If math preparation is an issue, can 'remedial' training be implemented? Can math courses be taught in ECE? Can Math Clinic for Engineers (like Slawski in Physics) be implemented? Can tutors for 322/324 be hired or numbers increased? Make it optional for CpE?