CYBER-PHYSICAL SYSTEMS ENGINEERING MAJOR

Program Director: Romel Gomez, Ph.D.

The Bachelor of Science in Cyber-Physical Systems Engineering will provide students with a solid foundation in key emerging technologies of the Internet of Things (IoT), the ability to integrate devices into complete IoT systems, and an understanding of how IoT fits within the wider context of information and communications technology, including data analytics and cloud computing. At the senior level, students will ultimately be able to specialize in one of the following tracks: Hardware, Computation, or Security track or pursue a General track option that provides a focus on courses from the other three tracks. It is expected that graduates will be in high demand in such occupational areas as hardware/software developers, computer systems analysts, network architects and administrators, information security analysts, information systems analysts and computer programs.

Admission to the Major

Clark School Admissions Criteria

All students applying to the Cyber-Physical Systems Engineering (CPSE) program must first meet the Clark School of Engineering's Limited Enrollment Program requirements (https://eng.umd.edu/transfer/external/):

Engineering LEP Requirements

- Minimum 3.0 cumulative GPA (from all previous institutions)
- Completion of MATH141 (Calculus II) with a minimum grade of a B-
- Completion of PHYS161 (Physics I) with a minimum grade of B-
- Completion of either CHEM 135, CHEM 271 or CHEM134* with a minimum grade of C-.

Students must adhere to all LEP Admissions policies outlined in the University's LEP Website (https://lep.umd.edu/).

**Students who take an equivalent to CHEM134 must also have completed an equivalent to CHEM131 with a minimum grade of C-.*

Additional Admissions Requirements

In addition to the LEP admissions criteria, students applying to the Cyber-Physical Systems Engineering (CPSE) major must meet the following requirements:

- Completion of the following major courses with a minimum grade of a C-
  - ENES100: Intro to Engineering Design
  - MATH140: Calculus I
  - PHYS260/261: Physics II
  - An introductory programming course (see curriculum page (https://shadygrove.ece.umd.edu/curriculum/) for details)
  - One of the following math courses:
    - MATH246: Differential Equations
    - MATH241: Calculus III
    - MATH240: Linear Algebra
- Completion of all lower-level General Education requirements (usually satisfied by earning an associate's degree from a community college within the State of Maryland).
- At least 60 transferable credits to UMD

Due to the similarity in curriculum content and the physical location of course offerings, students in the Electrical Engineering, Computer Engineering, and Computer Science programs at UMD will not be eligible to add Cyber-Physical Systems Engineering as a second major or degree.

This program is mainly intended for students transferring from a Maryland public community college. While students at the College Park campus can pursue the program, they will not be able to seek admission into the School of Engineering and the Cyber-Physical Systems Engineering major until they have completed the Engineering LEP gateway courses, required first and and second year major courses, lower-level General Education requirements, and have earned at least 60 credits. The junior and senior years would take place at the Shady Grove campus.

Program Educational Objectives

The program educational objective of this program is to produce a well-trained workforce in the emerging technologies of internet of things. The Bachelor of Science in Cyber-Physical Systems Engineering will produce engineering graduates who:

- Use their hardware and software engineering design training and problem-solving skills to contribute professionally in an industrial, research and applications environment;
- Demonstrate initiative, leadership, teamwork, and continued professional development;
- Demonstrate understanding of the impact of their professional activities on society.

Student Learning Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. The ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments that must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

REQUIREMENTS

First & Second Year

Prior to being admitted to the Cyber-Physical Systems Engineering major, students should have completed the Engineering LEP gateway courses, basic math/science courses, lower-level General Education requirements, and at least 60 credits.

Course	Title	Credits
MATH140	Calculus I	4
MATH141	Calculus II	4
ENGL101	Academic Writing	3
CHEM135	General Chemistry for Engineers	3
PHYS161	General Physics: Mechanics and Particle Dynamics	3
PHYS260	General Physics: Electricity, Magnetism and Thermodynamics	3
PHYS261	General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)	1
Programming Requirement [1]		2-4
ENES100	Introduction to Engineering Design	3
One of the following MATH2xx courses:		3-4
MATH246	Differential Equations for Scientists and Engineers	
MATH241	Calculus III	
MATH240	Introduction to Linear Algebra	
General Education Requirements/Additional Electives		28-31

[1] Any of the following programming courses or their equivalents will be accepted:

- ENEE140
- CMSC131
- CMSC106
- Any introductory course in C, C++, Java, or Python (student must submit the course to ECE Department for Evaluation)

Junior & Senior Year at Shady Grove

Junior Year

First Semester	Credits	Second Semester	Credits
ENEB302	4	ENEB304	3
ENEB344	4	ENEB352	3
ENEB354	3	ENEB353	3
ENEB340	3	ENEB355	3
ENEB341	3	ENEB345	3
	17		**15**

Senior Year

First Semester	Credits	Second Semester	Credits
ENEB408 (ENEB408A Capstone Design I)	3	ENEB408 (ENEB408B Capstone Design II)	3
ENEB454	3	Senior Level Electives (based on track)	12
ENEB444	3		
ENEB346 (Linear Algebra for Machine Learning Applications)	3		
Professional Writing	3		
	15		**15**

Total Credits 62

Tracks

Hardware Track

Course	Title	Credits
Required Courses		
ENEB455	Advanced FPGA System Design using Verilog for Embedded Systems	3
Elective Courses		**9**
Select three of the following:		
ENEB443	Hardware/Software Security for Embedded Systems	
ENEB451	Network Security	
ENEB452	Advanced Software for Connected Embedded Systems	
ENEB453	Web-Based Application Development	
ENEB456	Machine Learning Tools (Machine Learning Tools)	
ENEB457	Foundations of Databases for Web Applications	
Total Credits		**12**

Computational Track

Course	Title	Credits
Required Courses		
ENEB456	Machine Learning Tools (Machine Learning Tools)	3
Elective Courses		**9**
Select three of the following:		
ENEB443	Hardware/Software Security for Embedded Systems	
ENEB451	Network Security	
ENEB452	Advanced Software for Connected Embedded Systems	
ENEB453	Web-Based Application Development (Web Based Application Development)	
ENEB455	Advanced FPGA System Design using Verilog for Embedded Systems	
ENEB457	Foundations of Databases for Web Applications	
Total Credits		**12**

Security Track

Course	Title	Credits
Required Courses		
ENEB451	Network Security	3
Elective Courses		**9**
Select three of the following:		
ENEB443	Hardware/Software Security for Embedded Systems	
ENEB452	Advanced Software for Connected Embedded Systems	
ENEB453	Web-Based Application Development	

ENEB455	Advanced FPGA System Design using Verilog for Embedded Systems
ENEB456	Machine Learning Tools (Machine Learning Tools)
ENEB457	Foundations of Databases for Web Applications (Foundations of Databases for Web Applications)
Total Credits	**12**

General Track

The General Track offers a general focus of course content with classes from each of the three tracks. While there are no specific required or elective courses for this track, the General Track requires 12 credits, which is the same as the other three tracks. Consult with an advisor for details.

GRADUATION PLANS

Click here (https://eng.umd.edu/advising/four-year-plans/) for roadmaps for graduation plans in the A. James Clark School of Engineering.

Additional information on developing a graduation plan can be found on the following pages:

- http://4yearplans.umd.edu
- the Student Academic Success-Degree Completion Policy (https://academiccatalog.umd.edu/undergraduate/registration-academic-requirements-regulations/academic-advising/#success) section of this catalog