

CYBER-PHYSICAL SYSTEMS ENGINEERING MAJOR

Notice of Addendum: The Student Learning Outcomes on this page were updated via an addendum. To see the update, visit [ADDENDA TO THIS CATALOG \(https://academiccatalog.umd.edu/undergraduate/addenda/#cyber-physical-systems-engineering-major\)](https://academiccatalog.umd.edu/undergraduate/addenda/#cyber-physical-systems-engineering-major).

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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

As an undergraduate program within the A. James Clark School of Engineering, the Cyber-Physical Systems Engineering major is a Limited Enrollment Program (LEP). Admission to this program will follow the School of Engineering's admissions criteria found on the LEP website: <http://lep.umd.edu>.

Beyond the LEP gateway criteria, students will need to fulfill the following requirements to gain admission to the Cyber-Physical Systems Engineering major:

- Completion of all first and second year required major courses with a minimum grade of a "C-."
- Completion of all lower-level University General Education requirements.
- Completion of 60 credits.

A minimum grade point average of 3.0 in all courses taken at the University of Maryland and all other institutions is required for internal and external transfer students.

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 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 Education Objectives

The program education 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 apply knowledge of computing, engineering, science, and mathematics to identify, analyze and solve complex engineering problems.
2. An ability to design, implement, and evaluate a computer-based system, process, component, or program 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. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
5. An ability to analyze the local and global impact of computing on individuals, organizations, and society.
6. An ability to function effectively on teams to accomplish a common goal.
7. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
8. An ability to acquire and apply new knowledge, 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: Vibration, Waves, Heat, Electricity and Magnetism	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.

FOUR-YEAR PLAN

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

Additional information on developing a four-year academic 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