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.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH140</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH141</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>ENGL101</td>
<td>Academic Writing</td>
<td>3</td>
</tr>
<tr>
<td>CHEM135</td>
<td>General Chemistry for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>PHYS161</td>
<td>General Physics: Mechanics and Particle Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS260</td>
<td>General Physics: Vibration, Waves, Heat, Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHYS261</td>
<td>General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)</td>
<td>1</td>
</tr>
<tr>
<td>Programming Requirement</td>
<td>2-4</td>
<td></td>
</tr>
<tr>
<td>ENES100</td>
<td>Introduction to Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>One of the following MATH2xx courses:</td>
<td>3-4</td>
<td></td>
</tr>
</tbody>
</table>
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
Course  Title  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
Course  Title  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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENEB455</td>
<td>Advanced FPGA System Design using Verilog for Embedded Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

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
ENEB455  Advanced FPGA System Design using Verilog for Embedded Systems
ENEB457  Foundations of Databases for Web Applications (Foundations of Databases for Web Applications)

Total Credits 12

Computational Track

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENEB456</td>
<td>Machine Learning Tools (Machine Learning Tools)</td>
<td>3</td>
</tr>
</tbody>
</table>

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
ENEB455  Advanced FPGA System Design using Verilog for Embedded Systems
ENEB457  Foundations of Databases for Web Applications (Foundations of Databases for Web Applications)

Total Credits 12

Security Track

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENEB451</td>
<td>Network Security</td>
<td>3</td>
</tr>
</tbody>
</table>

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
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.

Total Credits 12

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