Advice on Undergraduate Courses for the
Accelerated Master’s Program in Electrical Engineering
at Haverford College and the University of Pennsylvania

The Master’s degree in Electrical Engineering requires ten graduate level (500 or 600 level) courses, of which five must come from a set of core courses, shown in the table below. Students have the option of concentrating in one of the three areas shown in the table:

Physical Devices and Nanosystems: Often leads to careers in consulting and in research.
Circuits and Computer Engineering: Often leads to careers in circuits and in defense (e.g. Lockheed).
Information and Decision Systems: Often leads to careers in intelligence and with tech companies (e.g. Google, Amazon).

Note that students are not required to concentrate in one of the areas, and may choose any five courses from the table; the courses need not come from a single area. However, taking courses from more than one area increases the number of prerequisite engineering courses that must be taken, as explained below.

Table of core courses (at least five required for the Master’s degree)
Note: You should probably check here for the most up to date version: https://www.ese.upenn.edu/masters/electrical-engineering-program/mse-ee-deg-reqs/

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<th>Physics Devices &amp; Nano Systems</th>
<th>Circuits &amp; Computer Engineering</th>
<th>Information &amp; Decision Systems</th>
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<tr>
<td>ESE 5100: Electromagnetic &amp; Optical Theory</td>
<td>ESE 5160: IoT Edge Computing</td>
<td>ESE 5030: Simulation Modeling &amp; Analysis</td>
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<td>ESE 5130: Principles of Quantum Technology</td>
<td>ESE 5190: Smart Devices</td>
<td>ESE 5060: Intro to Optimization Theory</td>
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<td>ESE 5230: Quantum Engineering</td>
<td>ESE 5350: Electronic Design Automation</td>
<td>ESE 5120: Dynamical Systems for Engineering &amp; Biological Applications</td>
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<td>ESE 5250: Nanoscale Science &amp; Engineering</td>
<td>ESE 5390 HW/SW Co-Design for ML</td>
<td>ESE 5140: Graph Neural Networks</td>
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<td>ESE 5800: Power Electronics</td>
<td>ESE 5420: Statistics for Data Science</td>
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<td>ESE 6680: Mixed Signal Design &amp; Modeling</td>
<td>ESE 5450: Data Mining: Learning from Massive Datasets</td>
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<td>ESE 5460: Principles of Deep Learning</td>
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PREREQUISITES FOR CORE COURSES

Each of the above courses has significant prerequisites, many of which can be satisfied by Haverford and Bryn Mawr courses. The listings below assume you have completed physics H105 and H106 and math through linear algebra.

Physical Devices and Nano Systems core courses

All courses in this area require physics through intro quantum mechanics (214)

Courses with no additional prerequisites besides the above:
- ESE 5090
- ESE 5130
- ESE 5290

Courses which require Electronic, Photonic, and Electromechanical Devices (Penn ESE 2180) as a prerequisite, in addition to the other prerequisites listed below:
- ESE 5100: no additional prerequisites
- ESE 5210: no additional prerequisites
- ESE 5230: *Advanced Quantum Mechanics* (Haverford Physics 302)
- ESE 5250: no additional prerequisites
- ESE 5360: permission of the instructor required, but usually granted to Accelerated Master’s students. Alternatively, you can take *Nanoscale Science and Engineering* (Penn ESE 5250).

Circuits and Computer Engineering core courses

All courses in this area require the following as prerequisites:

- Electrical Systems and Circuits (Penn ESE 2150)
- Haverford CMSC H105, CMSC H107, ASTR H104, or equivalent significant programming experience
- Haverford PHYS H211
- Bryn Mawr PHYS B305 strongly suggested, but not required

Course with no additional prerequisites besides the above:
- ESE 5150
- ESE 5350
- ESE 5390
- ESE 5800
- ESE 6680

Courses with additional non-course prerequisites:
- ESE 5320: Knowledge of C programming. One way to obtain this is with Penn ESE 2400. *Embedded Systems/Microcontroller Laboratory* (Penn ESE 3500) recommended.

Courses that additionally require one Penn course (highlighted in blue) as a prerequisite:
- ESE 5190: *Embedded Systems/Microcontroller Laboratory* (Penn ESE3500)
- ESE 5700: *Fundamentals of Solid State Circuits* (Penn ESE 3190)
- ESE 5720: *Fundamentals of Solid State Circuits* (Penn ESE 3190)
Courses that additionally require two or more Penn courses (highlighted in blue) as prerequisites:

**ESE 5160:** Embedded Systems/Microcontroller Laboratory (Penn ESE3500) and Smart Devices (Penn ESE 5190)

**ESE 5780:** Fundamentals of Solid State Circuits (Penn ESE 3190) and Analog Integrated Circuits (Penn ESE 5720)

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<td>Courses with no additional prerequisites:</td>
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All the following require Signal and Information Processing (Penn ESE 2240) as a prerequisite

Courses with no additional prerequisites besides the above:

ESE 5070
ESE 5140
ESE 5300 Suggested: Statistical Methods and Their Applications (Math H203)

Courses that additionally require only Haverford and Bryn Mawr courses as prerequisites:

**ESE 5000:** Differential Equations (Math H204 or B210)
**ESE 5120:** Differential Equations (Math H204 or B210), Suggested: Intro to Dynamic Systems (Penn ESE 2100)

**ESE 5310:** Waves and Optics (Physics H213) or other course that covers Fourier analysis

**ESE 5420:** Topics in Intro Programming: Physics and Astronomy (CMSC H104) OR Introduction to Computer Science (CMSC H105) OR Introduction to Computer Science and Data Structures (CMSC H107)

**ESE 5450:** Topics in Intro Programming: Physics and Astronomy (CMSC H104) OR Introduction to Computer Science (CMSC H105) OR Introduction to Computer Science and Data Structures (CMSC H107)

Courses that additionally require one Penn course (highlighted in blue) as a prerequisite:

**ESE 5460:** Topics in Intro Programming: Physics and Astronomy (CMSC H104) OR Introduction to Computer Science (CMSC H105) OR Introduction to Computer Science and Data Structures (CMSC H107) AND Data Mining: Learning from Massive Datasets (Penn ESE 5450)