

**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/>

<b>Physics Devices &amp; Nano Systems</b>	<b>Circuits &amp; Computer Engineering</b>	<b>Information &amp; Decision Systems</b>
ESE 5090: Quantum Circuits & Systems	ESE 5150: Internet of Things: Sensors & Systems	ESE 5000: Linear Systems Theory
ESE 5100: Electromagnetic & Optical Theory	ESE 5160: Iot Edge Computing	ESE 5030: Simulation Modeling & Analysis
ESE 5130: Principles of Quantum Technology	ESE 5190: Smart Devices	ESE 5060: Intro to Optimization Theory
ESE 5210: The Physics of Solid State Energy Devices	ESE 5320: System on a Chip Architecture	ESE 5070: Introduction to Networks & Protocols
ESE 5230: Quantum Engineering	ESE 5350: Electronic Design Automation	ESE 5120: Dynamical Systems for Engineering & Biological Applications
ESE 5250: Nanoscale Science & Engineering	ESE 5390 HW/SW Co-Design for ML	ESE 5140: Graph Neural Networks
ESE 5290: Introduction to MEMS and NEMS	ESE 5700: Digital Integrated Circuits & VLSI Fundamentals	ESE 5280: Estimation & Detection Theory
ESE 5360: Nanofabrication & Nanocharacterization	ESE 5720: Analog Integrated Circuits	ESE 5300: Elements of Probability Theory
	ESE 5780: RFIC (Radio Frequency Integrated Circuit) Design	ESE 5310: Digital Signal Processing
	ESE 5800: Power Electronics	ESE 5420: Statistics for Data Science
	ESE 6680: Mixed Signal Design & Modeling	ESE 5450: Data Mining: Learning from Massive Datasets
		ESE 5460: Principles of Deep Learning

## 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)

<b>Information and Decision Systems core courses</b>
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**Courses with no additional prerequisites:**

**ESE 5030**

**ESE 5060**

**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)