

# **BIOENGINEERING 4+1 CURRICULUM (U. PENN MSE DEGREE) FOR UNDERGRADUATES AT HAVERFORD (2017)**

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## **I. Applying to the Penn Bioengineering Program:**

<http://www.be.seas.upenn.edu/prospective-students/masters/applying.php>

## **II. Overview of requirements**

### **Prerequisite Requirements**

Academic requirements for the MSE degree are an undergraduate degree from an accredited natural science major, with completion of the following minimum coursework:

- Math preparation through calculus III (the equivalent of three semesters);
- One year of physics with calculus and laboratory
- One year of biology with lab
- One year of chemistry with lab
- Minimum Science GPA of 3.0

### **Other Highly Recommended Courses and Advice**

- Differential equations (MATHH 204) and/or linear algebra (MATHH215)
- One 300-level course in physics (Mechanics of Discrete and Continuous Systems (PHYSH308 particularly recommended w/ PHYSH213 as prerequisite)
- At least one semester of organic chemistry (CHEM222 or CHEM225)
- Engineering Mechanics 006 course at Swarthmore
- A GPA of 3.5 is highly recommended to be competitive in the application pool
- It should be noted that Bioengineering is a relatively new foray for engineers. While in some areas of engineering the MSE is traditionally a terminal degree, this is less the situation in Bioengineering. Students should be prepared to consider a PhD thesis if they wish to have the full scope of opportunities for careers in Bioengineering.

## Curricular Requirements of All MSE Students

There are eight required MSE course units that must be taken by students in both the thesis and non-thesis tracks, for which up to three of these courses may double-count towards the MSE degree and an HC degree. Penn BE courses may be taken during a student's third and fourth undergraduate year; two such courses are recommended for a student to stay on track to receiving the MSE after one year of study post-graduation from HC. These MSE requirements are:

- [One graduate level math course](#)
- [One Biological Science course \(Students may select from BE 513, BIOM 600, or another Biology course\)](#)
- [Two Bioengineering graduate courses \(must be BE courses\)](#)
- Three SEAS and or Biomedical Science Electives (one of these may be replaced by a two-quarter set of 35x/36x courses at Haverford)
- One technical elective course from any science or engineering discipline
- A thesis project is highly recommended
- [Students can download a list of approved graduate courses here.](#)

### Other resources:

**A list of the Bioengineering electives that a student could take at UPenn.**  
<http://www.be.seas.upenn.edu/about-academics/pdf/BE%20ABET%20Accredited%20Course%20Descriptions.pdf>

### III. Sample Schedules

**Sample schedule for Haverford student coming in with calculus and interested in the 4+1 MSE degree in Bioengineering with a Biology major.**

<b>First year</b>	<b>Semester 1</b>	<b>Semester 2</b>
	Chem 111	Chem 112 or 115
	Physics 105	Physics 106
	Language	Language
	Other class	Writing
<b>Second year</b>	Bio200a	Bio200b
	Physics 213 (& 211?)	Math 204 or 215
	Other class	Other class
	Other class	Other class
<b>Third year</b>	3xx Biology (2 quarters)	3xx Biology (2 quarters)
	Superlab in Biology	Superlab in Biology
	Organic Chem	Engineering 006 (Engineering Mechanics) at Swarthmore <i>or</i> Bioengineering Class (Penn)
	Physics 308	Other class
<b>Fourth year</b> * Note: <b>Bio499</b> needs to be taken all year (0.5 credits for entire year)	Bioengineering Class (Penn)	Bioengineering Class (Penn)
	Senior thesis research	Senior thesis research
	35x Biology	35x Biology
	Other class	Other class

**Sample schedule for Haverford student coming in without calculus and interested in the 4+1 MSE degree in Bioengineering with a Biology major.**

<b>First year</b>	<b>Semester 1</b>	<b>Semester 2</b>
	Chem 111	Chem 112 or 115
	Math 118	Math 121
	Language	Language
	Other class	Writing
<b>Second year</b>		
	Bio200a	Bio200b
	Physics 105	Physics 106
	Organic Chem	Math 204 or 215
	Other class	Other class
<b>Third year</b>		
	3xx Biology (2 quarters)	3xx Biology (2 quarters)
	Superlab in Biology	Superlab in Biology
	Physics 213 (& 211?)	Engineering 006 (Engineering Mechanics) at Swarthmore <i>or</i> Bioengineering Class (Penn)
	Other class	Other class
<b>Fourth year</b>		
<b>* Note: Bio499</b> needs to be taken all year (0.5 credits for entire year)	Bioengineering Class (Penn)	Bioengineering Class (Penn)
	Senior thesis research	Senior thesis research
	35x Biology	35x Biology
	Physics 308	Other class

**Sample schedule for Haverford student with calculus interested in the 4+1 MSE degree in Bioengineering, with interdisciplinary physics major at Haverford.**

<b>First year</b>	<b>Semester 1</b>	<b>Semester 2</b>
<i>With hope that student has successfully completed Calculus in high school</i>	Chem 111	Chem 112 or 115
	Physics 105	Physics 106
	Language	Language
	Writing	Other class
<b>Second year</b>	<b>Bio200a</b>	<b>Bio200b</b>
This schedule has you taking 3.5 credits the first semester of this year, because the courses are challenging, but some students would prefer to take 4.5 courses.	Physics 213 (Waves & Oscillations)	Physics 214 (Intro Quantum)
	Physics 211 (Waves Lab, half credit)*	Engineering 006 (Engineering Mechanics) at Swarthmore or Bioengineering Class (Penn)
	Math 121 (Multivariable), 204 (partial differential equations) or 215 (Linear algebra)	Other class
<b>Third year</b>	Advanced Physics Lab	Bioengineering Class (Penn) (Could be postponed to senior year)
	Organic Chem	300-level physics
	Physics 308 (Mechanics of discrete and continuous systems)	Math 215
	Other class	Other class
<b>Fourth year</b>	Bioengineering Class (Penn)	Bioengineering Class (Penn)
	Senior thesis research	Senior thesis research
	Physics 399 (Senior seminar, half credit)	Physics 399 (Senior seminar, half credit)
	300-level physics	Other class
	Other class	Other class