

# CHEMICAL AND BIOMOLECULAR ENGINEERING, PHD

The Ph.D. in Chemical and Biomolecular Engineering is primarily a research-oriented degree for students showing exceptional promise for original contributions to the theory and practice of chemical and biomolecular engineering. The degree is a virtual requirement for those planning to teach chemical and biomolecular engineering, as well as for those planning on a research career. Doctoral candidates are expected to show superior capability for independent work and study.

**For more information:** <http://www.cbe.seas.upenn.edu/prospective-students/doctoral/index.php> (<http://www.cbe.seas.upenn.edu/prospective-students/doctoral/>)

## University PhD Benchmarks

In addition to Program requirements, the following milestones must be completed:

Code	Title	Course Units
	Qualifying Evaluation	
	Candidacy Examination	
	Dissertation Defense/Oral Exam	
	Dissertation Deposit	

For more information view the University's Academic Rules for PhD Programs (<http://catalog.upenn.edu/pennbook/academic-rules-phd/>).

## Required Courses

Code	Title	Course Units
<b>Core Courses</b>		
ENM 5100	Foundations of Engineering Mathematics - I	1
ENM 5110	Foundations of Engineering Mathematics - II	1
or ENM 5020	Numerical Methods and Modeling	
CBE 6180	Advanced Molecular Thermodynamics	1
CBE 6210	Advanced Chemical Kinetics and Reactor Design	1
CBE 6400	Transport Processes I	1
<b>Electives</b>		
Select five course units <sup>1</sup>		5
<b>Teaching Requirement</b>		
CBE 8950	Teaching Practicum	
<b>Seminar</b>		
CBE 6990	Chemical and Biomolecular Engineering Seminar (minimum 6 semesters)	
CBE 9000	Chemical and Biomolecular Fourth Year Seminar	
<b>Dissertation/Research</b>		
CBE 9999	Independent Study Research	

or CBE 9950 Dissertation

**Total Course Units** 10

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<sup>1</sup> 5 CU's of electives are required to complete the doctoral program. PhD students in CBE select their electives with their Faculty Advisor. Electives may be chosen from any courses at a level of 5000 or above. Students may take up to 1 course in the Wharton School. Non-technical classes will be allowed at the discretion of the Graduate Chair.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2025 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.

### Sample Plan of Study

Code	Title	Course Units
<b>First Year</b>		
<i>Fall</i>		
CBE 6180	Advanced Molecular Thermodynamics	
CBE 6400	Transport Processes I	
ENM 5100	Foundations of Engineering Mathematics - I	
CBE 6990	Chemical and Biomolecular Engineering Seminar	
<i>Spring</i>		
ENM 5020	Numerical Methods and Modeling	
CBE 6210	Advanced Chemical Kinetics and Reactor Design	
CBE 6990	Chemical and Biomolecular Engineering Seminar	
Elective (1-2) <sup>1</sup>		
Qualifier Exam		
<b>Second Year</b>		
<i>Fall</i>		
CBE 8950	Teaching Practicum	
CBE 9999	Independent Study Research	

CBE 6990 Chemical and Biomolecular Engineering Seminar

Electives (2-3) <sup>1</sup>

*Spring*

CBE 8950 Teaching Practicum

CBE 9999 Independent Study Research

CBE 6990 Chemical and Biomolecular Engineering Seminar

Electives (1-2) <sup>1</sup>

**Third Year**

CBE 9999 Independent Study Research  
or CBE 9950 Dissertation

CBE 6990 Chemical and Biomolecular Engineering Seminar

**Fourth Year and beyond**

CBE 9000 Chemical and Biomolecular Fourth Year Seminar

CBE 9999 Independent Study Research  
or CBE 9950 Dissertation

<sup>1</sup> Electives can be chosen from most 5000+ level courses in engineering or the sciences and should be chosen with advisor input. Courses outside of engineering MUST have advisor approval prior to registration.