

# NANOTECHNOLOGY, MINOR

Nanotechnology is an interdisciplinary field that underpins next generation energy, communications, and health care solutions. The Nanotechnology minor provides the foundation to contribute to these advances. The program is accessible to engineering and physical science students.

## SEAS Second Major or Minor Option

Students interested in a second major (College students only) or minor with SEAS are required to meet with the Undergraduate Curriculum Chair from the major/minor department you wish to declare to discuss requirements and obtain approval on the Second Major or Minor form. The approved form must be returned to the SEAS Research and Academic Services Office, 109 Towne Building.

**For more information:** <http://www.seas.upenn.edu/undergraduate/degrees/minors.php>

## Nanotechnology Minor

Code	Title	Course Units
EAS 210		1
<i>Basic Science and Engineering Electives</i>		
Select one of the following:		1
CBE 231	Thermodynamics of Fluids	
CBE 351	Heat and Mass Transport	
ESE 218	Electronic, Photonic, and Electromechanical Devices	
ESE 310	Electric and Magnetic Fields I	
MEAM 203	Thermodynamics I	
MEAM 302	Fluid Mechanics	
or CBE 350	Fluid Mechanics	
MEAM 333	Heat and Mass Transfer	
MSE 221	Quantum Physics of Materials	
MSE 260	Energetics of Macro and Nano-scale Materials	
<i>Biotechnology and Biophysics Electives</i>		
Select one of the following:		1
BE 350	Introduction to Biotransport Processes	
CBE 150	Introduction to Biotechnology	
CBE 479	Biotechnology and Biochemical Engineering	
CBE 480	Laboratory in Biotechnology and Genetic Engineering	
PHYS 280	Physical Models of Biological Systems	
<i>Nano/Micro Fabrication Devices Electives</i>		
Select one of the following:		1
CIS 398	Quantum Computer and Information Science	
ESE 460	Principles of Microfabrication Technology	
ESE/MEAM 550	Advance Transportation Seminar, Air Transportation Planning	
ESE/MSE 525	Nanoscale Science and Engineering	

MSE 465/565 Fabrication and Characterization of Micro and Nanostructured Devices

*Nano Electives*

Select two NANO electives <sup>1</sup> 2

Total Course Units 6

<sup>1</sup> Program approval required.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2018 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.