

NANOTECHNOLOGY, MSE

Nanotechnology, the application of the science of the very small, is an exciting field that is enabling solutions in alternative energy, electronic devices, medical diagnostics and therapeutics. Penn's Nanotechnology Master's degree can prepare students for leadership roles, both technical and managerial, in emerging high tech industries as well as in traditional industries that exploit nanoscale phenomena.

For more information: <https://masters.nano.upenn.edu/>

Curriculum

10 course units are required for the MSE in Nanotechnology.^{1,2}

Code	Title	Course Units
Required Courses		
ENGR 5040	Fundamental Concepts in Nanotechnology	1
ESE/MSE 5250	Nanoscale Science and Engineering	1
ESE 5360	Nanofabrication and Nanocharacterization	1
or MSE 5650	Fabrication and Characterization of Micro and Nanostructured Materials	
Nanotechnology Core		
Select 4 from the following:		4
BE 5550	Nanoscale Systems Biology	
CBE 5250	Molecular Modeling and Simulations	
CBE 5310	Nano-Transport	
CBE 5350	Interfacial Phenomena	
CBE 5450	Electrochemical Energy Conversion and Storage	
CBE 5460	Fundamentals of Industrial Catalytic Processes	
CBE 5550	Nanoscale Systems Biology	
ESE 5100	Electromagnetic and Optics	
ESE 5130	Prin of Quantum Tech	
ESE 5210	The Physics of Solid State Energy Devices	
ESE 5230	Quantum Engineering	
ESE 5290	Introduction to Micro- and Nano-electromechanical Technologies	
ESE 6110	Nanophotonics: Light at the Nanoscale	
ESE 6210	Nanoelectronics	
ESE 6250	Nanorobotics	
ESE 6730	Integrated Photonic Systems	
MSE 5050	Mechanical Properties of Macro/Nanoscale Materials	
MSE 5200	Structure of Materials	
MSE 5370	Nanotribology	
MSE 5400	Kinetics of Materials	
MSE 5500	Elasticity and Micromechanics of Materials	
MSE 5550	Electrochemical Engineering of Materials	
MSE 5610	Atomic Modeling in Materials Science	
MSE 5700	Physics of Materials I	
MSE 5750	Statistical Mechanics	
MSE 6100	Transmission Electron Microscopy	

MSE 6110	Advanced Synchrotron and Electron Characterization of Materials	
MSE 6400	Optical Materials	
MEAM 5030	Direct Energy Conversion: from Macro to Nano	
MEAM 5040	Tribology	
MEAM 5050	Mechanical Properties of Macro/Nanoscale Materials	
MEAM 5190	Elasticity and Micromechanics of Materials	
MEAM 5290	Introduction to Micro- and Nano-electromechanical Technologies	
MEAM 5370	Nanotribology	
MEAM 5500	Design of Microelectromechanical Systems	
MEAM 5550	Nanoscale Systems Biology	
MEAM 5700	Transport Processes I	
MEAM 5750	Micro and Nano Fluidics	
MEAM 5800	Electrochemistry for Energy, Nanofabrication and Sensing	
MEAM 6630	Mechanics of Macromolecules	
Science or Technology-Relevant Electives		
Select 3 pre-approved Science or Technology-Relevant electives ³		3
Total Course Units		10

¹ Students must complete 10 course units at the graduate level (5000+)

² Students must attend and submit reports on four technical seminars (two seminars per year for full-time students). Students are expected to present on seminars they attended during their first year to the new cohort of Nano students the following year.

³ Science or Technology-Relevant Electives:

- These courses may be chosen from: any SEAS course (including engineering entrepreneurship, technology policy, NANO 5970 Master's Thesis Research, special topics, and/or NANO 5990 Master's Independent Study, as well as technology-relevant courses from other Penn departments (typically physics, chemistry, math, biology, etc.).
- The courses must have significant technical and scientific content and relevance to the student's program.
- Approval must be obtained from the NANO program prior to enrollment in the course.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2024 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.