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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Course Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 504</td>
<td>Fundamental Concepts in Nanotechnology</td>
<td>1</td>
</tr>
<tr>
<td>ESE/MSE 525</td>
<td>Nanoscale Science and Engineering</td>
<td>1</td>
</tr>
<tr>
<td>ESE 536 or MSE 565</td>
<td>Nanofabrication and Nanocharacterization</td>
<td>1</td>
</tr>
<tr>
<td>ESE 536 or MSE 565</td>
<td>Fabrication and Characterization of Micro and Nanostructured Materials</td>
<td>1</td>
</tr>
</tbody>
</table>

Nanotechnology Core

Select 4 from the following: 4

- BE 555 Nanoscale Systems Biology
- CBE 525 Molecular Modeling and Simulations
- CBE 535 Interfacial Phenomena
- CBE 545 Electrochemical Energy Conversion and Storage
- CBE 546 Fundamentals of Industrial Catalytic Processes
- CBE 555 Nanoscale Systems Biology
- CBE 641 Transport Processes II (Nanoscale Transport)
- ESE 510 Electromagnetic and Optics
- ESE 521 The Physics of Solid State Energy Devices
- ESE 523 Quantum Engineering
- ESE 526 Photovoltaic Systems Engineering
- ESE 529 Introduction to Micro- and Nanoelectromechanical Technologies
- ESE 611 Nanophotonics: Light at the Nanoscale
- ESE 621 Nanoelectronics
- MSE 505 Mechanical Properties of Macro/Nanoscale Materials
- MSE 520 Structure of Materials
- MSE 537 Nanotribology
- MSE 550 Elasticity and Micromechanics of Materials
- MSE 555 Electrochemical Engineering of Materials
- MSE 561 Atomic Modeling in Materials Science
- MSE 570 Physics of Materials I
- MSE 640 Optical Materials
- MEAM 504 Tribology
- MEAM 505 Mechanical Properties of Macro/Nanoscale Materials
- MEAM 537 Nanotribology

MEAM 550 Design of Microelectromechanical Systems
MEAM 555 Nanoscale Systems Biology
MEAM 570 Transport Processes I
MEAM 575 Micro and Nano Fluidics
MEAM 580 Electrochemistry for Energy, Nanofabrication and Sensing

Science or Technology-Relevant Electives

Select 3 pre-approved Science or Technology-Relevant electives 3

Total Course Units 10

1 Students must complete 10 course units at the graduate level (500+)
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 597 Master’s Thesis Research, special topics, and/or NANO 599 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 2019 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.