

# NANOTECHNOLOGY, MINOR

Requirements for a minor may be completed at any campus location offering the specified courses for the minor. Students may not change from a campus that offers their major to a campus that does not offer their major for the purpose of completing a minor.

## Program Description

The Nanotechnology minor is designed to help prepare students from diverse disciplines for careers in a broad range of industries innovating with nanotechnology. The minor builds on the singular strengths of Penn State's nanofabrication facilities including its class 1 and class 10 clean rooms, its faculty, and existing academic programs. The minor provides students with fundamental knowledge and skills in simulation, design, modeling, syntheses, characterization, properties, processing, manufacturing, and applications at the nano scale.

As nanotechnology increasingly bridges across disciplines, a basic understanding of mathematics, physics, biology, and chemistry is recommended. To complete the 18 credit nanotechnology minor, students will take two prescribed courses (6 credits) in nanoscience fundamentals, and then select four additional courses (12 credits) from a growing list of courses that address the areas described in the previous paragraph.

In addition to nanotechnology career opportunities in microelectronics, information storage, optoelectronics, bioelectronics, pharmaceuticals, agriculture, medicine, life sciences and the sciences, the minor prepares undergraduate students to support major new nanotechnology research programs as graduate students. Interested 3rd and 4th year students from related fields in engineering, the chemical, physical, and the biological sciences, medicine, life, and agricultural sciences are encouraged to enroll.

## What is Nanotechnology?

Nanotechnology is inherently interdisciplinary and bridges across physics, biology, materials science, and chemistry. It is a general purpose, enabling technology that is already impacting a broad spectrum of human endeavors, from medicine and catalysis to textiles and quantum computing.

## You Might Like This Program If...

- You are interested in an interdisciplinary minor that bridges across physics, biology, materials science, and chemistry.
- You are interested in gaining fundamental knowledge and skills in nanoscale simulation, design, syntheses, characterization, properties, processing, manufacturing, and applications.

## Program Requirements

Requirement	Credits
Requirements for the Minor	18

## Requirements for the Minor

A grade of C or better is required for all courses in the minor, as specified by Senate Policy 59-10 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/59-00-minors-and-certificates/#59-10>).

Code	Title	Credits
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### Prescribed Courses

<i>Prescribed Courses: Require a grade of C or better</i>		
ESC 312	Engineering Applications of Wave, Particle, and Ensemble Concepts	3
ESC 313	Introduction to Principles, Fabrication Methods, and Applications of Nanotechnology	3

### Supporting Courses and Related Areas

<i>Supporting Courses and Related Areas: Require a grade of C or better</i>		
Select 12 credits (at least 6 credits at the 400 level) from an approved list		12

## Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy>)

## University Park

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## Career Paths

In addition to preparing students for career opportunities in a diverse variety of fields such as microelectronics, information storage, optoelectronics, pharmaceuticals, agriculture, and medicine, the minor also prepares undergraduate students for exciting research opportunities and multidisciplinary nanotechnology-based advanced degree programs in graduate schools around the world. Graduate students in engineering science and mechanics conduct innovative research with a diverse, award-winning faculty on interdisciplinary programs that address society's grand challenges.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES WITH A MINOR IN NANOTECHNOLOGY (<http://www.esm.psu.edu/academics/resources/career-resources.aspx>)

## Opportunities for Graduate Studies

The ESM department offers the following graduate degree options:

- Master of Engineering (M.Eng.) in Engineering Mechanics
- Master of Engineering (M.Eng.) in Additive Manufacturing
- Master of Science (M.S.) in Engineering at the Nano-scale

- Master of Science (M.S.) in Engineering Science and Mechanics
- Master of Science (M.S.) in Additive Manufacturing
- Doctor of Philosophy (Ph.D.) in Engineering Science and Mechanics
- Doctor of Medicine and Doctor of Philosophy in Engineering Science and Mechanics (M.D./Ph.D.)
- Graduate Certificate in Laser-Materials Processing and Laser-Based Manufacturing

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<http://www.esm.psu.edu/academics/graduate/prospective-students.aspx>)

## **Contact**

### **University Park**

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