

NANOTECHNOLOGY, CERTIFICATE

Requirements for an undergraduate certificate may be completed at any campus location offering the specified courses for the certificate.

Program Description

The primary goal of the program is to offer students and incumbent workers worldwide the opportunity to earn this 18-credit certificate, which will be available only online. All candidates are required to successfully complete the required courses.

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. The Nanotechnology certificate is designed to help prepare students from a broad range of disciplines for careers or graduate study in fields involving nanotechnology. It builds upon the strengths of Penn State's faculty, expertise, academic programs, and nanofabrication facilities, including its class 1 and class 10 cleanrooms. The curriculum provides students with fundamental knowledge and skills in nanoscale simulation, design, syntheses, characterization, properties, processing, manufacturing, and applications.

You Might Like This Program If...

You are interested in gaining fundamental knowledge and skills in nanoscale simulation, design, syntheses, characterization, properties, processing, manufacturing, and applications.

Program Requirements

To earn an undergraduate certificate in Nanotechnology, a minimum of 18 credits is required.

Code	Title	Credits
Prescribed Courses		
ESC 211	Material, Safety and Equipment Overview for Nanotechnology	3
ESC 212	Basic Nanotechnology Processes	3
ESC 213	Materials in Nanotechnology	3
ESC 214	Patterning for Nanotechnology	3
ESC 215	Nanotechnology Applications	3
ESC 216	Characterization, Testing of Nanotechnology Structures and Materials	3

Prerequisites Required.

Certificate Learning Objectives

- MATERIALS AND SAFETY:** Students will learn the principles and practices of safe equipment operation/maintenance and materials handling in regards to environment, health and safety issues. Material classification methods based on their physical, mechanical and optical properties will be covered while vacuum systems are introduced.
- NANOTECHNOLOGY PROCESSES:** Students will be introduced to the basic processes involved in "top down", "bottom up", and hybrid

nanofabrication including deposition, etching, and pattern transfer. Students will learn the similarities and differences in the equipment used and process flows. Nano-characterization methods will also be outlined.

- NANOSTRUCTURES:** Students will develop a detailed understanding of how materials are fabricated into nano-structures used in nanotechnology. Nanoparticles, quantum dots will be covered with their bio applications. Oxidation and plasma techniques will also be studied.
- PATTERNING:** Students will be able to identify techniques of advanced pattern transfer and select the appropriate tool and technique that will best create the product needed in the competitive modern workplace.
- MATERIAL MODIFICATION:** Students will learn in detail processing techniques and about the operation of specialty tools used in materials modification in forming nanoscale devices and systems. Students will also learn to avoid unintentional material modifications. Application fields of nanotechnology in health sciences, energy, manufacturing, food, agriculture, medicine and environmental discussions will be highlighted.
- CHARACTERIZATION:** Students will examine characterization techniques and measurements essential for testing and for controlling material fabrication and final device performance.

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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World Campus

Undergraduate Academic Advising

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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 certificate also prepares undergraduate students for exciting research opportunities and multidisciplinary nanotechnology-based advanced degree programs in graduate schools around the world.

Contact

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World Campus

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<https://www.worldcampus.psu.edu/degrees-and-certificates/nanotechnology-certificate/overview> (<https://www.worldcampus.psu.edu/degrees-and-certificates/nanotechnology-certificate/overview/>)