Master of Nanoengineering Program

Executive Summary

The Master of Nanoengineering (MNAE) program is designed for students with an undergraduate degree in a science or engineering discipline who wish to pursue a graduate degree in nanoengineering. The field of nanoengineering is expected to revolutionize technology and improve quality of life, particularly as related to energy, environment, and health. Students will achieve an understanding of the fundamental advantages in nanoscale materials, devices, and systems. The interdisciplinary MNAE program will be offered on campus and via the internet through the North Carolina State University College of Engineering Online program. It is a 30 credit hour degree program that does not require a thesis, final oral exam or on-campus residency. NC State has an existing strength in nanostructured materials and devices, and additional information on our nanotechnology efforts can be found at http://ncsu.edu/nano.

The degree will cover all of the key components, namely, advanced materials synthesis and processing, nanoscale characterization and unique properties of nanomaterials, simulation and modeling, and nanoscale devices and systems. Figure 1 shows the framework for the proposed program. This octahedron demonstrates the science base (consisting of synthesis and processing of nanomaterials, nanoscale characterization, structure-property correlations and modeling), which is necessary for designing devices and systems (top), and eventually manufacturing products for the benefit of society. We plan to offer a set of basic courses with electives, which can lead to a concentration in specific areas within nanoengineering. To complete the degree, students are required to complete ten courses for a total of 30 credit hours.

![Figure 1. Framework for the proposed Masters in Nanoengineering](image-url)
In his 1959 lecture to the American Physical Society, entitled “There is plenty of room at the bottom,” Richard Feynman, 1965 Nobel Laureate in Physics, predicted the significant impact that nanotechnology can have on society. Feynman was inspired by biological systems in which cells are active, have the ability to manufacture substances, and store information on a small scale. In the intervening fifty years, nanotechnology has become to be recognized as a transformational technology, which has the potential to revolutionize multiple industrial sectors, for example, aerospace, agriculture, biotechnology, defense, electronics, energy, and medicine. NSF has estimated the associated market impact of nanotechnology to be $1T by 2015 and as a consequence has estimated a need for two million individuals that are trained to support projected growth in this area.

The educational objectives of this distance education program are to educate and train students in the science, engineering systems, and manufacturing in the complex, multidisciplinary field of nanotechnology for the benefit of societal needs. Students will achieve an understanding of the fundamental advantages in nanoscale materials, devices, and systems. We propose to offer a series of basic core courses with electives, which will allow students to pursue an area of concentration in nanoengineering. The proposed program will enable students to achieve skills, which allow them to compete in a global economy.

This new program is a Master of Nanoengineering and offers a series of basic courses with the potential for concentration in one of three areas: (1) Materials Science in Nanoengineering; (2) Nanoelectronics and Nanophotonics; and (3) Biomedical Sciences in Nanoengineering. To complete the degree, students must satisfactorily complete ten courses. Of these ten courses, students must take four basic courses and four from the three areas of concentration with an additional two technical elective courses. The proposed program has the flexibility so that students can tailor their course sequence to meet their individual interests and needs. This degree will be offered on campus and through the existing College of Engineering Online Distance Education Network at North Carolina State University. The online method of delivery will be streaming media technology. On campus lectures will be captured, digitized and placed on the Internet for viewing by the distance students from their home or work locations. This is an interdisciplinary program involving COE faculty in biomedical, chemical and biomolecular, electrical and computer, industrial, mechanical, and materials science engineering departments.

The primary objective of this program is to educate students in the exciting field of Nanoengineering, which is poised to have significant impact on society. This program is intended for students interested in the materials science, electronics/photonics, and/or biomedical sciences at nanoscale dimensions. Students from various industries related to nanoengineering and educational institutions in the US and overseas are welcomed.