DEGREE/PROGRAM CHANGE
FORM C
Form Number: C1291

Fields marked with * are required

Name of Initiator: Zayd Leseman **Email:** zleseman@unm.edu **Phone Number:** 505 277-4940 **Date:** 10-07-2013

Associated Forms exist? No Initiator's Title Associate Professor: SOE Mechanical Engineering

Faculty Contact Zayd Leseman
Department Mechanical Engineering
Branch

Administrative Contact Mary Jastrzemski
Admin Email maryjazz@unm.edu
Admin Phone 7-1326

Proposed effective term

Semester Spring Year 2015

Course Information

Select Appropriate Program Undergraduate Degree Program

Name of New or Existing Program BSME Nanoscience & Nanotechnology Concentration

Select Category Concentration Degree Type

Select Action New

Exact Title and Requirements as they should appear in the catalog. If there is a change, upload current and proposed requirements.
See current catalog for format within the respective college (upload a doc/pdf file)

☐ **Does this change affect other departmental program/branch campuses? If yes, indicate below.**

Reason(s) for Request (enter text below or upload a doc/pdf file)
see uploaded file

Mechanical Engineering - NanoCertificate - Reason4Request.pdf

Upload a document that inlcudes justification for the program, impact on long-range planning, detailed budget analysis and faculty workload implications.(upload a doc/pdf file)

Mechanical Engineering - NanoCertificate - Justification.pdf

☐ **Are you proposing a new undergraduate degree or new undergraduate certificate? If yes, upload the following documents.**

Upload a two-page Executive Summary authorized by Associate Provost. (upload a doc/pdf file)

Upload memo from Associate Provost authorizing go-ahead to full proposal. (upload a doc/pdf file)

NanoScience and NanoTechnology Concentration in Mechanical Engineering

In an effort to encourage those students who are interested in NanoScience and NanoTechnology (NS&NT) topics we propose to offer a concentration in this area at the Bachelors Level. The concentration is designed such that it does not strain the ME Department's curriculum or put a cumbersome burden on students. NS&NT modules have been placed into some of the required courses in the ME Curriculum. Thus by simply pursuing their diploma ME students are taking most of the requirements to qualify for the concentration. The only conscious decision the students must make is to take two additional courses during their degree program that are a part of the approved list of NS&NT Concentration Courses (see below).

This effort started in 2007 with the awarding of a Nano Undergraduate Education (NUE) Award from the National Science Foundation (NSF). UNM Professors Leseman, Al-Haik, Luhrs, and Taha led this original effort. With that initial award NS&NT modules were created and added into ME 370/352L. A special topics course was also created that has now turned into ME 419/519 – a senior level NS&NT Course. In 2010, another NUE Award was granted to co-PIs Leseman, Luhrs, Pleil, and Hosein-Zadeh. This time modules were added to ME 318L and 370/352L and new course was created ENG 116. With the 2010 award we pledged to create a concentration in NS&NT at UNM. The SOE Dean's office initially signed off on this plan and Associate Dean Fleddermann has agreed to sign the necessary forms to create the NS&NT Concentration once it has cleared the ME Department. The current (2010) NUE program is up for renewal again this year. If renewed NS&NT modules will be added to ME320L and a new NS&NT elective will be offered on Nanocharacterization of Materials.

Overall Plan for a Concentration in NS&NT in ME Department

A student must take 2 or more from the following Stage 1 courses:

ENG116 Introduction to Engineering (NS&NT Topic)
ME 318L* Mechanical Engineering Laboratory
ME 370/352L* Engineering Materials Science/Material Laboratory

AND take 2 or more from the following Stage 2 elective courses:

ME 419 – Theory, Fabrication, and Characterization of Nano and Microelectromechanical Systems (NEMS/MEMS)
ME 461/462 - Special Topics (Courses on NS&NT, e.g. Nanomechanics - approved by ME UG Chair)
ME 451/452 – Undergraduate Problems (on NS&NT – approved by ME UG Chair)
ECE 495 – Special Topics (Courses on NS&NT, e.g. Introduction to Nano-BioSensors, - approved by ME UG Chair)
ECE 474L – Microelectronics Processing
CHNE 499 – Special Topics (Courses on NS&NT, e.g. Nanocharacterization of Materials, - approved by ME UG Chair)
Or any other course approved by the ME Undergraduate Chair (this accommodation is for new courses appearing in the future, these courses must be NS&NT focused)

* ME Core Courses

NanoScience and NanoTechnology Concentration in Mechanical Engineering: Supplemental Material for UNM Committee Consideration

Creating this concentration will be beneficial to UNM students and the university itself. The NanoTechnology sector is growing at a rapid rate in the field of manufacturing. Most of the high technology gadgets used today contain nanomaterials, nanosensors, or chips with nanocircuitry. Understanding the NanoScience behind these gadgets and NanoTechnological Manufacturing Processes will be of great benefit to UNM students; this concentration is about giving UNM-ME students a background in NanoScience and Nanotechnology that give them an edge in today's competitive job market. Topics in NS&NT are of interest to many of the local and international companies that may hire UNM-ME students such as Intel, Sandia National Laboratories, Air Force Research Laboratory – Kirtland, Los Alamos National Laboratories. Additionally, adding this concentration may foster interest in UNM-ME students to go to graduate school in particular it may increase the number of students in UNM's popular graduate program – NanoScience and MicroSystems (NSMS).

The desired outcome for NanoScience and NanoTechnology Concentration is UNM-ME students with enough information about NS&NT such that they can apply NS&NT to the skill set they already developed as they went through the ME Curriculum. The course sequence was designed to achieve this outcome. Courses taken from Stage 1 include general background material on the importance of size scale and the benefits of moving to this scale. Concepts introduced in lecture are reinforced in NS&NT Laboratory Modules that have been developed in parallel to the lectures. Selections from the Stage 2 courses allows the UNM-ME student to select courses that are on specific NS&NT topics that is in their realm of interest.

The course sequence for the NS&NT Concentration is designed such that it does not place a burden on the student; rather it encourages them to seek the concentration. Four courses are required for the NS&NT Concentration. Two of the courses are part of the undergraduate ME core curriculum, i.e. every ME Student must take them in order to graduate. These two courses have been enhanced with modules on NS&NT since 2007. This pedagogical effort even led to a publication[1]. These enhancements are now permanent parts of the courses. The third and fourth courses are from the list of approved electives. Each elective is a specialized topic from NS&NT. Reasonably, it is expected that 10 students per academic year will want the concentration. This constitutes approximately 20% of the ME undergraduate student population. An example of anecdotal evidence is ME 419 during AY13; this course had an enrollment of 10 undergraduate students. By making an official NS&NT Concentration it is hoped that enrollment would increase. Implementation of this concentration will not affect the budget of the ME Dept. or SOE, because it uses courses that are already taught in the current ME curriculum. Therefore, it will not change faculty workloads either.

REFERENCE:

1. M. Al-Haik, C. C. Luhrs, Z. C. Leseman, and Mahmoud Reda Taha, "Introducing Nanotechnology to Mechanical and Civil Engineering Students through Materials Science Courses," *Journal of Nano Education*, vol. 2, pg. 13-26, 2010.