



Letter of Intent to Develop New Academic Degree Program

The following approvals must be obtained prior to sending the Letter of Intent to Develop a New Academic Degree Program to the UNC System Office.

Institution North Carolina State University

Degree Program Title Master of Science in Engineering Education

Reviewed and Approved By (Title)

Provost:

Faculty Senate Chair (if applicable):

Undergraduate or Graduate Dean (if applicable):

Academic College Dean:

Department Chair:

Program Directors/Coordinators:

New Academic Proposal Process

New academic programs are initiated and developed by the faculty members. Approval of the Letter of Intent to Develop a New Academic Degree Program must be obtained from department chairs and college deans or equivalent administrators before submission to the UNC System Office review.

Letter of Intent to Develop a New Academic Degree Program

Institution	<u>North Carolina State University</u>
Joint Degree Program (Yes or No)? If so, list partner campus.	No
Degree Program Title (e.g. M.A. in Biology)	Master of Science in Engineering Education
CIP Code and CIP Title (May be found at National Center for Education Statistics)	14.9999
Require UNC Teacher Licensure Specialty Area Code (Yes or No). If yes, list suggested UNC Specialty Area Code(s).	No
Proposed Delivery Mode (campus, online, or site-based distance education). Add maximum % online, if applicable.	Both campus and online (maximum 100%) delivery mode
Proposed Term to Enroll First Students (e.g. Spring 2019)	Fall 2020
List other programs in the UNC System (may be found at UNC System website)	none

SACSCOC Liaison Statement: *(Provide a brief statement from the University SACSCOC liaison regarding whether the new program is or is not a substantive change.)*

This program represents a significant departure from those that were offered when the institution was last evaluated.

Program Summary: *(Briefly describe the proposed program and summarize the overall rationale.)*

Include the following in your narrative:

- Ways in which the proposed program is distinct from others already offered in the UNC System (use the 4-digit CIP as a guide). Information on other programs may be found on the UNC System [website](#).
- How this program supports specific university and UNC System [missions](#).

- Collaborative opportunities with other UNC institutions as appropriate. (maximum length 500 words)

The Masters in Engineering Education will bring two colleges together to administer a new degree program in conjunction with the, also proposed, Ph D degree in Engineering Education. Students who have at least one degree (or equivalent hours of coursework) in engineering (or related fields) are expected to enroll in the program, which will equip them to engage in a variety of roles: community college instructor, industry education coordinators, engineering outreach services director, and entrepreneur. Students in this program will receive a degree in engineering.

The College of Education at NC State currently has a Master of Education in Technology Education. This is focused on teaching and learning issues of K-12 students, including informal settings.

The proposed degree is distinct and non-overlapping with this area of study in STEM Education, as it is aimed at students who will teach at the post-secondary level, primarily in community colleges. **There are no universities in the US that offer a masters in Engineering Education that is administered jointly by a College of Engineering and a College of Education¹. This would be the first such degree, and there are no similar degrees offered in the UNC system.**

The Master of Science in Engineering Education aligns with several of the goals of the NC State strategic plan:

Goal 1: Educational Innovation—A jointly administered degree will lead to a high level of interdisciplinary work. The cooperation between two colleges to offer this degree will be the first such collaboration that we have been able to identify in the nation. Other Engineering Education degrees offered at peer institutions are housed exclusively in colleges of engineering. Creating a degree that accesses the expertise in the cognitive-social and cultural dimensions of teaching and learning from the College of Education while accessing domain knowledge and knowledge of the development and formation of engineers from the College of Engineering will make us a leader in the nation.

Goal 2: Enhance scholarship and research by investing in faculty and infrastructure—There are currently over 30 faculty in the colleges of Engineering and Education who do research related to engineering education. This new degree will center our work and allow us to delve deeper into issues of engineering education and leverage the strengths that NC State has in both education and engineering.

Goal 3: Enhance interdisciplinary scholarship to address the grand challenges of society—Scholarship in this area involves not only researchers in engineering and education, but also sociology, psychology, mathematics, various sciences, statistics, and many other areas. The

¹ Note that the joint administration between colleges does not indicate a joint program as listed on page 2 of this document, which refers to joint between campuses.

College of Engineering has centered its strategic mission around the Engineering Grand Challenges and a large portion of the proposed program will also be centered there by building on the idea of interdisciplinary and problem-based pedagogy and research. There is evidence for a national increased emphasis on interdisciplinary work of this nature in the requirements for engineering education grants, which now frequently require a social science partner. For example, the request for proposals for the IUSE / Professional Formation of Engineers: REvolutionizing engineering and computer science Departments (IUSE/PFE: RED) grants lists the following requirements for the proposal team: "...There must be a RED team that includes (at a minimum) an expert in engineering education or computer science education research who can ground the research plan in the literature, and a social science expert who can advise on strategies for developing a culture of change. In addition, in the discussion around how to produce more engineers, the role of community colleges is playing an increasingly important role. NSF proposals, such as the ATE, are directed at community colleges. To teach transfer-eligible courses or to teach in an engineering technology program at a community college, an instructor must possess a master's degree. This highlights an opportunity for a master's in engineering education to fill a need and to be connected with a research-intensive and collaborative PhD program, such as the companion program to this degree which is also being proposed. This allows for interesting research on the K-16 continuum that is not currently being conducted anywhere in the country.

Goals 4 (pursue organizational excellence) and 5 (engage locally and globally) Cooperation between the two colleges will certainly benefit from the strengths of both programs. Expanding the pipeline of individuals qualified to teach engineering at the post-secondary level will help meet an important need of our state and our nation.

Student Demand: *(Provide evidence of student demand. Discuss the extent to which students will be drawn from a pool of students not previously served by the institution. Maximum length 1,000 words.)*

The student demand for the Master of Science in Engineering Education is based on projections by the Bureau of Labor Statistics survey of Engineering Teachers, Postsecondary. Employment in this sector in 2017, the last year for which statistics are currently available, is listed as over 37,000. These numbers include community college, junior college, technical and trade school and other post-secondary institutions. Teaching engineering at the community college (or comparable) level requires a minimum of 18 hours of post-secondary engineering education and a master's degree is either highly desirable or required. This degree would be the first in the nation that fulfills these requirements with a direct focus on engineering education.

The difficulty of projecting student demand for this totally new degree is limiting, but the first course in the potential sequence of courses is being offered this semester. With no advertisement....only listing the course in engineering online and in the registration and records offerings on campus, 24 students enrolled. This is evidence of strong interest in education among engineering graduate students and among community college presidents and faculty.

The web site, <http://engineeringeducationlist.pbworks.com>, lists worldwide programs in graduate-level engineering education. According to this list, there are two degrees in the world that are master's degrees in engineering education. The University of Malaysia has a master's in engineering education planning and research, which focuses on evaluation, measurement and psychological development in engineering education. The University of Texas at El Paso has a master's in engineering with a concentration in engineering education and leadership, which focuses on engineering leadership and entrepreneurship. To the best of our knowledge, there is NO degree in the world that provides engineering education preparation directed at community college educators. An additional conversation with the Director of Professional Development and Student Success Strategies for the American Association of Community Colleges revealed no degree programs of this type in engineering education in existence.

Societal Demand: *(Provide evidence of societal demand and employability of graduates from each of the following source types. Maximum length 1,000 words)*

- Labor market information (projections, job posting analyses, and wages)
 - Specific to North Carolina (such as ncworks.gov, nctower.com, or outside vendors such as [Burning Glass](http://burningglass.com))
 - Available from national occupational and industry projections (such as the [U.S. Bureau of Labor Statistics](http://www.bls.gov))
- Projections from professional associations or industry reports
- Other (alumni surveys, insights from existing programs, etc.)

Societal demand for more engineering graduates is well documented. Publications such as “The Engineer of 2020,” from the National Academy of Engineering also point to the need for new approaches to educating those new graduates: “To enhance the nation's economic productivity and improve the quality of life worldwide, engineering education in the United States must anticipate and adapt to the dramatic changes of engineering practice. The Engineer of 2020 urges the engineering profession to recognize what engineers can build for the future through a wide range of leadership roles in industry, government, and academia—not just through technical jobs. Engineering schools should attract the best and brightest students and be open to new teaching and training approaches. With the appropriate education and training, the engineer of the future will be called upon to become a leader not only in business but also in nonprofit and government sectors”.

In light of these paradigm shifts and increasing demand, engineering is still being taught, in many cases, as it has been for the last hundred years. While the amount of knowledge in these fast-changing, highly technological fields is ever increasing, departments struggle to add more information to already tightly scheduled degree plans. Additionally, engineering remains a field occupied largely by white, male participants. This, too, is a compelling problem that engineering education needs to address. Because the new degree, like its sister PhD degree, will incorporate issues of diversity and inclusion across the curriculum, it will be an effective step towards

making a difference in these areas. Teaching and learning engineering can differ greatly from more basic sciences or mathematics, due to the highly integrated types of problems addressed (witness the Engineering Grand Challenges highlighted by the National Academy of Engineering, which involve mathematics, physics, biology, chemistry, politics, economics, sociology, psychology and other academic subjects). Because of this difference, the field of engineering education has become an important player in the world of academic research and practice.

In the late 1990's, the field of engineering education began to emerge as an important research area. By way of illustrating the nature of engineering education as a field, research topics include how students learn to do design, how classrooms are best administered to scaffold learning for all types of students, what are the issues with recruitment and retention of a diverse student body in engineering, how does one teach spatial visualization skills, can innovative teaching techniques (such as flipped classrooms, online learning, and others) be used to enhance traditional classroom instruction effectively, and many more. A new National Science Foundation grant program, IUSE/Professional Formation of Engineers: REvolutionizing engineering and computer science Departments (IUSE/PFE: RED), was introduced in 2015. There is a need for researchers and educators who are trained in this specialized area of teaching and learning.

Potential positions for graduates from the Master of Science in Engineering Education program include the following:

- Community college faculty
- Engineering diversity director
- Engineering higher education administrator, community college instructor
- Engineering education research associates and program managers for the federal government
- Engineering outreach services director (companies, museums, other informal education contexts, consultancies)
- Industry trainers

The categories that the Bureau of Labor Statistics Occupational outlook handbook lists are tabulated below together with their predicted rate of growth over the next seven years.

OOH Category	Job title	Predicted rate of growth
Post-secondary engineering teachers	Departmental engineering faculty, including community college instructors , engineering education professors, disciplinary engineering teaching faculty	+15%

Instructional coordinator for engineering (industry)	Instructor, trainer	+12%
Outreach services director	Entrepreneur, museum educator, professional developer	+10%

For Doctoral Programs Only:

N/A

Contact: (List the names, titles, e-mail addresses and telephone numbers of the person(s) responsible for planning the proposed program.)

Position Title	Name	E-mail Address	Telephone
Director and Teaching Associate Professor Engineering and Education	Dr. Laura Bottomley	laurab@ncsu.edu	919-515-3263
Professor, STEM Education	Dr. Aaron C. Clark	aclark@ncsu.edu	919-515-6900
Professor and Associate Head for Undergraduate Programs, Civil Const & Environ Engineer	Dr. Rudi Seracino	rudi_seracino@ncsu.edu	919-515-7695
Associate Professor, STEM Education	Dr. Cameron Denson	cddenson@ncsu.edu	919-513-0859
Assistant Professor, STEM Education	Dr. Tamecia Jones	trjones8@ncsu.edu	919-515-6908
Teaching Assistant Professor, Engineering and Education	Dr. Tameshia Ballard Baldwin	tsballar@ncsu.edu	919-515-3263
Associate Professor, Engineering	Dr. Wendy Krause	wekrause@ncsu.edu	919-515-6560
Alumni Distinguished Undergraduate Professor, the Director of Undergraduate Programs and Associate Department Head	Dr. Russell Gorga	russell_gorga@ncsu.edu	919-515-6553

Professor of Mathematics	Dr. Jo-Ann Cohen	cohen@ncsu.edu	919-513-4106
Professor, Electrical and Computer Engineering	Dr. Rhett Davis	rhett_davis@ncsu.edu	919-515-5857
Associate Professor, Mechanical and Aerospace Engineering	Dr. Scott Ferguson	scott_ferguson@ncsu.edu	919-515-5231
FREEDM Center Director of Education and Workforce Programs	Dr. Pam Carpenter	ppcarpen@ncsu.edu	919-513-8335
Professor, Civil Const & Environ Engineer	Dr. Joel Ducoste	jducoste@ncsu.edu	919-515-8150

This Letter of Intent to Plan a New Program has been reviewed and approved by the appropriate campus authorities.

Position Title	Signature	Date
Provost		
Provost (Joint Partner Campus)		


{Insert Descriptive Title Here}
North Carolina State University


This request has been reviewed and approved by the appropriate campus committees and authorities.


Endorsed By:

 Douglas Reeves 12-7-2018
Head, Department/Director of Graduate Program (Printed Name and Signature) Date

Recommended By:

 Aaron C. Chik 12/14/18
Chair, College Graduate Studies Committee (Printed Name and Signature) Date

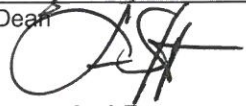
 RANTI RANJITHAN 12/7/18
Chair, College Graduate Studies Committee (Printed Name and Signature) Date


 Karen Hollebrands 12/13/18
Chair, College Graduate Studies Committee (Printed Name and Signature) Date

Endorsed By:

 Douglas Reeves 12-7-2018
College Dean (Printed Name and Signature) Date

Recommended By:

 Lee V. Stiff 12-13-2018
Vice Provost, DELTA (if DE degree) (Printed Name and Signature) Date

 Thomas R. Miller 1/15/19
Vice Provost, DELTA (if DE degree) (Printed Name and Signature) Date

Approved By:

Peter J. Harris 3/25/19
Dean of the Graduate School (Printed Name and Signature) Date

Recommended By:

Dean's Council (Printed Name and Signature) Date

Approved By:

Executive Vice Chancellor and Provost (Printed Name and Signature) Date

Approved By:

Chancellor (Printed Name and Signature) Date

(revised August 2015)