

**Request for Authorization to Establish a  
Master of Science in Applied Energy and Electromechanical Systems program at  
University of North Carolina at Charlotte**

University of North Carolina at Charlotte requests authorization to establish a Master of Science in Applied Energy and Electromechanical Systems degree program (CIP 15.0503).

**Program Description**

The M.S. in Applied Energy and Electromechanical Systems will prepare students to enter energy and power workforces with an understanding of the interface between mechanical work, electrical / electronic control systems, and electrical energy. Students will gain the understanding of the mechanisms for coupling these domains and the competencies necessary to design and implement appropriate systems. Graduates will be prepared for technical positions in energy product design and development, system integration, field installation and commissioning. The 30-credit hour program consists of 15-credit hours of common core courses that include energy production and generation, power transmission and conversion, system dynamics, and mechatronics. Students then choose either the research and thesis option or the non-thesis coursework option for the remaining 15-credit hours. Students electing the research and thesis option will complete two major elective courses, a research and analytical methods course, and a 6-credit hour graduate research thesis. Students electing the non-thesis option will complete five elective courses and a formal comprehensive exam.

**Mission Relevance**

The M.S. in Applied Energy and Electromechanical Systems aligns with UNC Charlotte's mission as an urban research university and its particular commitment to address cultural, economic, educational, environmental, health and social needs of the greater Charlotte region. The program also directly addresses, as expressed in the Institutional Plan (2011-2016), UNC Charlotte's effort to position itself as the region's preferred provider of talent, knowledge, and innovation in energy and other dynamic fields. The proposed program also aligns with the mission of the William States Lee College of Engineering Energy Production and Infrastructure Center (EPIC). EPIC was formed in response to the need from industry to supply highly trained engineers and technical professionals qualified to meet the demands of the energy industry. The proposed program will assist EPIC in meeting its mission to "enhance the available technical workforce, advance technology, and facilitate strategic industry-university collaboration" for the Carolinas and beyond.

**Student Demand**

UNC Charlotte's B.S. in Electrical Engineering Technology and B.S. in Mechanical Engineering Technology degree programs, anticipated feeders to the proposed M.S. program, currently enroll approximately 350 students. Thirty-eight of those students have already indicated interest in starting the proposed program. Upon marketing the program outside UNC Charlotte, both domestic and international applications are expected to grow. UNC Charlotte also referenced the success of similar programs that provide a graduate education path for students with engineering technology degrees. For example, their M.S. in Construction & Facilities Management provides a graduate education path for the approximately 275 students pursuing a civil engineering technology undergraduate degree; indeed, about 10% of those baccalaureate students continue to pursue the M.S. at UNC Charlotte.

**Societal Demand and Opportunities for Program Graduates**

The U.S. Bureau of Labor Statistics shows modest growth of 2-6% in electrical and mechanical engineering fields through 2018. A substantial number of positions will be created through the graying

of the current energy workforce, which has an average age of 55. Half of the experienced workforce at major energy companies is expected to retire in the next 10 years. A 2006 report of the U.S. Department of Energy to Congress reiterated the necessity for power engineering education and expressed concern for the ability to meet future demands. The report particularly advocated for public-private partnerships in power research, such as exists at EPIC. The UNC Charlotte College of Engineering Director for Employer Relations and Student Professional Development reports that approximately 40% of COE graduates work in some aspect of the energy industry. The Shaw Group, Areva, Siemens, MacLean Power Systems, CoaLogix, and United Mechanical Corporation provided letters acknowledging the growth of North Carolina's energy sector economy, the need for highly trained energy professionals, and support for the proposed program.

### **Resource Implications**

Additional resources are required to launch the program and will be achieved through a combination of reallocation of present institutional resources, differential tuition, enrollment increase funds, and external research funding. A differential tuition amount of \$1,800 per academic year per student is requested, which aligns with tuition rates charged for other UNC Charlotte College of Engineering programs.

UNC Charlotte estimates three new faculty are needed to launch the program. Hires will be accomplished through reallocation of present institutional resources and enrollment increase funding. One new hire has already been made with a Fall 2013 start date, and a second round of interviews were completed this summer with another offer expected to be made soon. A laboratory support position and some part-time instructional support will also be covered through a combination of internal reallocations, differential tuition and enrollment increase funds.

Graduate stipends will be provided through a combination of internal reallocations and contracts and grants.

Existing library holdings and facilities are adequate for the launch of the program. Other projected expenses include supplies and materials, travel, communications, marketing and advertising. Differential tuition will be applied towards these expenses, as well as some reallocation of present institutional resources.

Should projected funding from enrollment increase funds be unavailable, the Office of the Provost has committed to provide the necessary support through additional internal reallocations.

### **Collaborative Opportunities**

No other UNC degree programs exist in this CIP code. UNC Charlotte explored the possibility of collaboration with UNC programs that offer courses related to the proposed M.S. program and generally found no courses with an electromechanical focus, courses with too narrow an energy focus (e.g. renewable energy), or courses in which engineering technology graduates would not meet the math and physics prerequisites. EPIC is a key partner that will allow the proposed program to leverage over \$76 million in state support and \$17 million in industry funding, as well as faculty associates, in support of its educational and research goals.

### **Outcome of Consultation with Disciplinary Experts**

The proposal was reviewed by twelve faculty and graduate program administrators from six UNC campuses. Reviewers consistently noted that the proposal aligns well with UNC Charlotte's mission and

## APPENDIX H

has the potential to leverage existing resources such as EPIC and local business relationships. UNC Graduate Council reviewers requested additional information regarding student demand, collaborative opportunities, appropriateness of the program title, and faculty sufficiency. UNC Charlotte discussed that, in contrast to engineering majors, engineering technology majors often do not meet admissions requirements for graduate programs in engineering but have exhibited demand for advanced degrees. For example, UNC Charlotte's existing M.S. in Construction and Facilities Management provides their civil engineering technology B.S. graduates with a path for continued professional development, and program enrollments have grown each year since its establishment in 2011. The electrical and mechanical engineering technology B.S. feeder programs for the proposed M.S. degree enroll approximately 350 students. Because the proposed M.S. program targets students with engineering technology degrees, opportunities to collaborate with engineering graduate programs are limited. EPIC, a main collaborator with the proposed program, provided a letter of support denoting their role in course delivery and research. UNC Charlotte explained that, while no specific courses include "electromechanical" in the title, the electromechanical concept spans the entire program and the title is appropriate. Finally, UNC Charlotte confirmed that they have already added one new faculty member with extensive industry experience in electromechanical systems and completed interviews this summer and will make an offer for a second new faculty position with expertise in energy systems.

### **Recommendation**

It is recommended that the Board of Governors approve University of North Carolina at Charlotte's request to establish a Master of Science in Applied Energy and Electromechanical Systems degree program (CIP 15.0503) effective January 2014.