



Item: AS: A1

Tuesday, March 15, 2016

**SUBJECT: APPROVAL OF A NEW ACADEMIC PROGRAM – BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING**

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**PROPOSED BOARD ACTION**

Approval of new academic programs:

**CIP 14.1404 (B.S.E.V.) Bachelor of Science in Environmental Engineering**

**BACKGROUND INFORMATION**

The College Engineering & Computer Science proposes a new undergraduate degree program, Bachelor of Science in Environmental Engineering (BSEV). This program integrates principles of engineering, mathematics, earth science, soil science, life science, and materials science with emphasis on the design and development of solutions to environmental challenges, such as improvement of water and air pollution control, safe disposal of wastes, and the stewardship of our natural resources. This program will provide students with opportunities to practice and advance their knowledge of environmental engineering, serve as effective professionals, and participate as leaders in activities that support service to, and/or economic development of, the region, the state and the nation.

**IMPLEMENTATION PLAN/DATE**

Degree will begin in Fall 2016.

**FISCAL IMPLICATIONS**

The final five year projected program costs will be \$530,977.

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**Supporting Documentation: New Degree Program Proposal**

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and Dr. Gary W. Perry, Provost and VP for Academic Affairs**

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## Request to Offer the Bachelor of Science in Environmental Engineering (BSEV)

### New Program Description and Relationship to System-Level Goals

**Program description:** The proposed undergraduate degree program, Bachelor of Science in Environmental Engineering (BSEV), integrates principles of engineering, mathematics, earth science, soil science, life science, and materials science with emphasis on the design and development of solutions to environmental challenges, such as improvement of water and air pollution control, safe disposal of wastes, and the stewardship of our natural resources.

**Curriculum:** The Environmental Engineering curriculum has been designed to meet all requirements for accreditation by the Accreditation Board for Engineering and Technology (ABET) with a total of *120 credit hours*. Graduation from an ABET-accredited program is the universally accepted education credential required for professional registration as an environmental engineer. The proposed implementation date is August 1, 2016, with the first students accepted for the Fall 2016 semester. Details of the curriculum are attached. The curriculum was developed with the assistance of the Department Advisory Council comprised of industry representatives.

**Program educational objectives:** The Bachelor of Science in Environmental Engineering (BSEV) degree program in the College of Engineering & Computer Science is designed to provide students with the following program educational objectives:

- A. Practice environmental engineering within the general areas of water and wastewater, air quality, solid and hazardous waste, and groundwater and soils in the organizations that employ them.
- B. Advance their knowledge of environmental engineering, both formally and informally, by engaging in lifelong learning experiences including attainment of professional licensure, and/or graduate studies.
- C. Serve as effective professionals, based on strong interpersonal and teamwork skills, an understanding of professional and ethical responsibility, and a willingness to take the initiative and seek progressive responsibilities.
- D. Participate as leaders in activities that support service to, and/or economic development of, the region, the state and the nation.

**Rationale:** The Department Advisory Council for the Department of Civil, Environmental & Geomatics Engineering [the Department] has urged the faculty to create a Bachelor's of Science degree program specializing in Environmental Engineering, which is the primary purpose of this proposal. Environmental Engineering is a program in very high demand with a bright national outlook, as discussed later in this proposal. The program will train students in the areas of solid and hazardous waste management, water quality and air pollution control, green technologies, and pollution prevention of natural ecosystems and the built environment. Presently, the students in the civil engineering and geomatics engineering programs at FAU, through a series of courses and research activities, are exposed to environmental issues at both Undergraduate (BS) and Graduate (MS) levels. However, students at FAU studying civil engineering, geomatics engineering, or other closely related fields can only experience very few courses in the field of environmental engineering. Only 12 of the last 60 credits are considered fundamental environmental engineering courses in the current civil engineering program and none in the geomatics engineering program; therefore, FAU students are ill-prepared to compete for environmental engineering related jobs without substantial additional training. In addition, the FAU 2006-2010 strategic plan had a proposed environmental engineering graduate degree program slated for 2009, which was never realized. However, since the implementation of a BS program will provide the steady stream of students needed to sustain the graduate program pipeline, it makes sense to implement the undergraduate degree program first.

This new program supports the University's strategic plan calling for the creation of an Ocean Energy/Environmental Science pillar that will move FAU toward national prominence. The new program would also align well with the state-wide performance metrics by increasing the number of undergraduate degrees and providing an additional STEM program, and it could also feed into the Master of Science with major in Civil Engineering, Water Resources/Environmental Track.

**Number of Credits:** With respect to the number of credits and requirements for ABET, the proposed environmental engineering curriculum is consistent with all requirements for SACS and has been intentionally designed to meet all requirements for accreditation by ABET, which is the universally accepted education credential required for professional registration. Accreditation reviews are only possible after the program has produced its first graduate. Thus, the ABET review will be requested at the first possible opportunity immediately following the first graduation class. A retroactive provision covers students who graduate prior to the award of accreditation.

According to ABET, the curriculum must:

1. Prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, and fluid mechanics.
2. Prepare graduates to: (a) formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; (b) conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health); (c) design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and (d) apply advanced principles and practice relevant to the program objectives.
3. Prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.

### **Need and Demand**

The external consulting firm Hanover Research was contracted to review the demand for the program on July 14, 2015, and on October 2, 2015, they submitted the results of their market analysis of environmental engineering programs at the bachelor's level. Through this study, student demand was assessed as measured by degree conferral trends, the labor market outlook was measured by economic forecasts and job posting trends, and market saturation was based upon the number of graduates in the region compared to the number of projected job opportunities.

The findings by Hanover Research indicate that an environmental engineering program at Florida Atlantic University would be very viable. In general, the labor market is expected to grow significantly over the next several years and at current, especially in south Florida, there are not enough graduates being produced to meet demand in specific areas. For example, the Water Research Foundation is predicting a "workforce crisis" for water utility workers as the industry will see many of its current Baby Boomer Generation employees retire between now and 2020.

## **Key Findings**

Enrollment and degree completions trends for bachelor's programs in South Florida indicate growing student demand for environmental engineering programs. A scan of programs in the area suggests that Florida International University (FIU) and the University of Miami (UM) are the only institutions within a 100-mile radius of Boca Raton offering bachelor's programs in this field. Bachelor's degree completions at these institutions expanded from seven completions in 2010 to 22 in 2014, indicating rapidly expanding student interest in this field.

Institutions in South Florida are not currently producing enough graduates to meet the labor market demand for the local environmental engineering workforce. FIU and UM graduated 22 undergraduates in environmental engineering in 2014, while the FDEO projects 191 annual job openings in related positions. Even considering both bachelor's and master's degree completions, these institutions (FIU and UM) only produced enough graduates to fill 17% of the projected annual openings for environmental engineering related positions.

A new bachelor's program in environmental engineering at FAU may expand the future pipeline of students interested in graduate programming in this field. Student outcomes data from 2011 to 2013 suggests that between 21 and 33 percent of students who studied environmental engineering at a State University System of Florida institution continued their education after graduation. Several Florida institutions have accelerated 4+1 programs that may incentivize students to remain at their undergraduate institution to complete a master's program, securing a steady pipeline of students for graduate offerings.

According to recent graduation data from 2009-2013 in the State of Florida, about 47 environmental engineering graduates are produced per million people. In South Florida, the current number is only 3 per million, clearly demonstrating that South Florida is failing to produce enough environmental engineers to meet the current demand.

## **Jobs Outlook**

- The South Florida tri-county area ranks in the top ten in the state of Florida for job openings in environmental engineering fields
- Employment of environmental engineers is projected to grow 15% from 2012 to 2022, faster than the average for all job occupations.
- According to employflorida.com, environmental engineering has a bright outlook nationally and is a green occupation.

- The highest number of job openings for recent environmental engineering graduates in Florida as of September 7, 2014, occurs in the Miami-Fort Lauderdale-Pompano Beach metro service area.
- Median annual wage for environmental engineers in 2012 was \$80,890, and the top 10% earned more than \$122,290 (<http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>).
- The US Bureau of Labor Statistics predicts the number of new jobs needed between 2012 and 2022 for environmental engineering-related occupations is 99,600 with another 101,400 in closely-related fields.
- The Florida Agency for Workforce Innovation projects long-term job growth in environmental engineering in Florida to grow by 18%.
- Florida ranks 16<sup>th</sup> in the nation in job growth for the environmental engineering sector and ranks 6<sup>th</sup> in the nation with the most number of jobs projected for the next ten years, behind only California, Texas, New York, Massachusetts, and Pennsylvania.
- There were 1232 job postings for environmental engineering related job openings in South Florida in the first quarter of 2015.
- U.S. Department of Labor, Employment and Training Administration (<http://www.myskillsmyfuture.org>), there are 18,012 environmental engineering-related businesses in Florida, and 8,200 of those environmental engineering businesses are located in south Florida.
- A recent survey of 25 local businesses determined that 75% of survey respondents would be “most likely” to hire graduates with an environmental engineering undergraduate degree in their company. The other 25% were “likely” to hire environmental engineering graduates, and none of those surveyed responded as “unlikely.”
- Albert Muniz, P.E., Vice President of Hazen and Sawyer commented that a new Environmental Engineering undergraduate degree program would “raise the bar significantly” because most applicants to his firm lack the environmental treatment process design skills he needs.
- Donald A. Eckler, P.E., President of Eckler Engineering remarked that, “nearly all of his employees are recent FAU graduates, and a new program in environmental engineering would benefit his small business in a great number of ways.”
- Edward Kent, Ph.D., P.E. is the chief Environmental Engineering Consultant for Parsons Corporation, and he remarked that, “Environmental Engineering is the foundation for

sustainability of our nation's natural resources. Here in Florida, we have the nexus of steep, long-term population growth and unique natural resources such as coral reefs, the Biscayne Aquifer, and the Everglades. Environmental engineers are in demand for the foreseeable future to assure the quality of life for our people and to protect and preserve our natural resources now and for future generations,” and his firm would definitely hire FAU Environmental Engineering students if the program were in place.

- FIU, FGCU, UCF, and UF are the only SUS universities that have accredited environmental engineering programs in the state of Florida. Headcounts average 150 students with 26 graduates per year.
- According to recent graduation data from 2009-2013 in the State of Florida, about 47 environmental engineering graduates are produced per million people. In South Florida, the current number is only 3 per million, clearly demonstrating that South Florida is failing to produce enough environmental engineers to meet the current demand.