TENNESSEE HIGHER EDUCATION COMMISSION

REGULAR CALENDAR ITEM: II.H.

MEETING DATE: May 16, 2024

SUBJECT: New Academic Program
University of Tennessee, Knoxville
Environmental Engineering, Bachelor of Science (BS)
CIP Code: 14.1401 (Environmental/Environmental Health Engineering)

ITEM TYPE: Action

ACTION RECOMMENDATION: Approval

PROGRAM DESCRIPTION

The University of Tennessee, Knoxville (UTK) proposes a 128-credit hour, Bachelor of Science (BS) in Environmental Engineering. The proposed program will augment and build on the strengths of existing bachelor, master, and doctoral programs offered in the Department of Civil and Environmental Engineering at UTK. The proposed program is designed to prepare graduates to pass the Environmental Engineering Fundamentals of Engineering Exam administered by the National Council of Examiners for Engineering and Surveying and prepare them for work in various Environmental Engineering roles.

The proposed Environmental Engineering, BS responds to the increasingly complex environmental issues faced by our society over the last 50 years, providing graduates with the skills needed to create sustainable food, water, and energy; curb climate change and adapt to its impacts; design a future without pollution or waste; create efficient, healthy, resilient cities; and to foster informed decisions and actions. All students will complete a two-semester capstone design project that progresses from project scoping, community outreach, professional communication, and reflection toward detailed engineering design. The program also has the potential to address specific regional needs and institutional strengths, including atmospheric science, watershed and river management, hydropower, and nuclear decommissioning and waste management.

INSTITUTIONAL GOVERNING BOARD APPROVAL

The proposed Environmental Engineering, BS program was approved by the University of Tennessee Board of Trustees Executive Committee on January 20, 2023.

PROPOSED IMPLEMENTATION DATE

August 1, 2024

ALIGNMENT WITH STATE MASTER PLAN AND INSTITUTIONAL MISSION/STRATEGIC PLAN

The proposed Environmental Engineering, BS aligns with the State Master Plan for Higher Education by increasing “enrollment in majors leading to high-demand jobs” by providing training that addresses workforce shortages in both civil engineering and construction, and environmental scientists and specialists, indicated in the THEC supply and demand report. The program will also contribute to the Drive to 55 goals, by offering a STEM oriented degree that is appealing to students, particularly to students from underrepresented groups within the engineering field, such as women and minorities, who are often

unlikely to enroll in a traditional Civil Engineering program but make up about 50 percent of the student body in Environmental Engineering programs at comparable institutions.

The proposed program will also align with key aims of UTK's strategic plan. Specifically, it enhances educational excellence by offering a new, high-demand program that will increase enrollment and degrees awarded. Further, it will expand research capacities through supporting new faculty expertise. Finally, it will foster outreach and engagement by addressing grand challenges in Tennessee through teaching, research, and outreach.

CURRICULUM

The proposed program will consist of 128 hours of coursework and will be offered with both on-ground and online course options. The coursework will include 41-credit hours of fundamental courses, 30-credit hours of core courses, four (4) credit hours of lab requirements, 25-credit hours of supporting courses, and four (4) credit hours for Senior Design 1 and 2. The remaining 24-credit hours are technical electives and additional courses to satisfy UTK's general education requirements. A total of six (6) new courses will be developed for the implementation of the proposed program.

The proposed program and associated student learning outcomes has been developed to meet the Accreditation Board for Engineering and Technology (ABET) accreditation standards. At the completion of the program, graduates will have:

- An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics;
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions, and,
- An ability to acquire an apply new knowledge as needed, using appropriate learning strategies.

PROGRAM PRODUCTIVITY

Projections for the Environmental Engineering, BS program estimate that 50 students will enroll in the first year, with total enrollment of 115 by year five. The program will graduate its first students in year three.

	2024-25	2025-26	2026-27	2027-28	2028-29
Enrollment	50	75	100	111	115
Graduates	--	--	14	21	23

PROGRAM DUPLICATION

No public institutions in Tennessee offer a freestanding undergraduate program in environmental engineering. Tennessee Technological University and the University of Memphis offer environmental engineering concentrations in their existing Civil Engineering, BS programs. The University of Tennessee,

Chattanooga offers as environmental concentration in both their Civil Engineering, BS and Chemical Engineering, BS.

STUDENT DEMAND

Thirty UTK students who had selected water resources or environmental engineering as their specialty-area electives were surveyed to determine their interest in the proposed program as compared to the existing Civil Engineering, BS. More than half of these students indicated that they were extremely interested or very interested in the proposed program. In addition, 492 first-and-second-year students enrolled in engineering fundamentals courses were surveyed to gauge their interest in the proposed program and 45 indicated that they were extremely or very interested in the proposed program. Finally, between 2017 and 2019, 165 civil engineering students selected either environmental engineering or water resources as their specialty area.

OPPORTUNITIES FOR PROGRAM GRADUATES

There is a strong national demand for environmental engineers. The United States Bureau of Labor Statistics (BLS) indicates that 52,300 environmental engineering jobs were posted in 2020, representing an increase of 1,900 between 2010 and 2020. BLS estimates a 4 percent increase in environmental engineering jobs over the next decade. To assess regional demand, UTK distributed a survey to 15 employers. Eleven employers responded to the survey, and the results indicated that there is a regular and steady demand for environmental engineers, and that undergraduate training in environmental engineering would help fill this demand.

Letters of industry support were received from United Cleanup Oak Ridge, LLC; Gresham Smith; S&ME, Inc.; First Utility District of Knox County; Amentum National Security; HDR Engineering, Inc.; Tennessee Department of Environment and Conservation; and the Tennessee Valley Authority. Several of these letters express a willingness to sponsor student interns, assist with capstone projects, and to hire program graduates.

INSTITUTIONAL CAPACITY TO DELIVER THE PROGRAM

Several existing faculty members will support the proposed program, including two (2) governor's chairs, the department head, six (6) tenure-line faculty, and a PhD student who teaches two (2) labs. Searches are approved for a full-time lecturer and for the Goodrich Chair of Excellence. One (1) faculty member has already been hired to teach in the proposed program. Existing campus infrastructure includes environmental engineering research labs and equipment, a fully equipped environmental teaching lab, a designated water resources teaching lab, two (2) full-time staff technicians, and the Water Quality Core Facility. Additionally, the proposed program will be supported by several campus research centers, including the Tennessee Water Resources Research Center, the Institute for a Secure and Sustainable Environment, the Center for Environmental Biotechnology, the Baker Center for Public Policy, and the Bredesen Center for Interdisciplinary Research and Graduate Education.

EXTERNAL JUDGEMENT

An external review of the proposed program was conducted during a site visit on September 25, 2023, by Dr. Shannon Bartelt-Hunt, Professor and Chair of the Department of Civil and Environmental Engineering, University of Nebraska-Lincoln. The site visit included meetings with campus administrators and faculty from UTK, as well as current UTK students and industry partners. Dr. Bartelt-Hunt enthusiastically recommended approval of the proposed program, noting that "the proposed degree requirements will provide all the necessary training for students to meet the stated program goals and objectives and to gain successful employment in the environmental engineering workforce." Further, she stated "discussions with the community partners indicated a very strong need for more environmental engineers across the public and private sector workforce." Dr. Bartelt-Hunt also observed that "the department has the resources and

faculty capacity and expertise to support development of this new program and it will make a positive impact on the university and state."

ASSESSMENT AND POST-APPROVAL MONITORING

An annual performance review of the proposed program will be conducted for the first five (5) years following program approval. The review will be based on benchmarks established in the approved proposal. At the end of this period, the campus, institutional governing board, and THEC staff will perform a summative evaluation. If benchmarks are not met during the monitoring period, the Commission may recommend that the institutional governing board terminate the program.

PROGRAM COSTS AND REVENUE

The proposed one-time and recurring expenditures for the Environmental Engineering, BS program are listed in Table 1. Projected revenue is displayed in Table 2.

Table 1: Estimated Costs to Deliver the Proposed Program

Estimated Costs to Deliver the Proposed Program						
One-Time Expenditures						
Category	**Planning**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Accreditation				$6,700		
Consultants	$2,500					
Equipment		$103,935	$78,740			
Information Tech						
Library						
Marketing		$8,000				
Facilities						
Travel	$2,000					
Other						
Total One-Time Expenditures	**$4,500**	**$111,935**	**$78,740**	**$6,700**	**$0**	**$0**
Recurring Expenditures						
Category	**Planning**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Faculty & Instructional Staff		$136,990	$141,100	$145,333	$149,693	$154,183
Non-instructional Staff		$31,920	$32,878	$33,864	$34,880	$35,926
Graduate Assistants		$44,686	$87,979	$46,229	$90,720	$92,171
Accreditation					$715	$715
Consultants						
Equipment						
Information Tech						
Library						
Marketing						
Facilities						
Travel						
Other						
Total Recurring Expenditures	**$0**	**$213,596**	**$261,956**	**$225,426**	**$276,008**	**$282,995**

Grand Total (One-Time and Recurring)	**$4,500**	**$325,531**	**$340,696**	**$232,126**	**$276,008**	**$282,995**

Table 2: Projected Revenue

Projected Revenue						
Category	**Planning**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Tuition		$913,357	$1,394,363	$1,844,895	$2,070,289	$2,175,933
Grants			$22,343	$22,450	$43,565	$43,991
Other						
Total Revenues	**$0**	**$913,357**	**$1,416,706**	**$1,867,345**	**$2,113,854**	**$ 2,219,924**