



TENNESSEE HIGHER EDUCATION COMMISSION

REGULAR CALENDAR ITEM: IV.A.

MEETING DATE: November 16, 2023

SUBJECT: Expedited New Academic Program
East Tennessee State University
Mechatronics Engineering, Bachelor of Science (BS)
CIP Code: 14.4201 (Mechatronics, Robotics, and Automation Engineering)

ITEM TYPE: Action

ACTION RECOMMENDATION: Approval

PROGRAM DESCRIPTION

East Tennessee State University (ETSU) proposes a 128-credit hour Bachelor of Science (BS) in Mechatronics Engineering. The proposed program was developed in response to substantial regional industry demand in the manufacturing sector for engineering graduates with knowledge in advanced manufacturing methods which enable efficient manufacturing with reduced labor costs. Mechatronics skills are especially in demand in the Tri-Cities area where the manufacturing industry represents a significant sector of employment and has a difficult time recruiting and keeping qualified applicants with the specialized skills needed.

The proposed program will include 60 to 70 credits focused on mechatronics content, including robotics, automation, advanced sensors systems, and control systems and will also include nationally-recognized certifications in mechatronics offered by Siemens and National Instruments. The program will be delivered primarily on-campus, with some potential online offerings, and can be completed in four (4) years for first-time freshmen and in two (2) years for transfer students.

The proposed Mechatronics Engineering, BS will serve students interested in specialized engineering training and will accommodate transfer students through articulation agreements with nearby Walters State and Northeast State Community Colleges, as well as through relevant Tennessee Transfer Pathways.

INSTITUTIONAL GOVERNING BOARD APPROVAL

The proposed Mechatronics Engineering, BS was approved by the East Tennessee State University Board of Trustees on November 18, 2022.

PROPOSED IMPLEMENTATION DATE

Fall 2024.

ALIGNMENT WITH STATE MASTER PLAN AND INSTITUTIONAL MISSION/STRATEGIC PLAN

The proposed Mechatronics Engineering, BS aligns with the state master plan for higher education by providing training in an emerging area of significant job growth and workforce need. The program will contribute to family prosperity in the East Tennessee region by providing graduates with skills that are demand in the area and have high starting salaries and positive career trajectories. Finally, the program aligns with state efforts to build STEM-related pathways in K-12 education.

The proposed program also aligns with ETSU’s mission to train students for success in their careers and to improve the quality of life in the region by providing students training in a field that will allow significant post-graduation opportunities.

CURRICULUM

The proposed Mechatronics Engineering, BS will require 128 hours of coursework including 37 credits of general education, 85 credits of major courses, and six (6) credits for a senior project. The primary delivery method will be on-ground at the ETSU main campus and will require the creation of 13 new courses. All students will complete a senior project that requires them to collaborate with their peers to solve an engineering problem using engineering principles and standards. Industrial partners will be sought to provide real-world projects whenever possible.

Upon completion of the proposed program, students will be expected to:

- Identify, formulate, and solve complex mechatronics engineering problems, properly applying the principles, methods, techniques and tools of engineering, science and mathematics.
- Design and integrate mechatronics engineering systems and components that meet specified needs with consideration of health, safety, and welfare issues.
- Communicate clearly and effectively in oral, written, and graphical formats, interacting with different types of audiences.
- Recognize and assume ethical and professional responsibilities in engineering situations and make informed judgments.
- Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams whose members together provide leadership, creating a collaborative and inclusive environment.
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

ACCREDITATION

The proposed program will seek Accreditation Board for Engineering and Technology (ABET) accreditation. ABET will visit the program in fall of the fifth year for an accreditation review, which always occurs after the first graduates complete the programs. The Department of Engineering, Engineering Technology, Interior Architecture, and Surveying already has six (6) programs accredited through ABET (four (4) engineering technology programs, one (1) engineering program, and one (1) surveying program).

PROGRAM PRODUCTIVITY

Projections for the Mechatronics Engineering, BS estimate that eight (8) students will enroll in the program’s first year, with total enrollment growing to 55 in year five (5). The program anticipates 20-25 percent attrition which is typical of other engineering programs at the university.

	2024-25	2025-26	2026-27	2027-28	2028-29
Enrollment	8	15	25	40	55
Graduates	0	0	0	6	12

PROGRAM DUPLICATION

Free-standing undergraduate mechatronics engineering programs are offered at two (2) public institutions in Tennessee: Middle Tennessee State University and the University of Tennessee, Chattanooga. Mechatronics is offered as a concentration in several undergraduate engineering programs at Tennessee Technological University, University of Tennessee, Martin, Tennessee State University, and Vanderbilt University.

The proposed program is unique due to the geographic location and course offerings which are designed to meet the needs of regional partners and employers. Further, offering a complete program focused on mechatronics engineering will allow for in-depth training in content areas that are responsive to local and regional industry needs at a depth which would not be possible in a concentration.

STUDENT DEMAND

To assess demand, ETSU surveyed current engineering students in January 2023. The survey received 11 responses, the majority of which indicated an interest in enrolling in the degree area as well as a desire to remain in the East Tennessee region for higher education. An additional survey of regional community college and high school STEM students was conducted in April 2023 to gauge local interest. Nearly 200 students responded (118 high school students and 76 community college students). On average, 65 percent of respondents viewed the proposed program favorably, while 93 percent of community college students and 68 percent of high school students indicated that they would consider the degree area. The majority of students indicated a desire to remain in the East Tennessee region for higher education (91 percent of community college students and 59 percent of high school students). Furthermore, several current ETSU students who participated in the site visit expressed a desire to switch to the proposed program if approved.

ETSU plans to market the program to current students, community college students, and high school students through internal and external marketing efforts. Internal outreach will include ETSU admissions, advisors, and university development officers, while external outreach will include regional high schools and community colleges within Tennessee and in bordering states as well as to local employers who participate in campus career fairs. Relationships with external stakeholders are already established through similar outreach for the existing Engineering programs. Further, the department's faculty participate in several specialized recruiting programs on ETSU's campus, including BUCS academy and summer engineering camps designed for young students.

OPPORTUNITIES FOR PROGRAM GRADUATES

The proposed program will prepare graduates for a variety of positions in the engineering and manufacturing sectors. The Bureau of Labor Statistics does not disaggregate mechatronics job data from other engineering fields. However, internet job searches (on Jobs4TN and Indeed.com) conducted in January of 2023 located over 200 job openings for mechatronics engineers and technicians in Tennessee. A Tennessee Department of Labor Report (STEM Jobs Report, 2019) projects a 21.6 percent growth in new STEM jobs from 2016 to 2026. The state is facing shortages of engineers as the existing workforce retires and mechatronics engineers will be in high demand in East Tennessee as manufacturing facilities update product lines and develop additional automated processes to be competitive. The estimated starting annual salary for a mechatronics engineer is approximately \$99,040.

Additionally, ETSU surveyed engineering alumni who graduated in 2005 or before about the need for the proposed program. Their responses indicated that Mechatronics is in demand with their employer and that they fully support ETSU developing a program in this area. Respondents represent engineers working in

senior industry positions at TVA, the US Army, Microsoft, Walmart, Somic America, and BorgWarner, among others.

Letters of support point to an industry need for the training offered in the proposed program, a willingness to host student interns, and an interest in hiring ETSU graduates who have completed the proposed program. Letters of support are provided by Cross Company, Siemens Industrial Automation, JTEKT North America Corporation, and SKF Lubrication Management.

INSTITUTIONAL CAPACITY TO DELIVER THE PROGRAM

The proposed program will be located in the Department of Engineering, Engineering Technology, and Surveying, which is housed in the College of Business and Technology. ETSU is confident that the Department of Engineering, Engineering Technology, Interior Architecture, and Surveying has the capacity to deliver the proposed program. The department currently has 20 faculty members of varying ranks, three (3) of whom will teach in the proposed program. Two (2) faculty will be hired to support the program; one (1) search will begin following program approval to start in Fall 2024 and one (1) will be in place by Fall 2025. Additional faculty will be hired as needed.

The department currently has five (5) laboratories, several computer labs, and 16 classrooms in Wilson Wallis Hall. The proposed program will require the addition of two (2) new or renovated large lab areas and one (1) new or renovated large planning classroom. ETSU has plans to add these spaces in Wilson Wallis Hall, and has allowed \$750,000 to cover the costs of renovation. Additional space may be added as part of the Brown Hall renovation depending on the growth of the program.

Students enrolled in the program will have access to all support services offered by the university, including ETSU Student Support Services tutoring, the Writing Laboratory offered by the College of Business and Technology, and the Center for Academic Achievement. The department has an existing successful internship program with local industry, with over 38 industry partners participating. Career counseling is provided at the college and university levels, and two (2) advisors serve engineering students with specialized advising and career planning.

EXTERNAL JUDGMENT

An in-person external review of the proposed program was conducted on August 22, 2023 by Dr. Alberto Aliseda, Pacific Car and Foundry Company (PACCAR) Professor in Engineering and Chair of Mechanical Engineering at the University of Washington. The site visit included meetings with campus administrators and faculty at ETSU, as well as community partners and current and potential students. The visit also included tours of various existing engineering laboratory spaces, as well as potential additional lab space. Dr. Aliseda recommended approval of the proposed program “without reservation,” adding, “I am confident that the faculty at ETSU are prepared to create and administer a high-quality engineering degree that will lead to graduates who will be highly sought after by, and successful in, the local industry.” Aliseda noted the compelling need for well-trained and qualified engineers in the East Tennessee region, writing, “the [proposed] program at ETSU will contribute to fill a national need, but will do so benefitting primarily its regional area of influence, where there is already a burgeoning industry that demands this profile of engineers.” Aliseda found the curriculum “extensive” and remarked that it “contains all the elements to make it successful in preparing graduates for high paying jobs.” Finally, Dr. Aliseda found the faculty, administrative, and institutional enthusiasm for the program “extraordinary,” adding, their “commitment speaks volumes about the need of this program in Eastern Tennessee.”

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

The proposed one-time and recurring expenditures for the Mechatronics Engineering, BS program are listed in the Financial Projections Table below. Most of the program costs are associated with new faculty positions and equipment and space updates necessary for mechatronics instruction and labs.

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						
Consultants	\$2,000			\$16,000		
Equipment		\$1,363,335				
Information Tech						
Library						
Marketing	\$11,000					
Facilities			\$750,000			
Travel						
Other						
Total One-Time Expenditures	\$13,000	\$1,363,335	\$750,000	\$16,000		
Recurring Expenditures						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Accreditation						
Consultants						
Equipment						
Information Tech			\$50,000		\$50,000	
Library						
Marketing						
Facilities						
Travel						
Other**		\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Total Recurring Expenditures		\$20,000	\$70,000	\$20,000	\$70,000	\$20,000
Grand Total (One-Time and Recurring)*	\$13,000	\$1,383,335	\$820,000	\$36,000	\$70,000	\$20,000

*General Note: Many of the costs of supporting equipment, library databases, IT, Travel and so-on are supported by student fees in current programs. It is assumed as enrollment increases, this will also be the case for the Mechatronics engineering program.

**Other - Engineering programs consume items of technology for labs such as integrated circuits, metals and materials that do not count as equipment but can have real costs. In some cases, departmental fee money covers these expenses and in other cases it does not. One (1) example of this is an integrated circuit made by Analog Devices (AD595), used for making precise measurements, costs \$72 each at a supplier. Many times, students fail to hook these up properly, resulting in loss. Over the period of an academic year, these consumable costs can be very high in an engineering program.