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Memorandum

TO: Lori Bruce, Provost and Vice President for Academic Affairs
Tennessee Technological University

FROM: Julie A. Roberts, Chief Academic Officer
Tennessee Higher Education Commission

SUBJECT: Tennessee Technological University
Expedited Letter of Notification: Industrial and Systems Engineering, Master of Science

DATE: October 4, 2023

Thank you for the submission of the Expedited Letter of Notification (ELON) for the Industrial and Systems Engineering, Master of Science (MS) program. Per THEC Policy A1.6 – Expedited Academic Programs: Approval Process, the ELON is evaluated on the following criteria: alignment with workforce, economic, or other state needs while still assuring quality, student demand, uniqueness, and institutional capacity to deliver the proposed program.

After reviewing the ELON, I approve Tennessee Technological University's plan to develop the Expedited New Academic Program Proposal (ENAPP) for the Industrial and Systems Engineering, MS program. It is understood the proposed program will be developed in accordance with the mission of TTU and will meet the Master Plan for Tennessee Postsecondary Education 2015-2025 degree completion and workforce development objectives.

Attachment

cc: Philip Oldham, President, TTU
Steven Gentile, Interim Executive Director, THEC
Sharon Huo, Associate Provost, TTU
Ryan Korstange, Director of Academic Affairs, THEC

Tennessee Higher Education Commission
Expedited Letter of Notification Evaluation
October 4, 2023



The evaluation of the Expedited Letter of Notification (ELON) is in accordance with the [THEC Policy A1.6 Expedited Academic Programs: Approval Process](#). The evaluation is conducted by interested parties and THEC staff. The ELON is posted on the THEC website for a 10-day period of comment by interested parties. Based on the internal and external evaluation, THEC will make a determination to support, not to support, or defer a decision based on a revised ELON.

Institution: Tennessee Technological University	LON Submission Date: September 20, 2023
Academic Program, Degree Designation: Industrial and Systems Engineering, MS (MSISE)	
Proposed CIP Code: 14.3501 (Industrial Engineering, Systems Engineering)	
Proposed Implementation Date: Spring 2025	
Time Period Posted on Website for Public Comment: September 20-September 30, 2023	

Note: Comments in italics within this document should be addressed in the ENAPP.

Criteria	Comments
Letter of support from President/Chancellor	<ul style="list-style-type: none"> A letter of support from President Phil Oldham dated September 13, 2023 and addressed to THEC Interim Executive Director Bob Smith is included in the ELON.
Overall Comments	<ul style="list-style-type: none"> <i>The degree designation is listed as MS, MSISE and MS-ISE – please clarify the intended degree designation.</i>
Implementation timeline	<ul style="list-style-type: none"> The tentative timeline for the proposed program includes the following key dates: <ul style="list-style-type: none"> External Site Visit: Spring 2024 Submission of external review report: Spring 2024 Institutional response to external review: Spring 2024 Proposed timeline for accreditation: Not Applicable Proposed institutional governing board consideration date: June 2024 Proposed THEC consideration date: July 2024 Proposed date when students will enroll: Spring 2025 <i>In the ENAPP, please provide more specific dates for external review and institutional response.</i>
Background narrative	<ul style="list-style-type: none"> TTU is proposing a Master of Science in Industrial and Systems Engineering to address a demonstrable and growing demand for industrial and systems engineers in the state. This Master of Science program allows a faster, less expensive (in terms of startup costs) response to workforce need, as students can complete the program in 18 months, versus four years for a Bachelor of Science. Approval of the proposed program would confer several other benefits at TTU, including coursework that would support other MS programs

	<p>in the College of Engineering, assistance with faculty research activities, and opportunity for research collaboration with the new Engineering Management, MS.</p> <ul style="list-style-type: none"> ▪ TTU plans to follow a successful MS program with a BS program if resources and demand prove sufficient. ▪ TTU previously offered BS and MS degrees in Industrial Engineering, but both programs were terminated in 2012 and 2010, respectively. Since the time of the termination of these programs, Industrial Engineering has become one of the fastest growing engineering disciplines in the US. <i>In the ENAPP, please provide information about why these programs were terminated, and about what has changed on the campus since the termination.</i> ▪ The proposed program will not require extensive prerequisite coursework, which will attract students from non-industrial engineering disciplines. The curriculum will offer breadth across industrial and systems engineering and depth in data analysis and modeling, along with courses in engineering economics, human factors, and engineering or project management. ▪ The proposed program will require 32 credit hours and support both practitioner and research-focused students with a project option and thesis option. The program will be offered on-campus and online through full-time and part-time enrollment to accommodate working students. <ul style="list-style-type: none"> ○ All students will have three core topics courses (9 credits) and two core professionalism courses (1 credit each). ○ Students will also take courses from three (thesis option) or four (project option) focused elective areas to ensure breadth.
<p>Justification for consideration of expedited policy</p>	<ul style="list-style-type: none"> ▪ Industrial engineers are cited as in-demand across eight of the nine industry clusters identified in THEC's Supply and Demand Report (Food and agriculture; health and life sciences; rubber, ceramics, and glass; automotive; electrical equipment and appliances; headquarters, finance and technology; aerospace and defense; chemicals). Students with data analysis and modeling skills are often hired to work in the last career cluster, distribution and logistics, and the proposed program will offer such training. Additionally, Industrial engineering is cited as an "in demand occupation" in the same source. ▪ The Bureau of Labor Statistics projects a 13.1 percent national growth in employment from 2020-2030, which translates to 25,000 average job openings per year, higher than any other engineering field. BLS data also predicts that industrial engineering growth will be higher in Tennessee than in other states, likely due criticality of Industrial Engineering skills to the state's three major employment sectors, manufacturing, logistics, and healthcare. ▪ Despite the need for trained Industrial Engineers, few academic

	<p>programs and graduates are available to fulfill the need. For example, in 2019-20, only 80 degrees BS and MS Industrial Engineering degrees were awarded in Tennessee, despite there being 6,930 jobs in the field. Anecdotal evidence reported by employers and alumni indicates that many industrial engineering positions are filled by engineers of other disciplines without the specialized training offered by an industrial engineering degree.</p>
Existing programs of study at the institution	<ul style="list-style-type: none"> ▪ The proposed MSISE does not come from an existing minor or certificate program. However, some courses are currently offered through other BS and MS programs in the College of Engineering, and an undergraduate minor in Industrial and Systems Engineering was approved in Fall 2022. Please provide current enrollment figures for the undergraduate minor.
Community and industry partnerships	<ul style="list-style-type: none"> ▪ Letters of support for the proposed program were provided by: <ul style="list-style-type: none"> ○ Ethan Bernhardt, President, ATC ○ Jeff A. Bowerman, Global MFG Director Cummins Filtration; This letter is not properly dated (no year is indicated) ○ Aashish Galaut, Vice President of Marketing, FedEx ○ Tessa Powell, Human Resource Manager (South Division), JR Automation ○ Greg Tompkins, Plant Manager, Tenneco Automotive ○ Several of these letters of support directly address the development of a BS program rather than an MS program. Please ensure corporate partners are offering the same support for the proposed MS and attach updated letters. ▪ One hundred seventy-one employer representatives who recruited TTU engineering students from Fall 2021 to Fall 2022 were sent a survey to determine employer need for academic training in Industrial Engineering. The survey had 35 responses, with 42 percent (roughly 15 respondents) indicating that their organization hires industrial engineers and another 42 percent indicating they would definitely or probably be interested in interviewing students of the proposed program.
Accreditation	<ul style="list-style-type: none"> ▪ The Engineering Accreditation Commission of ABET (EAC-ABET) supports accreditation of engineering master's programs, but few programs in the US opt to seek it and instead focus on accrediting baccalaureate programs. TTU does not intend to seek accreditation for the proposed program.
Administrative structure	<ul style="list-style-type: none"> ▪ The proposed program will be housed in the General and Basic Engineering Department, one of six departments in the College of Engineering. ▪ A program director will be hired to lead the proposed MS in Industrial and Systems Engineering. When will this search begin?
Enrollment and graduation projections	<ul style="list-style-type: none"> ▪ Projected enrollments for part-time and full-time students are as follows and are based on persistence and graduation data in existing MS programs in engineering:

	Academic Year	Projected Fall Enrollment	Projected Attrition	Projected Graduates
	Spring 2025	4 (2 FT, 2 PT)	1	0
	2025-2026	9 (6 FT, 3 PT)	3	0
	2026-2027	13 (9 FT, 4 PT)	3	3
	2027-2028	16 (10 FT, 6 PT)	4	3
	2028-2029	19 (12 FT, 7 PT)	4	5
	<ul style="list-style-type: none"> ▪ <i>These enrollment projections point to a program that is aimed right at THEC’s minimum productivity threshold (5 graduates a year for Master’s degrees). The low number of projected annual graduates may be a challenge going forward. Please provide information to address concerns in relation to the THEC definition of low-producing program in the ENAPP.</i> ▪ <i>The enrollment projections seem to imply that the only full-time enrollment option will be for in person attendees. In the curriculum section of the ENAPP, make sure to describe the full-time and part-time pathways through the program.</i> ▪ The MS in Engineering Management informed projections for online enrollments since it is the only data set available. However, the program began in 2020 and the implementation has been impacted by the COVID-19 pandemic. The campus believes the part-time projections are extremely conservative. 			
<p>Alignment with State Master Plan and institutional mission profile</p>	<ul style="list-style-type: none"> ▪ The proposed program aligns with the State Master Plan for Higher Education Update in three ways: <ul style="list-style-type: none"> ○ The program will prepare students for employment as industrial and systems engineers and as operations research analysts, both of which are in high-demand and offer high starting salaries. ○ The program’s emphasis on data analysis and modeling addresses the goal to increase offerings in data analytics in the state. ○ The program aligns with the plan’s imperative for stackable credentials by offering educational advancement for engineers of various disciplines through specialized training in industrial and systems engineering, without requiring significant pre-requisite work. ▪ The proposed program aligns in numerous ways with TTU’s institutional mission to “create, advance, and apply knowledge to expand opportunity and economic competitiveness” through infusion of STEM, “enduring education, impactful research, and collaborative service.” <ul style="list-style-type: none"> ○ The Industrial and Systems Engineering, MS is a STEM infused program and promotes efficiency in the workforce through imparting skills in data analysis, data modeling, system design, and operation. ○ Student thesis research and collaboration with faculty 			

	<p>promotes “impactful research” and advances knowledge.</p> <ul style="list-style-type: none"> ○ The MS-ISE project will focus on real-world problem solving and will be an opportunity for collaborative service and enhancing economic competitiveness. ○ The program will be offered in two modalities to support enduring education.
<p>Student interest</p>	<ul style="list-style-type: none"> ▪ Surveys were distributed to cooperative education programs student participants, recent engineering alumni, and current students. <i>When were these surveys distributed?</i> <ul style="list-style-type: none"> ○ The cooperative ed student survey garnered 21 responses and indicated that 40 percent of students learned about some ISE topics during their co-op work assignment. Nineteen percent indicated an interest in one or more ISE topics. No students indicated interest in enrolling in a master’s degree after graduation. ○ The recent alumni survey was distributed to 2,236 COE alumni and had 105 completions (about average completion rate for emailed surveys). Respondents were asked to indicate if they were interested in seeking a graduate degree and if so, in which field. Thirty-seven respondents (35 percent) indicated an interest in a graduate degree and two expressed interest in Industrial and Systems Engineering. ○ The survey of current students received 37 responses (of 2,300+ distributed). Twelve students indicated that it was likely or extremely likely that they would consider pursuing a degree in Industrial Systems Engineering in the future, which 27 indicated that an MS in Industrial Systems Engineering would “enhance my employment prospects.” ▪ <i>It may be beneficial to include additional information about enrollment in related concentrations or minors at TTU, or enrollment trends in comparable programs in other states, to substantiate student demand.</i> ▪ <i>Please make sure to address the lack of knowledge about industrial engineering as an in-demand career field in the marketing section of the ENAPP.</i>
<p>Existing programs offered at public and private Tennessee universities</p>	<ul style="list-style-type: none"> ▪ No institutions offer a program covering both industrial and systems engineering. The proposed program offers instruction in both, rather than focusing on one. ▪ Industrial Engineering (CIP 14.3501) <ul style="list-style-type: none"> ○ UTK - BS, MS, and PhD in Industrial Engineering (CIP 14.3501). These programs do not have a systems engineering focus. A detailed curriculum comparison is provided on pg. 24 on the ELON.

	<ul style="list-style-type: none"> ○ The University of Tennessee, Martin’s Engineering, BS (CIP 14.0101) offers Industrial Engineering as a concentration, but the concentration is not active in the catalog. ▪ Systems Engineering <ul style="list-style-type: none"> ○ UTK, Master of Science in Industrial Engineering, Systems Engineering Concentration. ▪ Engineering Management (CIP 15.1501) <ul style="list-style-type: none"> ○ TTU, Engineering Management, MS ○ Memphis, Engineering Management, MS: Concentrations in Manufacturing or Transportation ○ UTC, Engineering Management, MS: Concentration in construction management ○ UTK, Engineering Management, MS UTK, Industrial Engineering, MS: Concentration in Engineering management (Phasing out in Spring 2024). MTSU, Professional Science, MS; Concentration in Engineering Management. ▪ Industrial and Systems Engineering related programs offered at private institutions in TN include: <ul style="list-style-type: none"> ○ Vanderbilt, ME: concentrations in Engineering management and Risk, Reliability, and Resilience engineering. ○ Christian Brothers, Engineering Management, MS. ▪ <i>Please provide the number of degrees awarded in each MS program listed for each of the last three years.</i>
Articulation and transfer	<ul style="list-style-type: none"> ▪ Transfer credit for the proposed degree will be evaluated in compliance with existing policies for graduate transfer credit at TTU.
Public comments	<ul style="list-style-type: none"> ▪ No public comments were received.