DEPARTMENT OF HIGHER EDUCATION & WORKFORCE DEVELOPMENT

New Program Report

Date Submitted:
11/21/2023

Institution
University of Missouri-Columbia

Site Information

Implementation Date:
1/1/2024 12:00:00 AM

Added Site(s):

Selected Site(s):

University of Missouri-Columbia, 105 Jesse Hall, Columbia, MO, 65211

CIP Information

CIP Code:
150000

CIP Description:
A program that generally prepares individuals to apply basic engineering principles and technical skills in support of engineers engaged in a wide variety of projects. Includes instruction in various engineering support functions for research, production, and operations, and applications to specific engineering specialties.

CIP Program Title:
Engineering Technology, General

Institution Program Title:
Engineering Technology

Degree Level/Type

Degree Level:
Bachelor's Degree

Degree Type:
Bachelor of Science

Options Added:

Collaborative Program:
N

Mode of Delivery

Current Mode of Delivery

Classroom

Student Preparation

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Special Admissions Procedure or Student Qualifications required:
FTC students who meet the minimum admission requirements set by MU will be eligible to be admitted into the new BSET program. FTC students admitted into the BSET program will be part of the first-year engineering program to provide them with critical academic and career advice.

Transfer applicants will also be admitted into the program following MU's policies and requirements. Community college students will be able to benefit from college pathways specifically designed for transfer students in collaboration with state community colleges and institutions that offer 2-year associate degree programs.

Specific Population Characteristics to be served:
n/a

Faculty Characteristics

Special Requirements for Assignment of Teaching for this Degree/Certificate:
The new NTT faculty will be required to have at least an MS degree in ET or related engineering fields, and a PhD degree will be preferred. At least 3 years industrial experience will be recommended for all new hires.

Estimate Percentage of Credit Hours that will be assigned to full time faculty:
55%

Expectations for professional activities, special student contact, teaching/learning innovation:
All faculty will be expected to become active members of state and national professional associations, which in turn provides opportunities for students to be involved in leadership within the profession.

Student Enrollment Projections Year One-Five

Year 1	Full Time: 20	Part Time: 0	
Year 2	Full Time: 38	Part Time: 0	
Year 3	Full Time: 66	Part Time: 0	Number of Graduates: 0
Year 4	Full Time: 89	Part Time: 0	
Year 5	Full Time: 107	Part Time: 0	Number of Graduates: 18

Percentage Statement:
n/a

Program Accreditation

Institutional Plans for Accreditation:
Accreditation efforts will initiate during the first year of the program start. An industrial advisory board will be formed to continuously review and improve the learning objectives and student outcomes to meet the workforce demands. Data needed for the Accreditation Board for Engineering and Technology (ABET) will be collected and assessed each semester during the first five years of the program. We plan to apply for initial accreditation during 2028.

Program Structure

Total Credits:
120

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Residency Requirements:
n/a

General Education Total Credits:
42

Major Requirements Total Credits:
63

Course(s) Added

COURSE NUMBER	CREDITS	COURSE TITLE
MAE 1100	3	Introduction to Computer Aided Design
ENGTC 4800	3	Industrial Safety and Risk Assessment-New
MFGET 4700	3	Industrial Automation II-New
MFGET 3700	3	Industrial Automation I-New
ENGTC 2350	3	Materials, Processes, and Testing with lab-New
ENGTC 3450	3	Fluid Mechanics for Technology with Lab-New
MFGET 1500	2	Intro Manufacturing Eng Tech Applications-New
MFGET 2030	3	Fund of Sys Design & Analysis
MFGET 4970w	3	Capstone Design I-New
MFGET 4950	3	- 6 Industrial Internship/Cooperative Education-New
ENGTC 1250	3	Statics for Technology with lab-New
ENGTC 2250	3	Mechanics for Technology with lab-New
MFGET 4980w	3	Capstone Design II-New
ENGTC 3350	3	Machine Tool Technology-New
MFGET 2600	3	Computer Aided Manufacturing I-New
ENGTC 2150	3	Electronics Fundamentals with lab-New
ENGINR 1000	1	Introduction to Engineering
MFGET 3400	3	Manufacturing Process Improvement-New
MFGET 3200	3	Intro Robotics-New
MFGET 2500	3	Manufacturing Methods I-New
MFGET 3800	3	Smart Manufacturing Technology-New

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INFOTC 1040	3	Computer Programming

Free Elective Credits:

0

Internship or other Capstone Experience:

All senior students are required to take an industrial internship class (3-6 hours) and two capstone design classes for a total of 9-12 credit hours.

Assurances

I certify that the program is clearly within the institution's CBHE-approved mission. The proposed new program must be consistent with the institutional mission, as well as the principal planning priorities of the public institution, as set forth in the public institution's approved plan or plan update.

I certify that the program will be offered within the proposing institution's main campus or CBHE-approved off-site location.

I certify that the program will not unnecessarily duplicate an existing program of another Missouri institution in accordance with 6 CSR 10-4.010, subsection (9)(C) Submission of Academic Information, Data and New Programs.

I certify that the program will build upon existing programs and faculty expertise.

I certify that the program can be launched with minimal expense and falls within the institution's current operating budget.

I certify that the institution has conducted research on the feasibility of the proposal and it is likely the program will be successful. Institutions' decision to implement a program shall be based upon demand and/or need for the program in terms of meeting present and future needs of the locale, state, and nation based upon societal needs, and/or student needs.

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Executive Summary

The MU College of Engineering proposes a new four-year Bachelor of Science in Engineering Technology (BSET) degree program. This new BSET will develop innovative educational experiences to our students that are relevant to existing and emerging careers in engineering technology. The initial emphasis of this BSET is on manufacturing engineering technology, and additional emphasis area will be developed based on enrollment trends.

This new degree program will provide students with a solid foundation in engineering principles and technology, as well as the hands-on experience they need to succeed in the workforce. The BSET degree will meet the workforce needs of regional employers who employ engineers in manufacturing engineering roles, will provide pathways for high school students and students from community colleges and universities that offer two-year associate degrees in engineering technology and/or pre-engineering program, and will provide pathways into these engineering jobs for non-traditional adult students.

The proposed BSET program reflects the mission of the College of Engineering to develop education and outreach programs that enhance economic competitiveness regionally, nationally and globally. The BSET program is also aligned with the College of Engineering's mission to educate engineers, create leaders, advance technology, and develop entrepreneurs within an inclusive, research and interdisciplinary environment; resulting in well-informed citizens, economic development, job creation, and an improved standard of living for Missouri and beyond, as outlined in its most recent strategic plan.

Many leading universities across the nation offer a Bachelor of Science in Engineering Technology. According to National Academy of Engineering publication, approximately 38 universities award at least 100 BSET degrees each year. These institutions include Purdue, Texas A&M, Columbia Southern, Southern Illinois, Rochester Institute of Technology, Michigan State, and Arizona State University Polytechnic. Most recently, the Ohio State University launched their BSET degree program with focus on manufacturing engineering technology as an initial emphasis area. Over 10,700 BSET degrees per year are conferred by the 50 top programs.

According to American Society for Engineering Education (ASEE), Engineering Technology (ET) programs are inclusive options that provide access to underrepresented groups by providing "weaving- in" opportunities to students

instead of "weeding-out", which is a large contributor to the lack of diversity in engineering programs. According to a review by the Engineering Technology National Forum, ET programs provide a more viable avenue to the skilled technical workforce for veterans, non-traditional adult students, community college students, and adults seeking to change professions than traditional engineering programs. According to the U.S. Bureau of Labor and Statistics, Science, Technology, Engineering and Mathematics (STEM) occupations are projected to grow by 10.8% from 2021 to 2031. It is critical that our university is prepared to meet this new workforce demand and is equipped to train and retain graduates including populations traditionally underrepresented in STEM. In a statement to the National Science Foundation (NSF), President Biden stated "to compete on the world stage, we must train and develop the absolute best technical workforce." In addition, the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act continues to drive the addition of manufacturing jobs and provide opportunities for STEM education and good-paying skilled jobs in existing and emerging industries built on the technologies of the future.

This new BSET degree program is designed to meet growing demand for graduates who possess engineering technology skills that integrate business and leadership principles with engineering processes and technical knowledge. The new BSET is designed to meet the workforce needs for regional employers who employ engineers in manufacturing design roles. The program will also provide pathways into these engineering jobs for non-traditional students.

The new BSET with an emphasis area in manufacturing prepares graduates with technical and leadership skills necessary for manufacturing competitiveness to analyze, synthesize and control manufacturing operations to design and build solutions to real-world problems and model, simulate and analyze manufacturing production processes for both small- and large-scale industries.

1. Introduction

Academic Components and Career Paths

Students completing the BSET curriculum be required to take the Fundamentals of Engineering Exam to prepare them for the professional engineering exam in the state in which they would practice if they chose to. Graduates of the BSET program will be prepared for entry-level technologist career opportunities in general engineering technology and in manufacturing engineering technology industries. Some of the career opportunities include general and operations manager, sales representative, product manager, management analyst, engineering analyst, industrial production manager, manufacturing engineer, quality engineer, engineering

technologists, product engineer, process engineer, and more.

Evolution of Concept

The degree is developed in response to the growing needs of regional and state industry for highly skilled college graduates who possess broad training in engineering technology and are prepared for the workplace. No such BSET degree program exist in the UM system. Initially, the focus of this new degree is on Manufacturing Engineering Technology, and additional emphasis areas within the degree program will be developed based on enrollment and graduation trends.

Preliminary Steps

The new BSET degree was developed based on analysis of the market and trends nationwide. No minor or certificate was offered prior to proposing this degree program. The potential for the Engineering Technology (ET) degree was based the current success of the current Information Technology degree program, which appeals to students interested in hands-on type of computer science careers.

A general ET program that would appeal to students interested in engineering, other than computer science, is expected to be an ideal fit for such students who are interested more in application than theoretical preparation.

2. University Mission and Other Academic Programs

2.A. Alignment with Mission

One of the primary goals of the proposed BSET program is to strengthen the relationship between the University of Missouri-Columbia and community colleges throughout the state. The curriculum for the BSET was designed with this goal in mind. Discussions with some feeder community colleges already started, and support from two state community colleges was obtained.

Alignment with Campus Strategic Plan

The proposed BS in Engineering Technology is closely aligned with the MU strategic plan goals of "Create new degree programs and revise existing programs based on student demand, workforce needs and emerging opportunities" and "Develop new and revise existing interdisciplinary undergraduate and graduate degree programs to magnify departmental strengths." Also, core to the Strategic plan, this new program will increase undergraduate enrollment by attracting additional students to MU including non-traditional adult students, students from underrepresented backgrounds, and transfer students from community colleges around the state. All is in alignment with MU's strategic goals to "Increase enrollment of transfer

students" and "Cultivate a stronger transfer- friendly environment." Also, the proposed BSET degree will improve students' success, retention, and graduation rates by creating weaving-in opportunities instead of weeding-out of students who tend to flourish in practice-oriented application of engineering science and design, focusing on hands-on educational experience.

The establishment of the BSET program is mission critical for recruiting and retaining students in an era where our college of engineering intends to grow enrollment by 1,500 students. This program will provide incoming and current students with a broad range of engineering options that contribute significantly to job creation and economic development for the State of Missouri. The College of Engineering Dean is committed to the success of this program and will vigorously support the investments that must be made to guarantee our success.

2.B. Duplication & Collaboration within State, Outside System

Duplication Within State
At the state level, Missouri Western State University (MWSU) offers an ABET (Accreditation Board for Engineering and Technology) accredited ET program with emphasis in Manufacturing Engineering Technology. In addition, Southeast Missouri State University (SEMO) offers an ABET accredited ET program with emphasis on Mechanical and Manufacturing Systems. Both programs are similar to the program requested in this proposal.

Rationale
Both MWSU and SEMO serve a more local population, whereas MU has the capacity to serve the entire state, including those from metropolitan areas and surrounding states. In addition, career opportunities requiring engineering technology knowledge and skills are rapidly growing, and workforce needs are on the rise. MU is well positioned to provide students with a broad-based education in engineering principles and technology and prepare graduates to meet these industry demands.

Based on Lightcast's Q1 2023 data, currently there are 716 completions regionally (MO+8 surrounding states) from baccalaureate level engineering technology programs (CIP 15.0000 and 15.0613) compared to 60,149 annual openings with a median annual salary of $67,100/year and 12.6% projected growth.

Collaboration and Feasibility Within the State
While there are currently no collaborations within the state, collaborations with state community colleges (CCs) that offer pre-engineering and/or 2-year degree programs in engineering have been initiated. Support letters from Saint Louis Community College and Moberly Area Community College have been obtained.

This collaboration will build on existing collaborations and articulations agreement between state CCs and college of engineering. The new ET degree program will advance such collaborations and develop seamless college pathways.

3. Business-Related Criteria & Justification

3.A. Market Analysis

3.A.1. Rationale and Workforce Demand

The program will prepare students to be competitive for jobs in Engineering Technology in Missouri, regionally, and nationally through strong connections to the industry. According to a review by the Engineering Technology National Forum, ET programs provide a more viable avenue to the skilled technical workforce for veterans, non-traditional adult students, community college students, and adults seeking to change professions than traditional engineering programs. According to the U.S. Bureau of Labor and Statistics, STEM occupations are projected to grow by 10.8% from 2021 to 2031. It is critical that our university is prepared to meet this new workforce demand and is equipped to train and retain graduates including populations traditionally underrepresented in STEM.

The demand for engineering technology professionals is expected to continue to grow in the coming years, as technology advances and the need for highly skilled workers increases. According to analysis of Lightcast data, which includes data sources such as the Missouri Economic Research and Information Center (MERIC), engineering technology and manufacturing engineering technology employments are projected to grow 3.4% and 11.3% in Missouri and surrounding state from 2021 to 2032, respectively. This growth is expected to be driven by several factors, including the increasing complexity of technology and the need for businesses to stay competitive in a global economy. Overall, a degree in engineering technology can open a wide range of career opportunities and is a solid investment for those looking to enter a dynamic and growing field. In terms of salary, engineering technologists can expect to earn a competitive income. According to Lightcast, the median annual wage for engineering technology and manufacturing engineering technology occupations are $57,600 and $67,700 in Missouri and surrounding state, respectively.

3.A.2. Student Demand for Program

There is currently no pathway at MU for students interested in pursuing a degree program in Engineering Technology. BSET will create opportunities for students who are interested in practice-oriented applications of engineering science and design. On average 67 students left the College of Engineering and

MU from FS2017- FS2021. The BSET degree program will create possible career pathways for such students including pre-engineering students who are not admitted into existing engineering program. It is estimated that 10 students per year will be transfers from within MU into BSET.

Table 1a. Student Enrollment Projections

Year	1	2	3	4	5
Full-time	20	38	66	89	107
Part-time	0	0	0	0	0
Total	20	38	66	89	107

Engineering technologists help close the gap between engineers and technicians. According to National Society of Professional Engineers (NSPE), many of ET students transfer from engineering programs, which is attributed mostly to the appeal of the applied hands-on education. ET programs capture students who might leave engineering or the university seeking other ET programs. For example, at Texas A&M, about 80% of ET students transferred from traditional engineering programs.

According ASEE's 2021 report, of the top 50 universities, Arizona State University had the largest ET enrollment of 5,001 students and Drexel University had the lowest enrollment of 161 students. According to the same report, 10,723 BSET degrees were awarded, or which 930 were in general ET and 1280 were in manufacturing engineering technology. Other relevant enrollment and graduation data are given in table below for specific institutions. Enrollment of underrepresented minorities (URM) and women was 23.6% and 17.4%, respectively, and the degrees awarded to URM were 20% and 15.5% to women.

Table 1b. New Student Enrollment Projections

Year	1	2	3	4	5
Total	10	10	20	25	30

Enrollment projections are for new students joining the program as FTC students and CC transfer students. New students joining the program as FTC and transfer students will grow steadily from 10 students in year 1 to 40 students in year 5. It is expected that 10 students will transfer from current engineering, and their tuition was not included in the revenue calculations in the attached Pro Forma spreadsheet.

Table 1c. Projected Number of Degrees/Certificates Awarded

Year	1	2	3	4	5	6	7	8	9	10
Completions	0	0	0	9	18	18	27	31	36	36

3.B. Financial Projections

3.B.1. Additional Resources Needed

The hiring of a full-time non-tenure/tenure track (NTT) faculty member is planned for year 1 and a second in year 2. The hiring of additional NTT faculty is planned for years 3 and 4, for a total of 4 NTTs to support the development of the program during the first 5 years. Depending on enrollment trends and creation of additional emphasis areas within the degree program, additional NTTs could be hired. The Dean has committed $300,000 in equipment funding and space to establish the new laboratory needs for the program. In addition, the Dean has committed to hiring the first NTT and to the additional cost for new laboratories. The program will require an academic advisor who will be hired during year 3. Additional resources are outlined below:

1) Four non-tenure/tenure track (NTT) faculty in first five years
2) Additional NTT faculty if emphasis areas are added
3) An academic advisor

The ET program will utilize existing college resources, such as library, laboratory facilities, etc. Program costs include new equipment, faculty and staff salaries/benefits; course development; and miscellaneous expenses.

Sources of Revenue

The sources of revenue include tuition and fees for new students. No financial support is being provided by the university. The EIT department currently graduates 90 Bachelor of Science in Information Technology (BSIT) students per year. By establishing the BS in Engineering Technology within the department, the college intends, long term, to grow the number of graduates from the EIT department to 300 students per year. To support this growth, the college is committed to adding new faculty and increasing the annual budget from $1.3M to $3.8M. This increase in faculty and budget will be added slowly as the student body grows.

In addition to building adequate teaching support for the program, the college is committed to providing world class laboratories that will support excellence in learning. The initial focus disciplines of the BSET program will be on manufacturing. The College of Engineering is currently investing $1M in an upgraded manufacturing lab and have been awarded another $1M on a MoExcels Grant from the State of Missouri to augment this lab with an

advanced manufacturing facility. These investments will also benefit existing programs in the college, such as industrial engineering and mechanical engineering. The total amount of space that has been dedicated for this laboratory upgrade is 3,370 SF on the first floor of Lafferre Hall. Additional equipment funds will be sought through the FY25 MoExcels program to support the establishment of state-of-the art facilities and experiential learning laboratories for the new BSET degree program.

3.B.2. Revenue

Based on the enrollment projection presented above, the total revenue in year one using Tier 3 Block Tuition will be $239,304; and increasing to $1,385,814 in year five. Detailed revenue and expense projections are provided in Appendix 2.

3.B.3. Net Revenue

The program will generate net revenue in all years, with the exception of Year 2, due to $300,000 one-time laboratory development expenses. The cumulative direct margin will be positive for the program in all years. Under a 50% enrollment scenario, the direct margin will be positive beginning in Year 3 and the cumulative direct margin will become positive in Year 6. The program will leverage existing resources and will require additional funding to be successful.

The college of engineering is currently investing $1M in an upgraded manufacturing lab and have been awarded another $1M on a MoExcels Grant from the State of Missouri to augment this lab with an advanced manufacturing facility.

In addition, the college of engineering is committed to support the development of the new program, including the recruitment of new NTT faculty and the appointment of peer learning assistants and an academic advisor to support the program. The college of engineering has excellent lab infrastructure to support lab courses.

Table 2. Financial Projections for Proposed Program for Years 1 Through 5.

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
New/Renovated Space	0	0	0	0	0
Equipment	0	300,000*	5,000	0	0
Library	0	0	0	0	0
Consultants	0	0	0	0	0
Other	0	0	0	0	0
Total one-time	0	300,000	0	0	0

B. Recurring	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty	65,000	132,600	198,900	265,200	270,504
Staff	0	0	45,000	45,900	46,818
Benefits	30,277	54,356	95,782	119,719	121,935
Equipment	0	0	0	0	0
Library	0	0	0	0	0
*Other***	50,600	51,212	56,836	57,473	58,122
Total recurring	145,877	238,168	396,518	488,292	497,380
Total expenses (A+B)	145,877	538,168	401,518	488,292	497,380
2. Revenue per year					
Tuition/Fees	239,304	463,772	821,608	1,130,085	1,385,814
Institutional Resources	0	0	0	0	0
State Aid -- CBHE	0	0	0	0	0
State Aid -- Other	0	0	0	0	0
Total revenue	239,304	463,772	821,608	1,130,085	1,385,814
3. Net revenue (loss) per year	$93,427	($74,397)	$420,090	$641,793	$888,434
4. Cumulative revenue (loss)	105,259***	$30,863	$450,952	$1,092,745	$1,981,179

Notes:
*$300,000 has already been committed by the Dean and were added to the EIT department budget for FY24.
**Peer Learning Assistants and marketing and recruitment.
***$11,832 net margin was added from Year 0 (implementation year).

3.B.4. Financial and Academic Viability

Table 3. Enrollment for Academic and Financial Viability

Enrollment	Minimum for Financial Viability	Minimum for Academic Viability
Full-time	60	40
Part-time	0	0
Total	60	40

The program will rely on existing courses offered in the EIT department and across campus. Twenty-one specialized ET courses are proposed, which will be developed and taught mostly by new NTT faculty who will be hired for the ET program over the next 4-5 years. Dr. Salim will also contribute towards the teaching needs for the program by teaching 2-3 of the new proposed courses in the mechanics and materials subjects.

The new NTT faculty will be required to have at least an MS degree in ET or related engineering fields, and a PhD degree will be preferred. At least 3 years industrial experience will be recommended for all new hires. If needed, adjunct faculty will be hired initially while trying to fill fulltime NTT positions. NTT faculty hired in the program will be on a 70% teaching and 30% service workload. Therefore, each NTT faculty will be responsible for teaching 7 courses per year. Therefore, at steady state, the program faculty will be able to teach 30-35 courses per year, which is expected to meet the needs of the program.

3.C. Business Plan: Marketing, Student Success, Transition & Exit Strategies

3.C.1. Marketing Plan & Strategy

The Engineering Technology degree program will be integrated into recruitment activities currently managed by the College of Engineering, as well as general MU admissions and recruitment activities (e.g., campus tours, college fairs, Meet Mizzou Days, high school visits, and community college visits). There are additional, discipline-specific opportunities to recruit through existing MU events aimed at K-12 and early career undergraduate students, such as Project Lead the Way; Columbia STEM Alliance; and KC STEM Fest.

Targeted recruitment to state community colleges (CCs) and high schools will also be conducted to develop pathways for transfer students and first-time freshmen. The initial recruitment plan will focus on working directly will CCs. Site visits to these CCs and holding day-long recruitment events will be key to introducing the new degree program.

Prospective MU students will also be able to find ample information about the new degree program and potential employment opportunities. Advertisements and flyers will be sent to feeder high schools in the state. In addition, the program will be introduced to undecided first-year engineering students for retention in MU and will target veterans and non-traditional adult students. In addition to recruitment, BSET will improve retention by providing an alternative path to an engineering career at MU.

The college of engineering recruitment and communication teams will work directly with the EIT department chair. Cassandra Siela, Director of Recruitment and Retention, College of Engineering and Danene Brooks, Director of Strategic Communications, College of Engineering, will be responsible for marketing the program.

Projected Program Growth

We project, at steady state, 30 new students to enroll in the new BSET degree program each Fall. BSET program will be marketed utilizing existing College of Engineering and MU campus marketing programs. In addition, the new BSET program will be advertised to community colleges and pre-engineering programs around the state for pathway development.

Marketing Costs

$30,000 per year is the estimated cost for marketing and recruitment efforts with a 2% estimated increase per year.

3.C.2. Student Success Plan

The College of Engineering has long-standing programs in advising, tutoring, MU Connect early alert and intervention and other student services to support student retention. BSET students will be integrated into the college of engineering's First Year Engineering program including the Peer Mentor program. In addition, students will be encouraged to participate in existing student teams.

Achieving Enrollment Outcomes

The EIT department plans to pursue ABET accreditation in the fifth year of the BSET program, which will enhance visibility and advance enrollment. Enrollment will be continuously monitored to develop action plans to address issues and improve outcomes. Enrollment outcomes will also be tracked using existing programs in the college.

3.C.3. Transition Plan

Professor Hani Salim, the interim Chair of EIT department is primarily responsible for the BSET degree program. Once the program is launched, an advisory faculty committee will be formed. The committee will work directly with the Dean of the college of engineering at an advisory capacity to ensure a seamless transition in the event the department chair can no longer fulfill the necessary duties for managing the program's day-to-day needs.

3.C.4. Exit Strategy

The college of engineering and the department will periodically evaluate enrollment, retention, graduation, and placement data of the new BSET program. The college and the department project that the new program will achieve its goals within five years of opening, and such period is sufficient to make decisions moving forward.

The following criteria will be considered for making decisions regarding discontinuing the program: at least an average of 5 new students per year joining the program, a freshman retention rate of at least 75%, at least an average of 10 graduates over three years; and at least 80% of graduates of the program finding successful career outcomes within six months of graduation. In addition, the program will work closely with the Dean and the Provost office to adjust these thresholds to meet the College's and the University's metrics for advancing our student outcomes and success.

If the situation arises that the program is underperforming expectations and financial viability is compromised, the advisory faculty committee will be charged with providing a plan of action to improve enrollments and/or decrease expenditures. A three-year window will be allowed following the implementation of the action plan. The department commits discontinuation if enrollment (either new or total) falls below the three year number that has been projected.

4. Institutional Capacity

The college of engineering has established lab facilities that will support many of the educational needs of the new BSET degree program. Additional equipment will be acquired to support the program, for which the Dean has already committed $300,000, and the space needs has already been identified. In addition, 21 new courses will be developed to support the educational objectives of the program. These courses will be developed by newly hired NTT faculty as part of their assignments. Minimum resources will be needed

to support the development of these courses. The Dean is fully committed to support the established of this program and will incrementally increase the budget of the EIT department to allow for the addition of new NTT faculty as enrollment grows. Support letter from Dean is attached.

5. Program Characteristics

5.A. Program Outcomes

Engineering technology has become an increasingly important field in recent years, as more and more industries rely on advanced technology to design, build, and maintain complex systems. A degree in engineering technology will provide students with the skills and knowledge they need to succeed in this dynamic field. The goal of the BSET is to provide innovative educational experiences to our students that are relevant to existing and emerging careers in engineering technology. The new program will provide students with a solid foundation in engineering principles and technology, as well as the hands-on experience they need to succeed in the workforce. The BSET degree will:

- Meet the workforce needs of regional employers who employ engineers in general engineering technology roles and manufacturing engineering roles.
- Provide pathways for high school students and students from community colleges and universities that offer two-year associate degrees in engineering technology and/or pre-engineering program
- Provide a pathway into these engineering jobs for non-traditional adult students.

Learning Objectives

The learning objectives (called Program Educational Objectives by ABET) of the new program are consisted with the Engineering Technology Accreditation Commission of ABET. A draft learning objectives are summarized below, which will continuously be developed in consultation with our Industrial Advisory Board:

- PEO1: Produce graduates that process the technical and professional skills to have successful careers in regional and national industries.
- PEO2: Apply engineering knowledge and tools to solve technical problems, design products, and improve processes that strive to meet the ethical, cultural and environmental needs of society.
- PEO3: Be effective team members who can lead, collaborate and communicate effectively.
- PEO4: Become successful professionals in their fields.
- PEO5: Pursue professional development through continuing education and industry-specific certifications.

Table 4. Student Learning Objectives

1	To apply basic knowledge of mathematics, science and engineering principles to solve technical problems.
2	To identify, formulate and solve technical problems.
3	To design systems, components, or processes meeting specified needs for broadly defined engineering problems appropriate to the discipline.
4	To apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
5	To conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.
6	To function effectively as a member as well as a leader on technical teams.

5.B. Program Design and Content

Curriculum Design

Achievement and attainment of the Program Educational Objectives (PEOs) are assessed by the following Student Outcomes (SOs). Note these SOs are defined by ABET and are required for future accreditation. The SOs are mapped to the PEOs below.

- SO1: The ability to apply basic knowledge of mathematics, science and engineering principles to solve technical problems. Mapped to PEO1 and PEO2.
- SO2: The ability to identify, formulate and solve technical problems. Mapped to PEO1 and PEO2
- SO3: The ability to design systems, components, or processes meeting specified needs for broadly defined engineering problems appropriate to the discipline. Mapped to PEO2 and PEO4.
- SO4: The ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature. Mapped to PEO1, PEO3, and PEO5.
- SO5: The ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes. Mapped to PEO1 and PEO2.
- SO6: The ability to function effectively as a member as well as a leader on technical teams. Mapped to PEO3, PEO4, and PEO5.

5.C. Program Structure

General Description

The proposed engineering technology degree program will consist of a combination of classroom instruction and project-based, teamwork-oriented, and hands-on laboratory experiences. Students will take courses in subjects such as mathematics, physics, and chemistry, as well as specialized courses in areas in engineering. The program will also include internships and other experiential learning opportunities to give students real-world experience. The Bachelor of Science in Engineering Technology (BSET) trains students to use a systems approach to integrate knowledge and skills to support emerging technical needs in engineering industry. The technology curricula allow for a variety of exciting opportunities in the areas of Engineering Technology.

Program Requirements

The BS in Engineering Technology requires a total of 120 credit hours for completion. The students are required to complete all University general education, University undergraduate requirements, degree, and major requirements, including selected foundational courses, which may fulfill some University general education requirements. These include 15 credits of general education requirements, 27 credits of technical core requirements, 63 credits of required core courses, and 15 credits of technical electives.

General Education Requirements (15 credits)

- ENGLSH 1000 (3)
- American History/Government (Social and Behavioral Science-SBS) (3)
- COMMUN 1200: Public Speaking (HUM) (3)
- PHIL 1100/1200: Ethics/Logic (HUM) (3)
- HUM/FA 2000+ level (3)

Technical Support Core Requirements (27 credits)

- ECONOM 1014: Principles of Microeconomics
    (meets SBS and cultural competency requirements) (3)
- Math 1400: Calculus for Science Majors (3)
- PHYSCS 1210: College Physics I (4)
- PHYSCS 1220: College Physics II (4)
- CHEM 1100: Atoms and Molecules with Lab (4)
- STAT 2500: Intro Probability & Statistics I (3)

- IMSE 2710: Engineering Economic Decision-Making
  (meets SBS requirement)   (3)
- MANGMT 3000: Principles of Management   (3)

Required Core Courses (63 credits)

- **<u>Engineering Technology Core Courses (28 credits)</u>**

  - ENGINR 1000: Introduction to Engineering   (1)
  - INFOTC 1040: Computer Programming   (3)
  - MAE 1100: Introduction to Computer Aided Design   (3)
  - ENGTC 1250: Statics for Technology with lab-New   (3)
  - ENGTC 2150: Electronics Fundamentals with lab-New   (3)
  - ENGTC 2250: Mechanics for Technology with lab-New   (3)
  - ENGTC 2350: Materials, Processes, and Testing with lab-New   (3)
  - ENGTC 3350: Machine Tool Technology-New   (3)
  - ENGTC 3450: Fluid Mechanics for Technology with Lab-New   (3)
  - ENGTC 4800: Industrial Safety and Risk Assessment-New   (3)

Manufacturing Engineering Technology Core Courses (35 credits)

  - MFGET 1500: Intro Manufacturing Eng Tech Applications-New   (2)
  - IMSE 2030: Fund of Sys Design & Analysis   (3)
  - MFGET 2500: Manufacturing Methods I-New   (3)
  - MFGET 2600: Computer Aided Manufacturing I-New   (3)
  - MFGET 3200: Intro Robotics-New   (3)
  - MFGET 3400: Manufacturing Process Improvement-New   (3)
  - MFGET 3700: Industrial Automation I-New   (3)
  - MFGET 3800: Smart Manufacturing Technology-New   (3)
  - MFGET 4700: Industrial Automation II-New   (3)
  - MFGET 4950: Industrial Internship/Cooperative Education-New   (3-6)
  - MFGET 4970W: Capstone Design I- New   (3)
  - MFGET 4980W: Capstone Design II-New   (3)

Technical Electives – select 5 courses from list (15 credits)

- INFOTC 2810: Fundamentals of Network Technology   (3)
- INFOTC 2910: Cyber Security   (3)
- INFOTC 3650: Project and Team Management   (3)
- ENGTC 3100: Microprocessors Systems with lab-New   (3)
- INFOTC 3810: Computer Network Security   (3)

• ENGTC 4100: Instrumentation & Process Control-New   (3)
• MFGET 4600: Introduction to Adaptive (Additive) Manufacturing-New   (3)

Table 5. Engineering Technology Suggested Plan of Study

First Semester	hr	Second Semester	hr
ENGINR 1000: Intro to Engineering	1	MAE 1100: Intro CAD	3
Math 1400: Calculus for Sciences	3	MFGET 1500: Intro to Manufacturing (New)	2
PHYSCS 1210: College Physics I	4	PHYSCS 1220: College Physics II	4
ENGLISH 1000	3	CHEM 1100: Atoms and Molecules with Lab	4
American History/Government (SBS)	3	ECONOM 1014 (SBS & Cultural Competency)	3
TOTAL	**14**	TOTAL	**16**
Third Semester		**Fourth Semester**	
INFOTC 1040: Computer Programming	3	IMSE 2030: Fund of Sys Design & Analysis	3
ENGTC 1250: Statics for Tech w/ lab (New)	3	ENGTC 2250: Mechanics for Tech w/ lab (New)	3
STAT 2500: Intro Probability & Statistics I	3	MFGET 2500: Manufacturing Methods I (New)	3
ENGTC 2150: Electronic Fund w/ lab (New)	3	ENGTC 3450: Fluid Mech Tech w/ Lab-(New)	3
COMMUN 1200: Public Speaking (HUM)	3	PHIL 1100/1200: Ethics/Logic (HUM)	3
TOTAL	**15**	**TOTAL**	**15**
Fifth Semester		**Sixth Semester**	
MFGET 2600: Computer Aided Mfg I (New)	3	MFGET 3400: Mfg Process Improvement (new)	3
ENGTC 2350: Materials w/ lab (New)	3	MFGET 3700: Industrial Automation I (New)	3
ENGTC 3200: Intro Robotics (New)	3	ENGTC 3350: Machine Tool Technology (New)	3
IMSE 2710: Engrg Econ Decision-Making (SBS)	3	MANGMT 3000: Principles of Management	3
HUM/FA 2000+ level	3	Technical Elective 1	3
TOTAL	**15**	**TOTAL**	**15**
Seventh Semester		**Eighth Semester**	
MFGET 3800: Smart Mfg Technology (New)	3	Technical Elective 3	3
MFGET 4950: Internship (New)	3	Technical Elective 4	3
ENGTC 4800: Ind Safety & Risk Assessment-New	3	Technical Elective 5	3
Technical Elective 2	3	MFGET 4700: Industrial Automation II (New)	3
MFGET 4970W: Capstone Design I (New)	3	MFGET 4980W: Capstone Design II (New)	3
TOTAL	**15**	**TOTAL**	**15**

Note: Grey shading indicates New course.

Residency Requirements

There are no residency requirements for the BSET.

Internship, Thesis or Other Capstone

All senior students are required to take an industrial internship class (3-6 hours) and two capstone design classes for a total of 9-12 credit hours.

Unique Features

Some of the required and technical elective courses are taught by faculty in the IT program and faculty in the College of Arts & Science and the Trulaske College of Business.

Admission Requirements

FTC students that meet the minimum admission requirements set by MU will be eligible to be admitted into the new BSET program. FTC students admitted into the BSET program will be part of the first-year engineering program to provide them with critical academic and career advice.

Transfer applicants will also be admitted into the program following MU's policies and requirements. Community college students will be able to benefit from college pathways specifically designed for transfer students in collaboration with state community colleges and institutions that offer 2-year associate degree programs.

5.D. Program Goals & Assessment

Assessment Learning Outcomes

The student outcomes (SOs) are mapped to the PEOs, which will be reviewed every semester during the first three years and then every two years. The SOs are mapped to required courses (see attached BS Engineering Technology-Full proposal document). The mapping of the SOs to required courses and assessment tools will be reviewed every semester.

SOs are assessed in the courses listed in the table in section 5.B. Assessment instruments and performance indicators (PIs) will be defined during the design of each of the core courses used for the assessment. Data will be collected from the instructor of each course. Depending on the course, this data could be performance on a project, an exam question, a presentation, or a homework assignment. This performance indicators data is provided to the program coordinator using a pre-defined cycle. The target for achievement in all courses is that at least 70% of the students score 75% or higher on the PI for the student activity relating to a particular SO. The Chair will be responsible for program oversight.

In addition to regular department assessment, the BSIT program will undergo routine accreditation through the Engineering Technology Accreditation Commission (ETC) of ABET alongside other currently accredited programs. ABET meetings within the department are currently ongoing for the current IT program and ABET is a standing agenda item at all EIT faculty meetings.

The ET program will initiate ET specific ABET meetings once the program is launched. To obtain and sustain ABET accreditation requirements and maintaining programmatic continuous improvement, all EIT faculty, including new ET faulty, will be involved in ABET accreditation measures, including course assessment, student work collection, PEO reviews, student survey reviews, and frequent interaction with industrial advisory council. The new BSET program will follow an assessment plan and structure very similar to those of the current engineering programs.

Retention and Graduation Rate Goals

The ET program will build on the success of the IT program which is part of the EIT department. For 2021-2022, the 2-year first-year- college (FTC) retention of the IT students was 92%, and the 4-year and 6-year graduation rates were 50% and 78.9% respectively. The ET program success will be measured with similar performance outcomes currently observed for the IT programs and college of engineering.

5.E. Student Preparation

FTC students who meet the minimum admission requirements set by MU will be eligible to be admitted into the new BSET program. FTC students admitted into the BSET program will be part of the first-year engineering program to provide them with critical academic and career advice.

Transfer applicants will also be admitted into the program following MU's policies and requirements. Community college students will be able to benefit from college pathways specifically designed for transfer students in collaboration with state community colleges and institutions that offer 2-year associate degree programs.

5.F. Faculty and Administration

Dr. Hani Salim, Interim Chair of the Engineering and Information Technology Department will serve as the program director for the new BSET program. His role initially is 35% administration which will increase at the ET program enrollment and faculty grows.

Instructional Needs

The program will rely on existing courses offered in the EIT department and across campus. Twenty-one specialized ET courses are proposed, which will be developed and taught mostly by new NTT faculty who will be hired for the ET

program over the next 4-5 years. Dr. Salim will also contribute towards the teaching needs for the program by teaching 2-3 of the new proposed courses in the mechanics and materials subjects.

NTT faculty hired in the program will be on a 70% teaching and 30% service workload. Therefore, each NTT faculty will be responsible for teaching 7 courses per year. Therefore, at steady state, the program faculty will be able to teach 30-35 courses per year, which is expected to meet the needs of the program. 55% of the program's credit hours will be taught by full-time faculty.

Students will meet with the advisor on a regular basis and faculty will be required to dedicate times during the week for open-hour advising of student to ensure successful progression through the program.

Credentials for Teaching Assignment

The new NTT faculty will be required to have at least an MS degree in ET or related engineering fields, and a PhD degree will be preferred. At least 3 years industrial experience will be recommended for all new hires. If needed, adjunct faculty will be hired initially while trying to fill fulltime NTT positions.

Faculty Involvement

All faculty will be expected to become active members of state and national professional associations, which in turn provides opportunities for students to be involved in leadership within the profession. A Professional student advisor will be hired for the program starting on year 3, but faculty will have an active role in student advising, mentoring, and career development.

5.G. Alumni and Employer Survey

Alumni Survey

In alignment with ABET accreditation standards, ET program plans to complete senior exit surveys, just as is done in all other accredited programs in the college. Currently, all graduating seniors in the college programs are required to fill out a senior exit survey through Qualtrics. The survey asks about SOs, student academic and career advising experience, job placement, and career goals. In addition to the survey, all graduating seniors will have a face-to-face senior exit interview with the department chair before graduating. This interview allows the students to elaborate on their responses to the survey questions as well as give other feedback from their experience in the program.

In addition, once per year a survey will be sent to employers. The survey will ask about PEOs and SOs. Alumni surveys will also be done after the first cohort of

graduates and will continue to be conducted once per year. The planned alumni survey will ask about the PEOs and SOs, whether they have an engineering job, whether they have a graduate degree, and whether they plan to or have become licensed.

Employer Survey

EIT department currently has an industrial advisor council (IAC) which advises the department on assessment and accreditation requirements of the IT program. The IAC will be expanded to include members from the ET industry to support the new BSET program. The advisory council members will represent employers of the program. The advisory board members are involved in maintaining a strong program. The IAC meets once a semester and participates in evaluating the capstone projects.

5.H. Accreditation

Accreditation efforts will initiate during the first year of the program start. An industrial advisory board will be formed to continuously review and improve the learning objectives and student outcomes to meet the workforce demands. Data needed for the Accreditation Board for Engineering and Technology (ABET) will be collected and assessed each semester during the first five years of the program. We plan to apply for initial accreditation during 2028.

6. Appendices

- Appendix 1: Course Map (page 24)

- Appendix 2: Pro Forma (page 25)

- Appendix 3: Letters of Support (page 26)