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# Cover Sheet for In-State Institutions
## New Program or Substantial Modification to Existing Program

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|---|---|
| Institution Submitting Proposal | Capitol Technology University |

***Each action below requires a separate proposal and cover sheet.***

- (●) New Academic Program
- ( ) New Area of Concentration
- ( ) New Degree Level Approval
- ( ) New Stand-Alone Certificate
- ( ) Off Campus Program
- ( ) Substantial Change to a Degree Program
- ( ) Substantial Change to an Area of Concentration
- ( ) Substantial Change to a Certificate Program
- ( ) Cooperative Degree Program
- ( ) Offer Program at Regional Higher Education Center

Payment Submitted: (●) Yes ( ) No
Payment Type: ( ) R*STARS # 99758 (●) Check # 99758
Payment Amount: 850.00
Date Submitted: 2/15/2026

| | | |
|---|---|---|
| Department Proposing Program | Engineering | |
| Degree Level and Degree Type | Bachelor of Science (B.S.) | |
| Title of Proposed Program | Bachelor of Science in Integrated Business and Engineering | |
| Total Number of Credits | 121 | |
| Suggested Codes | HEGIS: 901.00 | CIP: 14.0101 |
| Program Modality | ( ) On-campus ( ) Distance Education (fully online) (●) Both | |
| Program Resources | (●) Using Existing Resources ( ) Requiring New Resources | |
| Projected Implementation Date (must be 60 days from proposal submisison as per COMAR 13B.02.03.03) | (●) Fall ( ) Spring ( ) Summer | Year: 2026 |
| Provide Link to Most Recent Academic Catalog | URL: http://catalog.captechu.edu | |
| Preferred Contact for this Proposal | Name: Dr. Mohamed Ghazy | |
| | Title: Dean of Academics | |
| | Phone: (340) 965-2473 | |
| | Email: mshehata@captechu.edu | |
| President/Chief Executive | Type Name: Dr. Bradford Sims | |
| | Signature: [signature] | Date: 2-15-26 |
| | Date of Approval/Endorsement by Governing Board: | FEB. 15, 2026 |

Revised 1/2021

CAPITOL
Technology University

February 14, 2026

Dr. Sanjay Rai
Secretary of Maryland Higher Education
Maryland Higher Education Commission
217 E. Redwood Street, Suite 2100
Baltimore, MD 21202

Dear Dr. Rai,

Capitol Technology University is requesting approval to offer a Bachelor of Science (B.S.) in Integrated Business and Engineering. This degree program will be delivered by qualified university faculty and supported through an integrated curriculum that combines engineering fundamentals with business, analytics, and innovation coursework to meet the growing workforce demand for engineers with managerial and systems-level expertise.

Capitol Technology University's mission is to provide a practical, hands-on education in engineering, technology, and applied sciences—preparing students for professional success and lifelong learning. The proposed B.S. in Integrated Business and Engineering aligns with this mission by equipping students with strong foundations in mathematics, engineering analysis, electronics, systems engineering, data science, operations management, and technology innovation. Graduates will be prepared to contribute immediately to Maryland's advanced manufacturing, technology-driven enterprises, infrastructure systems, defense-related industries, and entrepreneurial sectors.

Demand for professionals who can integrate engineering principles with business strategy, financial analysis, supply chain systems, and innovation management continues to increase as organizations seek technically competent leaders capable of managing complex, technology-driven operations. This program is designed to serve students pursuing careers in engineering management, systems integration, technology commercialization, operations leadership, and related interdisciplinary technical fields.

To support this academic initiative, we respectfully submit the full proposal for the Bachelor of Science in Integrated Business and Engineering for your review and approval. Enclosed is the required documentation, including the letter confirming the adequacy of library resources to support this new degree program.

Respectfully,

Bradford L. Sims, PhD

President

CAPITOL
Technology University

February 14, 2026

Dr. Sanjay Rai
Secretary of Maryland Higher Education
Maryland Higher Education Commission
217 E. Redwood Street, Suite 2100
Baltimore, MD 21202

Dear Dr. Rai,

This letter is in response to the need for confirmation of the adequacy of the library of Capitol Technology University to support the proposed Bachelor of Science in Integrated Business and Engineering. As president of the university, I confirm that the library resources, including support staff, are more than adequate to support the B.S. in Integrated Business and Engineering. Additionally, the university remains dedicated and committed to the continuous improvement of its library resources by providing sufficient budget to ensure the success of our students.

Respectfully,

Bradford L. Sims, PhD

President

PROPOSAL FOR:

X NEW INSTRUCTIONAL PROGRAM
_____ SUBSTANTIAL EXPANSION/MAJOR MODIFICATION
COOPERATIVE DEGREE PROGRAM
X WITHIN EXISTING RESOURCES or _____ REQUIRING NEW RESOURCES

CAPITOL Technology University

Institution Submitting Proposal

Fall 2026
Projected Implementation Date

**Bachelor of Science**
Award to be Offered

**Bachelor of Science in Industrial Engineering Technology**
Title of Proposed Program

0901
Suggested HEGIS Code

14.0101
Suggested CIP Code

Engineering
Department of Proposed Program

**Dr. Mohamed Shehata**
Name of Department Head

**Dr. Mohamed Ghazy**
Dean of Academic

mshehata@captechu.edu
Contact E-Mail Address

(240) 965-2473
Contact Phone Number

2-15-26
Signature and Date

President/Chief Executive Approval

FEBRUARY 15, 2026
Date

Date Endorsed/Approved by Governing Board

# Bachelor of Science (B.S.) in Integrated Business and Engineering

Capitol Technology University
Laurel, Maryland

## A. Centrality to Mission and Planning Priorities

### 1. Program description and alignment with institutional mission

The Bachelor of Science in Integrated Business and Engineering is a 120-credit undergraduate program designed to prepare students to operate effectively at the intersection of engineering design, systems integration, and business strategy. The program provides a comprehensive engineering foundation complemented by structured coursework in business, finance, operations, analytics, and innovation. Graduates are prepared to contribute to technology-driven organizations in roles that require both technical competence and managerial insight.

The curriculum integrates rigorous mathematics and basic sciences, including calculus, differential equations, statistics, and calculus-based engineering physics, with a core of engineering coursework in circuits, electronics, digital systems, microcontroller system design, signals and systems, control systems, and systems engineering. A two-semester senior design sequence provides students with the opportunity to apply engineering analysis and design principles to open-ended, multidisciplinary projects that incorporate technical feasibility, economic evaluation, and operational considerations.

The program's business component includes engineering economics, financial accounting, financial management, operations management, supply chain systems, project management, data science, and technology innovation and entrepreneurship. These courses are intentionally integrated to enhance students' ability to evaluate technical alternatives using economic and financial criteria, manage complex projects, interpret data for strategic decision-making, and support innovation in competitive markets.

The program emphasizes applied problem-solving, systems thinking, quantitative analysis, and interdisciplinary collaboration. Students develop the ability to design and analyze engineering systems while understanding organizational constraints, financial structures, and market forces. The curriculum supports ethical reasoning, effective communication, teamwork, and awareness of the societal and organizational impacts of engineering decisions.

The Bachelor of Science in Integrated Business and Engineering aligns directly with the mission of Capitol Technology University to "create educational opportunities grounded in practical applications to develop agile professionals in technology-driven fields." The program advances this mission by preparing graduates who possess both engineering competence and business literacy, enabling them to lead and manage technical initiatives within modern, technology-enabled enterprises.

The program also supports the university's strategic vision by expanding STEM offerings, fostering interdisciplinary and practice-based learning, strengthening industry alignment, and contributing to enrollment growth through a distinctive, workforce-relevant undergraduate degree.

### 2. Explanation of how the proposed program supports the institution's strategic goals and evidence of institutional priority

The proposed Bachelor of Science in Integrated Business and Engineering directly supports Capitol Technology University's strategic goals and institutional priorities by expanding interdisciplinary engineering education and responding to evolving workforce demands.

The program contributes to Goal I: Expand Educational Offerings and Increase Program Completion by introducing a multidisciplinary engineering degree that integrates technical depth with business acumen. Its structure accommodates both first-time undergraduate students and transfer students from community colleges in engineering, engineering technology, business, or applied STEM fields. The inclusion of business and analytics coursework broadens career pathways and supports student persistence through practical, career-relevant learning.

The program supports Goal II: Increase Enrollment and Institutional Awareness by offering a distinctive degree not widely available in Maryland. By combining engineering rigor with structured business education, the program appeals to students seeking leadership roles in technology-driven organizations, product development, systems management, operations, and innovation. This integrated model differentiates the university within the regional higher education landscape.

The program aligns with Goal III: Improve Utilization of University Resources and Institutional Effectiveness while Expanding Revenue by leveraging existing faculty expertise, laboratories, and approved courses within engineering, mathematics, computing, and business. The majority of courses are already part of the university's academic portfolio, enabling efficient program implementation without significant new capital investment.

The program supports Goal IV: Increase the Number and Scope of Partnerships by providing a curricular framework conducive to collaboration with industry partners. The integration of engineering design, financial analysis, operations systems, and innovation prepares students for engagement with employers in sectors such as advanced manufacturing, defense and aerospace systems, infrastructure, technology services, and product development.

Evidence of institutional priority includes the following:

a. The program was developed under the direction of the Office of Academic Affairs and the Dean of Engineering as part of a strategic initiative to expand interdisciplinary engineering programs aligned with workforce demand.

b. The program concept has been reviewed within internal academic planning processes, including undergraduate program development discussions and enrollment strategy planning.

c. The curriculum leverages existing courses and faculty expertise across engineering, mathematics, computing, and business, demonstrating efficient use of institutional capacity.

d. The program has been identified as a pathway for attracting students interested in leadership within engineering-intensive industries, as well as transfer students seeking a program that integrates technical and managerial preparation.

e. The interdisciplinary nature of the program aligns with institutional efforts to strengthen Capitol Technology University's position as a leader in applied, practice-based STEM education.

The Bachelor of Science in Integrated Business and Engineering has been advanced through internal planning processes and endorsed by university leadership as a strategic initiative supporting enrollment growth, workforce alignment, and curricular innovation.

3. **Narrative describing how the proposed program will be adequately funded for at least the first five years**

The Bachelor of Science in Integrated Business and Engineering will be funded primarily through existing institutional resources and strategic allocation of instructional capacity within the School of Engineering. The program has been incorporated into academic planning and financial forecasting models to ensure sustainability during the initial five years of implementation.

Most courses included in the curriculum are already offered within existing engineering, mathematics, computing, and business programs. As a result, the program can be implemented without substantial new investment in course development, facilities, or laboratory equipment. Existing classrooms, engineering laboratories, computing resources, and instructional technologies are sufficient to support program delivery.

Instruction will be provided primarily by current full-time faculty within engineering and business disciplines, with adjunct faculty utilized selectively as enrollment grows or to support specialized subject areas. Faculty workload planning and instructional assignments have been integrated into existing budgeting frameworks and will be adjusted incrementally based on enrollment trends.

The program is expected to generate tuition revenue sufficient to cover instructional and administrative costs. Enrollment projections are conservative and aligned with the university's broader strategic enrollment objectives. Financial planning indicates that the program will be self-sustaining through shared instructional resources, efficient faculty utilization, and steady recruitment of both first-time and transfer students.

University leadership, including the Office of Academic Affairs and the Business and Finance teams, has reviewed the program's financial structure and confirmed its feasibility. Detailed multi-year financial projections are provided in Section L of this proposal.

4. Institutional commitment to the proposed program

Capitol Technology University is fully committed to the long-term success and sustainability of the Bachelor of Science in Integrated Business and Engineering. The program is integrated into the university's strategic academic planning and supported by existing administrative, financial, and technical resources.

a) Ongoing administrative, financial, and technical support

Administrative oversight will be provided through the Engineering Department in coordination with the Offices of Academic Affairs, Enrollment Management, and Finance. The Chair of Engineering will oversee curriculum implementation, faculty assignment, scheduling, assessment, and continuous program improvement. Financial support will be incorporated into the university's operating budget, with instructional costs managed through faculty workload planning and tuition revenue. Technical support, including laboratory access, instructional equipment, and information technology services, is available through established university infrastructure and will be maintained and updated as necessary.

b) Continuation of the program to allow enrolled students to complete the degree

Capitol Technology University is committed to maintaining the program for a period sufficient to allow all enrolled students to complete degree requirements. The university will ensure continuity of instruction, academic advising, and course scheduling. In the event that program modification or discontinuation becomes necessary, the university will implement a formal teach-out plan consistent with accreditation standards and regulatory requirements to protect students' academic progress and timely degree completion.

## B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan

### 1. Demonstration of demand and need for the program in terms of meeting present and future needs of the region and the State

**a) The need for the advancement and evolution of knowledge**

The Bachelor of Science in Industrial Engineering Technology contributes to the advancement and evolution of applied STEM education by integrating engineering technology, quantitative analysis, systems thinking, and operations-focused decision-making within a single, workforce-oriented curriculum. As industrial and service sectors become increasingly complex, employers seek graduates who can analyze, optimize, and improve systems that integrate people, processes, technology, and data rather than focusing solely on narrow technical functions.

The program prepares students to engage with evolving technologies and practices critical to Maryland's economy, including advanced manufacturing systems, quality and process improvement, supply chain and logistics operations, automation, data-driven decision-making, and Industry 4.0 environments. By emphasizing applied problem-solving, systems integration, and analytical methods grounded in real-world industrial contexts, the program supports the continued advancement of knowledge necessary to sustain productivity, innovation, and competitiveness across Maryland's public and private sectors.

**b) Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education**

The program is designed to expand access to applied engineering technology education for a broad and diverse student population, including first-generation college students, working adults, military-affiliated students, and community college transfer students. The Bachelor of Science in Industrial Engineering Technology offers a practical, career-oriented pathway for students who may be discouraged by highly theoretical engineering programs but who are motivated to pursue professional roles in manufacturing, operations, quality, logistics, and systems improvement.

Capitol Technology University has a demonstrated commitment to serving underrepresented and educationally disadvantaged populations in STEM disciplines. The applied nature of the program, combined with small class sizes, individualized academic advising, faculty mentoring, and industry-aligned coursework, supports student retention and degree completion. By emphasizing practical skills, analytical reasoning, and professional readiness, the program expands educational choice and access for students seeking attainable, workforce-relevant pathways into high-demand technical and operational fields.

**c) The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational programs**

While Capitol Technology University is not a historically black institution (HBI), it supports the statewide objective of strengthening educational capacity and opportunity for students served by Maryland's HBIs. The Bachelor of Science in Industrial Engineering Technology provides opportunities for collaboration through articulation agreements, transfer pathways, joint academic initiatives, and outreach activities that can complement and enhance HBI offerings in applied STEM, engineering technology, and operations-related disciplines.

The program's applied, systems-oriented structure is well suited to partnership-based pathways that broaden access to interdisciplinary industrial engineering technology education. Through collaboration and coordinated academic initiatives, the program supports the broader State goal of increasing participation, persistence, and success of underrepresented students in applied STEM fields, including those enrolled at or transferring from Maryland's historically black institutions.

**2. Evidence that the perceived need is consistent with the Maryland State Plan for Postsecondary Education**

The Maryland State Plan for Postsecondary Education identifies three primary goals for postsecondary education:

1. Student Access
2. Student Success
3. Innovation

**Goal 1: Student Access**

"Ensure equitable access to affordable and quality postsecondary education for all Maryland residents."

Capitol Technology University is committed to expanding access to high-quality, workforce-aligned education in industrial engineering technology for students across Maryland. The Bachelor of Science in Industrial Engineering Technology was developed to serve students who may be underserved by traditional engineering pathways, including transfer students, adult learners, first-generation college students, veterans, and underrepresented minorities in STEM.

The program supports access through targeted recruitment at Maryland high schools and community colleges, articulation agreements that facilitate transfer from associate-level engineering technology and industrial technology programs, and the availability of financial aid, institutional scholarships, and military tuition benefits. The applied focus of the curriculum, combined with flexible scheduling options, makes the program accessible to nontraditional and working students. These efforts align with the State Plan's priorities related to affordability, financial planning, and improving systems that support access for diverse student populations.

**Goal 2: Student Success**

"Promote and implement practices and policies that will ensure student success."

The Bachelor of Science in Industrial Engineering Technology is intentionally structured to promote student progression, retention, and timely degree completion. The curriculum emphasizes applied learning, hands-on projects, teamwork, and systems-based problem solving, which strengthen student engagement and practical competence.

Students benefit from individualized academic advising, faculty mentoring, tutoring services, and early alert systems that support academic success. Student success is further reinforced through a two-semester senior design experience that integrates technical knowledge with economic analysis, project management, communication, and professional practice. Opportunities for internships, industry-sponsored projects, and applied research experiences further strengthen workforce readiness and align learning outcomes with employer expectations. These practices support the State Plan's priorities related to educational quality, reduction of barriers to completion, and promotion of lifelong learning.

**Goal 3: Innovation**

"Foster innovation in all aspects of Maryland higher education to improve access and student success."

The Bachelor of Science in Industrial Engineering Technology represents an innovative approach to undergraduate STEM education by integrating applied engineering technology, systems analysis, operations management, and emerging industrial technologies within a single interdisciplinary program. The curriculum reflects evolving workforce needs by preparing students to analyze and improve complex systems across manufacturing and service environments rather than within narrowly defined technical silos.

Program innovations include a flexible curriculum structure that can support future certificates or applied specialization options, integration of existing laboratory and instructional resources to maintain quality

while minimizing startup costs, and a capstone design sequence grounded in real-world industrial and organizational challenges. These elements align with the State Plan's priorities related to innovative academic practices, new educational models, and work-based and applied learning experiences.
In summary, the Bachelor of Science in Industrial Engineering Technology aligns closely with all three goals of the Maryland State Plan for Postsecondary Education. The program expands equitable access to applied STEM education, promotes student success through experiential and practice-based learning, and advances innovative curricular approaches that respond directly to Maryland's current and future workforce needs.

## C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State

### 1. Description of potential industry or industries, employment opportunities, and expected level of entry for graduates of the proposed program

Graduates of the Bachelor of Science in Industrial Engineering Technology will be prepared for employment in a range of industrial, manufacturing, operations, logistics, and systems-focused roles across Maryland's technology-driven and production-oriented economy. The program supports entry-level employment opportunities in industries such as advanced manufacturing, quality and process improvement, supply chain and logistics operations, healthcare and service systems, defense and aerospace support services, infrastructure systems, and technology-enabled operations.
The curriculum is intentionally designed to align with employer demand for professionals who possess applied engineering technology skills, quantitative analysis capability, and systems-level understanding of industrial operations. Graduates will be prepared for job titles such as industrial engineering technologist, operations analyst, quality engineering technologist, process improvement specialist, manufacturing technologist, supply chain analyst, production planner, and systems or operations coordinator. These positions emphasize applied analysis, process optimization, data-driven decision-making, and operational support rather than theoretical engineering design.
Graduates are expected to enter the workforce at the technologist, analyst, or junior professional level. With experience and continued professional development, graduates may advance into supervisory, operations management, quality leadership, process engineering, or systems improvement roles within manufacturing, logistics, healthcare, government, and service-sector organizations.

### 2. Data and analysis projecting market demand and the availability of openings in the job market served by the program

Graduates of the Bachelor of Science in Industrial Engineering Technology are prepared for applied industrial and operations-oriented roles aligned with multiple occupational classifications identified by the U.S. Bureau of Labor Statistics (BLS). While "Industrial Engineering Technologist" is not a single, standalone BLS occupation, the competencies developed in this program align closely with categories such as industrial engineering technologists and technicians, operations research analysts, quality control analysts, production planners, and supply chain and logistics specialists.
According to the BLS, employment of industrial engineering technologists and technicians is projected to grow through 2033, driven by continued demand for process optimization, efficiency improvement, automation, and data-supported decision-making in manufacturing and service industries. National median annual wages for industrial engineering technologists exceed $60,000, reflecting sustained employer demand for applied systems and process expertise.
Operations research analysts represent another closely aligned occupation. The BLS projects employment in this field to grow faster than average through 2033, supported by increased reliance on data analytics, optimization, and modeling to improve organizational performance. National median annual wages for operations research analysts exceed $80,000, with strong demand in government, defense, logistics, healthcare, and manufacturing sectors.

In Maryland, demand for industrial engineering technology and operations-focused professionals is particularly strong due to the state's concentration of defense installations, federal agencies, healthcare systems, advanced manufacturing firms, logistics hubs, and infrastructure modernization initiatives. The Maryland Department of Labor projects continued growth across engineering, architecture, operations, and technical support occupations through 2032, with applied and systems-oriented roles comprising a significant portion of projected job openings.
Maryland also ranks among the leading states for employment in logistics, supply chain, and manufacturing-related occupations, all of which align closely with the applied, systems-based preparation provided by the Industrial Engineering Technology curriculum.

**3. Evidence from market surveys and workforce projections demonstrating educational and training needs and anticipated vacancies**

Market surveys and workforce projections consistently indicate strong demand in Maryland for applied professionals who combine engineering technology knowledge with quantitative analysis, systems thinking, and practical implementation skills. According to the Maryland Department of Labor's Occupational Projections for 2022–2032, employment in architecture, engineering, operations, and related technical occupations is projected to grow statewide, generating thousands of new and replacement job openings over the next decade.
The Georgetown University Center on Education and the Workforce, in its "Projections Through 2031" report, indicates that nearly 70 percent of jobs in Maryland will require postsecondary education or training. The report further highlights increasing demand for applied, bachelor's-level occupations that emphasize analytical reasoning, problem-solving, and operational competence rather than purely theoretical preparation. These findings align directly with the educational objectives of the Industrial Engineering Technology program.
The Maryland Statewide Workforce Development Plan (2024–2028) identifies advanced manufacturing, logistics and supply chain, healthcare systems, infrastructure, and defense-related industries as priority sectors. The plan emphasizes the need for employer-aligned academic programs that integrate applied learning, data analysis, systems optimization, and continuous improvement methods to address workforce shortages.
Real-time labor market data from sources such as Lightcast, Indeed, and LinkedIn further support demand in Maryland for roles such as process improvement analyst, quality specialist, manufacturing technologist, operations analyst, and supply chain coordinator. Job postings for these roles frequently specify bachelor's-level preparation with applied engineering, analytics, or operations-focused skills.

**4. Data showing the current and projected supply of prospective graduates**

The current supply of graduates from applied industrial engineering technology and operations-focused bachelor's programs in Maryland is limited. Most existing programs fall into one of two categories: traditional industrial engineering programs with a strong theoretical and mathematical emphasis, or engineering technology programs oriented toward technician-level preparation. Few programs offer a bachelor's-level pathway that integrates applied engineering technology, quantitative analysis, systems optimization, and operational practice.
IPEDS data indicate that Maryland institutions award bachelor's degrees annually in traditional engineering disciplines, including industrial engineering. However, these programs typically emphasize theoretical modeling and design rather than applied industrial systems, operational integration, and process improvement skills sought by many employers.
The Bachelor of Science in Industrial Engineering Technology addresses this gap by providing a practice-oriented, bachelor's-level program that integrates engineering technology, operations research methods, quality systems, manufacturing processes, and professional practice. The program is not positioned as a licensure-track engineering degree, allowing it to serve workforce needs that are not fully addressed by existing engineering or technician-focused programs.

Based on institutional planning and enrollment projections:

- The program is expected to enroll approximately 15 to 20 students in its first year
- Enrollment is projected to grow to approximately 60 to 75 students by year five
- The program anticipates graduating approximately 12 to 18 students annually by year five, assuming typical retention and completion rates

These graduates will contribute directly to meeting Maryland's demand for industrial engineering technologists and operations-focused professionals in sectors such as advanced manufacturing, logistics, healthcare systems, defense support services, and infrastructure operations. The proposed program will therefore help close the gap between workforce demand and the supply of applied, bachelor's-level industrial engineering technology graduates in the State.

## D. Reasonableness of Program Duplication

### 1. Identification of Similar Programs in the State and Discussion of Similarities and Differences

A review of academic programs offered by public and private institutions in Maryland indicates that no institution currently offers a Bachelor of Science degree titled "Integrated Business and Engineering," nor does any institution offer a substantially similar undergraduate program that formally integrates a comprehensive engineering science core with structured business, finance, operations, analytics, and innovation coursework within a single 120-credit engineering degree classified under CIP 14.0101 (Engineering, General).

While several Maryland institutions offer engineering degrees and others offer business or technology management programs, no existing program combines calculus-based engineering fundamentals, upper-level engineering science, and a structured business core in accounting, finance, operations management, supply chain systems, data science, and technology entrepreneurship as an integrated engineering curriculum.

The following programs are related in discipline or content area but differ in structure, emphasis, and degree orientation.

## Engineering Programs (Traditional Discipline-Specific Engineering)

• University of Maryland, College Park – Bachelor of Science in Engineering (General Engineering and discipline-specific programs such as Electrical Engineering and Mechanical Engineering)
• Morgan State University – Bachelor of Science in Engineering (including Electrical and Industrial Engineering)
• University of Maryland Baltimore County – Bachelor of Science in Mechanical Engineering and related engineering disciplines
• Johns Hopkins University – Bachelor of Science in Engineering (various disciplines)

These programs are traditional engineering degrees that emphasize discipline-specific technical depth, advanced mathematics, engineering science theory, and preparation for professional engineering licensure or graduate study. Their curricula are structured primarily around technical specialization within a defined engineering field.

Although some of these programs may allow students to pursue business minors or electives, business coursework is not structurally integrated into the engineering core. Financial management, accounting,

supply chain systems, and innovation strategy are not embedded as required components within the engineering curriculum.

**Engineering Technology and Applied Technology Programs**

• University of Maryland Eastern Shore – Bachelor of Science in Engineering Technology
• Stevenson University – Bachelor of Science in Engineering Technology
• Towson University – Bachelor of Science in Technology Management

These programs emphasize applied technology implementation, technical supervision, or management of technical systems. However, they do not include a full engineering science sequence consisting of calculus-based physics, differential equations, signals and systems, and control systems combined with structured business coursework at the depth included in the proposed program.

The proposed Bachelor of Science in Integrated Business and Engineering differs by maintaining engineering science rigor consistent with CIP 14.0101 while embedding a defined business and analytics core within the degree structure.

**Associate-Level and Transfer Pathways**

Several Maryland community colleges offer Associate of Science degrees in engineering intended for transfer to traditional engineering programs:

• Anne Arundel Community College – Engineering (A.S.)
• Montgomery College – Engineering (A.S.)
• Prince George's Community College – Engineering (A.S.)
• Community College of Baltimore County – Engineering (A.S.)

These programs do not confer bachelor's degrees and do not offer integrated engineering-business curricula. They serve primarily as transfer pathways into discipline-specific engineering programs.

**Similarities**

The proposed Bachelor of Science in Integrated Business and Engineering shares certain foundational elements with traditional engineering programs in Maryland, including:

• Coursework in calculus, differential equations, and calculus-based engineering physics
• Engineering core courses such as circuits, electronics, digital systems, microcontroller system design, signals and systems, and control systems
• A two-semester senior design experience involving open-ended engineering projects
• Preparation for employment in technology-driven industries

**Key Differences**

**Integrated Engineering and Business Structure**

Traditional engineering programs in Maryland focus primarily on technical specialization within a specific discipline. In contrast, the proposed program integrates engineering science with required

coursework in financial accounting, financial management, engineering economics, operations management, supply chain systems, data science, strategic management, and technology innovation.

Business competencies are not treated as optional electives but are embedded as structured, required components of the curriculum. This integrated model prepares graduates to evaluate technical solutions within financial, operational, and strategic organizational contexts.

**Interdisciplinary Systems Orientation**

The proposed program emphasizes systems thinking, engineering design, quantitative analysis, and managerial decision-making within a unified framework. Students are prepared to operate at the interface of engineering design and organizational leadership rather than solely within technical design roles.

This interdisciplinary structure distinguishes the program from both traditional engineering degrees and technology management programs.

**Target Student Population**

The Bachelor of Science in Integrated Business and Engineering is designed for students seeking careers that require both technical competence and business literacy, including roles in product development, systems integration, operations leadership, project management, and technology entrepreneurship. The program also provides an attractive pathway for transfer students who wish to combine engineering study with structured business preparation at the bachelor's level.

**Institutional Context**

Capitol Technology University's mission emphasizes practical, career-focused education in engineering and technology-driven fields. The proposed program leverages existing institutional strengths in engineering, computing, systems design, and applied business education to offer a distinctive interdisciplinary degree that bridges engineering and management.

No Maryland institution currently offers a bachelor's-level engineering degree under CIP 14.0101 that integrates a comprehensive engineering core with structured business, finance, operations, analytics, and innovation coursework in this manner.

## E. Relevance to High-Demand Programs at Historically Black Institutions (HBIs)

**1. Discussion of the program's potential impact on the implementation or maintenance of high-demand programs at HBIs**

The proposed Bachelor of Science in Integrated Business and Engineering is not expected to negatively affect the implementation or sustainability of high-demand engineering programs offered by Maryland's Historically Black Institutions (HBIs). Rather, the program complements existing engineering education offerings within the State by providing a differentiated interdisciplinary pathway under CIP 14.0101 (Engineering, General).

Maryland's HBIs, including Morgan State University and University of Maryland Eastern Shore, offer established engineering and engineering technology programs that emphasize discipline-specific technical depth and, in many cases, preparation for professional licensure and advanced study. These programs are essential contributors to Maryland's engineering workforce and to increasing representation of underrepresented populations in STEM fields.

The proposed Integrated Business and Engineering program differs structurally and academically from traditional discipline-specific engineering programs. While it includes a rigorous engineering science core, it intentionally integrates structured coursework in accounting, finance, operations management, supply chain systems, data science, and technology innovation within the engineering degree framework. The program is designed to prepare graduates for roles that combine engineering competence with managerial, operational, and entrepreneurial responsibilities.

This integrated structure distinguishes the program from existing HBI engineering degrees, which are primarily organized around technical specialization within established engineering disciplines. The proposed program does not replicate those discipline-specific curricula and does not replace licensure-oriented or traditional engineering pathways.

The program may support and strengthen statewide STEM capacity in several ways:

• By expanding engineering education options for students seeking interdisciplinary preparation that combines technical depth with business and analytics competencies.
• By providing potential articulation or transfer opportunities for students interested in complementing technical study with structured business integration.
• By supporting collaborative workforce development initiatives in areas such as advanced manufacturing, defense systems, infrastructure, healthcare technology, logistics, and product development.
• By increasing Maryland's overall capacity to produce engineering graduates equipped for leadership roles in technology-driven organizations.

The introduction of the Bachelor of Science in Integrated Business and Engineering is not expected to reduce enrollment in high-demand HBI programs. Instead, it broadens the portfolio of engineering education pathways in Maryland, thereby strengthening the statewide ecosystem of STEM education and workforce preparation.

## F. Relevance to the Identity of Historically Black Institutions (HBIs)

### 1. Discussion of the program's potential impact on the uniqueness and institutional identities and missions of HBIs

The proposed Bachelor of Science in Integrated Business and Engineering is not expected to negatively impact the uniqueness, institutional identities, or missions of Maryland's Historically Black Institutions. The program respects and supports the essential role that HBIs play in advancing access, equity, leadership development, and excellence in engineering and STEM education.

HBIs such as Morgan State University, Bowie State University, Coppin State University, and University of Maryland Eastern Shore serve distinctive missions that emphasize community engagement, inclusive

excellence, leadership preparation, and increased participation of African American and underrepresented students in high-demand fields, including engineering and technology.

The Integrated Business and Engineering program differs in focus and design from traditional engineering programs at HBIs. It is structured specifically as an interdisciplinary engineering degree that combines engineering science and systems design with business, financial, operational, and innovation competencies. The program is intended to prepare graduates for leadership-oriented roles within engineering-intensive enterprises rather than focusing exclusively on discipline-specific technical specialization.

The program does not duplicate the mission-driven focus of HBIs, nor does it attempt to replicate their established engineering identities. Instead, it contributes to Maryland's broader higher education landscape by offering an additional engineering pathway that expands student choice and aligns with emerging workforce needs.

Furthermore, the program provides opportunities for collaborative engagement, including:

• Articulation and transfer pathways for students seeking interdisciplinary engineering-business preparation.
• Joint industry partnerships focused on applied engineering projects, innovation initiatives, and workforce development.
• Shared participation in statewide efforts to increase diversity and representation in engineering leadership roles.

By expanding access to an interdisciplinary engineering degree that integrates technical and managerial preparation, the proposed program reinforces Maryland's commitment to equity, economic mobility, and inclusive participation in high-demand STEM careers.

The Bachelor of Science in Integrated Business and Engineering therefore supports, rather than diminishes, the identities and missions of Maryland's HBIs while contributing to the overall strength and diversity of the State's engineering education ecosystem.

## G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes

1. **Description of how the proposed program was established and the faculty who will oversee the program**

The Bachelor of Science in Integrated Business and Engineering was developed through a collaborative academic planning process involving faculty in Capitol Technology University's Engineering Department and Business-related instructional areas, in coordination with the Office of Academic Affairs and institutional leadership. Program development was informed by workforce trends that increasingly require graduates who can combine engineering fundamentals with financial, operational, and innovation-oriented decision-making in technology-driven organizations.

The program was intentionally structured under CIP 14.0101 (Engineering, General) to reflect its interdisciplinary engineering foundation and its purpose as an engineering degree that integrates business

competencies as a required component of the curriculum. The curriculum leverages existing institutional strengths in engineering (systems design, electronics, embedded systems, signals, controls, and senior design) and in business-oriented coursework (project management, engineering economics, finance, accounting, operations, supply chain, data analytics, and innovation). Approved courses currently offered by the university were organized into a coherent sequence that supports rigorous engineering preparation while developing managerial and strategic competencies aligned with industry expectations.

The program is designed to support both first-time undergraduate students and transfer students from community colleges. The curriculum includes a defined engineering core and a structured business core, culminating in a two-semester senior design experience that emphasizes open-ended engineering design, systems integration, and evaluation of technical alternatives in economic and operational contexts.

The program will be overseen by full-time faculty within the Engineering Department with expertise in electrical and systems engineering, embedded systems, engineering analysis and design, and multidisciplinary capstone supervision. Instruction in business, finance, operations, and analytics coursework will be supported by qualified full-time and adjunct faculty with appropriate academic credentials and professional experience. Faculty oversight includes curriculum implementation, course sequencing, assessment of learning outcomes, and continuous improvement.

2. **Description of educational objectives and learning outcomes appropriate to the rigor, breadth, and modality of the program**

The Bachelor of Science in Integrated Business and Engineering will be delivered primarily in an on-campus, face-to-face modality, with selected courses offered in hybrid or online formats to support transfer students and working professionals. The program emphasizes engineering analysis, systems thinking, and design integration supported by quantitative methods, case-based learning, team-based projects, applied analytics, and a two-semester senior design experience.

Educational Objectives
Graduates of the Integrated Business and Engineering program will:

1. Be prepared for entry-level and early-career employment in engineering-intensive organizations where technical responsibilities intersect with business, operations, project management, and innovation functions.
2. Apply engineering fundamentals and systems thinking to analyze, design, and improve products, processes, and technology-enabled systems while considering economic feasibility and operational constraints.
3. Demonstrate professional communication, ethical responsibility, teamwork, and leadership skills in multidisciplinary engineering and organizational environments.
4. Engage in lifelong learning and professional development through continued education, certifications, or advancement in engineering, project leadership, operations, or technology entrepreneurship.

Learning Outcomes
Upon graduation, students will be able to:

1. Apply principles of mathematics, science, and engineering to identify, formulate, and solve engineering problems.

2. Design engineering solutions that meet specified technical requirements while incorporating economic, operational, and organizational considerations.
3. Communicate effectively with technical and non-technical audiences using written, oral, and graphical formats.
4. Recognize ethical, professional, and societal responsibilities in engineering contexts and make informed decisions that consider the impact of engineering solutions.
5. Function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.
6. Develop and interpret data and use appropriate analytical tools to support engineering decision-making, operational evaluation, and continuous improvement.
7. Acquire and apply new knowledge using appropriate learning strategies, professional resources, and technology tools.

These learning outcomes reflect the rigor and breadth appropriate for a bachelor's-level engineering program under CIP 14.0101 and are supported by the engineering core, business integration, and capstone design experience.

**3. Explanation of how the institution will provide for assessment and documentation of student learning outcomes**

a) Assessment of student achievement of learning outcomes
Assessment of student learning outcomes will be conducted using a combination of direct and indirect measures. Course-level outcomes will be mapped to the program-level learning outcomes and assessed using embedded assignments such as exams, applied problem sets, laboratory activities (where applicable), case analyses, presentations, individual and team projects, and data-driven decision exercises.

The two-semester senior design sequence serves as the culminating assessment experience. Senior Design evaluates students' ability to integrate engineering analysis and design with project planning, system constraints, economic evaluation, documentation, and professional communication. Program faculty will review assessment results on a regular cycle, coordinated by the program leadership and the Dean's office, to identify achievement levels, trends, and opportunities for improvement. Feedback from industry engagement, advisory input (as available), and employer expectations will be incorporated as part of continuous improvement.

b) Documentation of student achievement of learning outcomes
Capitol Technology University maintains systematic documentation of program assessment and student achievement. Course portfolios include syllabi, major assignments, rubrics, representative samples of student work, and outcome mapping. Faculty submit periodic assessment summaries that document learning outcome achievement, identify areas for improvement, and recommend curricular or instructional adjustments. Documentation is retained to support institutional effectiveness, accreditation activities, and state and federal reporting requirements.

**4. List of courses, program requirements, and curriculum structure**

The Bachelor of Science in Integrated Business and Engineering is a 120-credit undergraduate degree designed to provide an interdisciplinary engineering education with a structured business core. The program includes general education, mathematics and basic sciences, engineering core coursework, integrated business coursework, and a two-semester senior design sequence. The curriculum is organized

to ensure engineering rigor consistent with CIP 14.0101 while preparing graduates to operate effectively in technology-driven organizations that require combined technical and managerial competencies.

**Curriculum Distribution**

| Category | Description | Credits |
|---|---|---|
| **General Education** | Courses developing written and oral communication, ethical reasoning, critical thinking, and social awareness to support professional practice in engineering and business environments. | 21 |
| **Mathematics and Basic Sciences** | Calculus sequence, differential equations, statistics, calculus-based engineering physics, chemistry, and an approved advanced math/science elective supporting analytical modeling and quantitative problem solving. | 32 |
| **Engineering and Computational Core** | Engineering fundamentals and engineering science coursework including circuits, electronics, digital systems, programming, artificial intelligence foundations, signals and systems, control systems, systems engineering, emerging technologies, and a two-semester senior design sequence. | 35 |
| **Integrated Business Core** | Structured coursework in engineering economics, accounting, financial management, operations, supply chain systems, project management, strategic management, data analytics, and technology innovation. | 30 |
| **Interdisciplinary Elective** | An approved upper-level elective that broadens or deepens interdisciplinary competencies consistent with program objectives. | 3 |
| **Total Program Credits** | | **121** |

**Program Requirements (Curriculum Table)**
Bachelor of Science (B.S.) in Integrated Business and Engineering - Total Credits: 121

I. General Education (21 Credits)

| Course Number and Title | Credits | Prerequisites |
|---|---|---|
| EN 101 – English Communications I | 3 | Placement test score |
| EN 102 – English Communications II | 3 | EN 101 |
| HU 331 – Arts and Ideas | 3 | EN 102 |
| SS 351 – Ethics | 3 | EN 102 |
| BUS 174 – Introduction to Business & Management | 3 | None |
| Social Science Elective | 3 | Varies |
| Humanities Elective | 3 | Varies |
| **Total** | **21** | |

II. Mathematics and Science (32 Credits)

| Course Number and Title | Credits | Prerequisites |
|---|---|---|
| MA 114 – Algebra & Trigonometry | 4 | MA 112 |
| MA 261 – Calculus I | 4 | MA 114 |
| MA 262 – Calculus II | 4 | MA 261 |

| | | |
|---|---|---|
| MA 128 – Introduction to Statistics | 3 | MA 112 |
| MA 340 – Ordinary Differential Equations | 3 | MA 262 |
| PH 261 – Engineering Physics I | 4 | MA 261 (Co-requisite: MA 262) |
| PH 262 – Engineering Physics II | 4 | PH 261 |
| CH 120 – Chemistry | 3 | None |
| Math/Science Elective (Approved) | 3 | Varies |
| **Total** | **32** | |

III. Engineering and Computational Core (35 Credits)

| **Course Number and Title** | **Credits** | **Prerequisites** |
|---|---|---|
| EL 100 – Introduction to DC/AC Circuits | 3 | Co-requisite: MA 112 |
| EL 200 – Electronic Devices & Circuits | 3 | EL 100 |
| EL 204 – Digital Electronics | 3 | None |
| EE 362 – Microcontroller System Design | 3 | EL 204 |
| EE 406 – Signals and Systems | 3 | MA 262 and MA 340 |
| EE 453 – Control I | 3 | MA 340 |
| EE 340 – Systems Engineering | 3 | BUS 301 |
| EE 205 – Emerging Technologies in Electrical Engineering | 2 | EL 200 |
| SDE 457 – Senior Design I | 3 | Senior standing |
| SDE 458 – Senior Design II | 3 | SDE 457 |
| CS 120 – Introduction to Programming Using Python | 3 | None |
| AIT 201 – Introduction to Artificial Intelligence | 3 | MA 128 |
| **Total** | **35** | |

IV. Integrated Business Core (30 Credits)

| **Course Number and Title** | **Credits** | **Prerequisites** |
|---|---|---|
| BUS 301 – Project Management | 3 | EN 101, BUS 174 |
| IET 220 – Engineering Economics & Cost Analysis | 3 | MA 128 |
| BUS 270 – Financial Accounting I | 3 | None |
| OPS 101 – Introduction to Operations Management | 3 | None |
| OPS 254 – Supply Chain Operations Management | 3 | None |
| BUS 372 – Financial Management | 3 | BUS 270, MA 112 |
| BUS 410 – Strategic Management | 3 | BUS 174, EN 101, EN 102 |
| DS 101 – Introduction to Data Science | 3 | MA 112 |
| DS 240 – Statistical Methods in Data Science | 3 | DS 101 |
| BUS 375 – Technology Innovation & Entrepreneurship | 3 | DS 240 |
| **Total** | **30** | |

V. Free / Interdisciplinary Elective (3 Credits)

| **Course Number and Title** | **Credits** | **Prerequisites** |
|---|---|---|
| Approved Interdisciplinary Elective | 3 | Varies |
| **Total** | **3** | |

Program Credit Summary

| Category | Credits |
|---|---|
| General Education | 21 |
| Mathematics and Science | 32 |
| Engineering Core | 35 |
| Integrated Business Core | 30 |
| Free / Interdisciplinary Elective | 3 |
| **Total Program Credits** | **121** |

**Course Descriptions**

**EN-101 – English Communications I (3 credits):** This introductory college-level course focuses on effective oral and written communication skills and the development of analytical abilities through various reading and writing assignments. Students must demonstrate competence in writing mechanics, including grammar, sentence structure, logical content development, and research documentation through 4 essays/research papers. Rhetorical modes may include description, comparison/contrast, narrative, and process analysis. Students are expected to develop effective oral communication skills through speeches. Group projects will develop effective team skills such as decision-making, time management, and cooperation. Prerequisite(s): Acceptance based on placement test scores. EN 102

**EN-102 – English Communications II (3 credits):** This sequel to EN-101 involves more sophisticated reading, writing, speaking, and research assignments. Students must demonstrate competence in writing mechanics, as well as advanced research skills, the ability to handle complex information, and effective team skills. Students write research papers: an information paper, a cause-and-effect paper, an argument paper, and a final research paper. Course includes group work. Presentations are required. Prerequisite(s): EN 101

**HU 331 - Arts and Ideas (3 credits):** This course enables students to study and appreciate various forms of art, including painting, sculpture, architecture, music, drama, film, and literature through in- class and on-site experiences. The arts are also surveyed from an historical perspective, focusing primarily on eras in Western civilization. This enables students to sense the parallel development of the arts, of philosophy, and of sociopolitical systems and to recognize various ways of viewing reality. Prerequisite(s): EN 102

**SS 351 – Ethics (3 credits):** This course is designed to help students improve their ability to make ethical decisions. This is done by providing a framework that enables the student to identify, analyze, and resolve ethical issues that arise when making decisions. Case analysis is a primary tool of this course. Prerequisite(s): EN 102

**BUS 174 - Introduction to Business and Management (3 credits):** This course presents a survey of the general business and management environment. Topics include an introduction to the various forms of business, organizational structure, and their legal implications. Modern management and supervision concepts, history and development of theory and practice, the roles of managers, and the relationship between manager and employee are examined. This is a seminar course with emphasis on class discussion and collaborative learning

**Social Science Elective (3 credits):** This elective allows students to select an approved course in the social and behavioral sciences that supports the development of critical thinking, cultural awareness, ethical reasoning, and an understanding of human and organizational behavior. The course broadens students' perspectives on societal, economic, and global systems, complementing the technical and analytical focus of the Integrated Business and Engineering degree. Approved courses may include topics such as economics, psychology, sociology, political science, or related disciplines.

**Humanities Elective (3 credits):** This elective allows students to select an approved course in the humanities that promotes critical thinking, ethical reflection, cultural awareness, and effective communication. The course encourages exploration of human values, historical perspectives, creative expression, and philosophical inquiry, complementing the technical and analytical components of the Integrated Business and Engineering program. Approved courses may include literature, history, philosophy, communication, fine arts, or related humanities disciplines.

**MA 114 - Algebra and Trigonometry (4 credits):** Designed for students needing mathematical skills and concepts for MA-261. Topics in this course are as follows. Algebra: basic operations on real and complex numbers, fractions, exponents and radicals. Determinates: Solution of linear, fractional, quadratic and system equations. Trigonometry: definition and identities, angular measurements, solving triangles, vectors, graphs and logarithms. Prerequisite(s): MA 112 or placement test score.

**MA 261 - Calculus I (4 credits):** This course covers lines, circles, ellipses; functions and limits, differentiation, power rule, higher-order derivatives, product, quotient and chain rules, implicit differentiation, and applications. Regarding integration, it addresses definite integrals; indeterminate forms; exponential, logarithmic, trigonometric and hyperbolic functions; differentiation and integration, and graphing. Prerequisite(s): MA 114

**MA 262 - Calculus II (4 credits):** This course centers on methods of integration, including completing the square, substitution, partial fractions, integration by parts, trigonometric integrals, power series, and parametric equations. It also addresses partial derivatives, directional derivatives, and an introduction to multiple integrals. Prerequisite(s): MA 261

**MA 128 - Introduction to Statistics (3 credits):** This course addresses probability: definitions, theorems, permutations and combinations; binomial, hypergeometric, Poisson and normal distributions; sampling distribution and central limit theorem; and estimation and hypothesis testing. Prerequisite(s): MA 110, MA 111 or MA 112

**MA 340 – Ordinary Differential Equations (3 credits):** This course addresses methods for solving first order equations with applications to mechanics and rate problems. It also covers solutions of second order equations by undetermined coefficients and variations of parameters. Applications to circuits are also included as well as an introduction to systems of equations and operational and numerical methods. Prerequisite(s): MA 262

**Math/Science Elective (approved):** This elective allows students to select one approved upper-level mathematics or science course that supports the quantitative and scientific rigor of the Integrated Business and Engineering program. Students may choose from MA 300, MA 330, MA 355, or PH 263. These courses strengthen analytical, modeling, and scientific competencies relevant to engineering practice. **Prerequisite(s):** Varies.

**PH 261 – Engineering Physics I (4 credits):** This is a calculus-based physics course. It covers displacement, velocity and acceleration, equations of motion, Newton's laws of motion and their applications, gravitation, work and energy, impulse and momentum, conservation laws, rotational motion, rotational dynamics, equilibrium, elasticity, and periodic motion. Students completing this course may not enroll in PH-201 for additional credit. **Prerequisite(s):** MA 261, **Corequisite(s):** MA 262

**PH 262 – Engineering Physics II (4 Credits):** This course covers calculus based physics. A continuation of PH-261, topics include wave motion, vibration and sound, electricity and magnetism, Coulomb's Law, electrical fields, and induction. **Prerequisite(s):** PH 261

**CH 120 – Chemistry ( 3credits)**: This courses teaches metric system and significant figures, stoichiometry, fundamental concepts of atomic structure and its relationship to the periodic table and electron configuration. Bonds and electronegativity, gases, oxidation states and redox, solutions, acids and bases, changes of state, thermodynamics, and chemical kinetics and equilibrium are also included. Prerequisite(s): MA 112 or MA 114

**EL 100 – Introduction to DC/AC Circuits (3 credits):** Basic electrical concepts and laboratory techniques. Current, voltage, resistance and power. Ohm's law, series and parallel resistive circuits. Kirchhoff's voltage and current laws. Loading effects on meters and supplies. Capacitors and Inductors. Charging and discharging. RC and RL time constants. Introduction to AC. Sinusoidal waveforms, phasors and use of the J operator. Reactance and admittance. Average values and RMS. Laboratory emphasis is on the proper use of standard meters, testing equipment and circuit breadboarding. MATLAB Part I: Introduction to MATLAB, variables, MATLAB functions, data types, writing a MATLAB program, using basic plotting functions. Corequisite(s): MA 112.

**EL-200 – Electronic Devices/Circuits (3 credits):** Principles and characteristics of semiconductor devices. Devices covered include diodes, Zener diodes, bipolar junction transistors, field-effect transistors, and operational amplifiers. Includes bias networks, operating points, maximum output and optimum bias, and DC and AC load lines. Input and output impedances, and voltage and current gains for each amplifier configuration. Prerequisite(s): EL 150.

**EL-204 – Digital Electronics (3 credits):** Number systems, including binary, octal and hexadecimal bases. Binary arithmetic. Boolean algebra, Karnaugh map simplification. Design of combinational circuits. Decoders, multiplexers, flip-flops and other multi-vibrator circuits. Logic families including TTL, CMOS, ECL and others. Memory, shift registers and counters. Prerequisite(s): None

**EE 362 – Microcontroller System Design (3 Credits):** Study of a state of the art microcontroller and related families. Evaluation board hardware preparation and checkout. PC to board interfaces. Assembler and C-compiler. Configuration registers for code and program protection. On-chip memories. Serial peripheral interface and parallel I/O routines. A/D converter, real-time interrupts and timer applications. A series of three group projects are required leading up to a final stand-alone project. **Prerequisite(s):** EL 204

**EE 406 – Signals and Systems (3 credits):** Mathematical models, systems, signal classifications, I/O differential and difference equations, block diagram realizations, discrete-time systems. Convolutions: discrete-time and continuous-time. The Z-transform in linear discrete-time systems, transfer functions. Trigonometric Fourier series, polar and rectangular forms, odd/even functions, response of a linear system to periodic input. Fourier transform, symmetry properties, transform theorems, linear filtering, modulation theorem. Laplace and Fourier transforms and their properties. Offered during fall semester only. Offered during fall semester only. **Prerequisite(s):** MA 262 and MA 340

**EE 453 – Control I (3 Credits):** This course provides a comprehensive introduction to feedback control systems, focusing on the analysis and design of dynamic systems. Key topics include mathematical modeling of physical systems, transfer functions, system response for first- and second-order systems, and stability analysis using Routh-Hurwitz criterion. Students will study steady-state error, system performance metrics, and compensator design methods such as lead and lag compensators. Frequency-domain analysis is emphasized with Bode plots, gain and phase margins, and crossover frequencies. Practical applications are integrated through laboratory exercises and industry-standard computer-aided design tools (e.g., MATLAB/Simulink), equipping students with skills to design and analyze control systems for mechatronics and robotics applications. This course emphasizes both theoretical foundations and hands-on implementation to bridge the gap between theory and practice. **Prerequisite(s):** MA 340

**EE 340 – Systems Engineering (3 Credits):** This course introduces the principles and practices of systems engineering, focusing on the design, management, and improvement of complex engineering systems. Students will learn systems lifecycle planning, project management, quality control, and risk analysis, with an emphasis on integrating safety and compliance with engineering standards. Topics include system modeling, production systems planning, and human factors, preparing students to tackle multifaceted projects. Designed for engineering students across disciplines, the course equips participants with the technical and managerial skills needed to develop safe, efficient, and sustainable systems in diverse engineering fields. **Prerequisite(s):** BUS 301

**EE 205 – Emerging Technologies in Electrical Engineering (2 Credits):** This two-credit course provides an in-depth introduction to selected emerging technologies that are transforming the engineering field. Each semester, the course will focus on a specific set of advanced technologies, such as renewable energy systems, artificial intelligence in engineering, additive manufacturing, or autonomous vehicle technologies. Students will explore the fundamental principles, applications, and technical challenges of each technology, gaining hands-on experience with the tools, methods, and practices that define these innovations. The topics covered will vary each semester to reflect the latest advancements and industry needs, ensuring students stay up-to-date with rapidly evolving engineering technologies. **Prerequisite(s):** EE 200

**SDE 457 - Senior Design I (3 credits):** Students/teams select a project, develop an understanding of the project scope that includes research and documentation of related work, prepare a feasibility study, develop project requirements (constraints) and engineering, software, and/or security specifications, propose solutions and multiple designs, analyze proposed designs, select a final proposed design, and prepare and present a preliminary design review (PDR). Students are expected to apply proper systems engineering and project management to their work. Additional components may be required in some projects. Students/teams submit a final report at the end of the semester. Prerequisite(s): Senior standing.
**SDE 458 - Senior Design II (3 credits):** Students/teams build and test their selected designs (completed in SDE 457). Each student team delivers a tested prototype and defends its project in front of a panel of experts. Students/teams submit a final report that includes description of the design, realization, and test processes as well as test results, discussion, and conclusion. Failure to deliver a completed design and a working prototype that meets engineering, software, and/or security specifications by the end of the semester may result in failing the course. Prerequisite(s): SDE 457

**CS 120 – Introduction to Programming Using Python (3 Credits):** The course will cover basic concepts and elements of computer programming using Python. Topics include variables, constants, operators, expressions, statements, branching, loops, and functions. Additionally, Python specific data structures, built-in functions, library modules and working with external files will be applied in developing working code.

**AIT 201 – Introduction to Artificial Intelligence (3 Credits):** Introduction to Artificial Intelligence explores the foundational principles and applications of AI. Students delve into key concepts such as machine learning, data representation, and problemsolving algorithms. The course introduces ethical considerations in AI development and its societal impact. Exploring various types of AI, from rule-based systems to machine learning approaches, students gain insights into the breadth of AI applications. Hands-on projects provide practical experience in implementing AI techniques. This course equips students with a broad understanding of AI's capabilities and challenges, laying the groundwork for advanced studies and real-world applications. **Prerequisite(s):** MA 128

**BUS 301 - Project Management (3 credits):** This course is an introduction to project management. It covers the origins, philosophy, methodology, and involves actual applications and use of tools such as MS

Project. The System Development Cycle is used as a framework to discuss project management in a variety of situations. Illustrative cases are used and project leadership and team building are covered as integral aspects of good project management. Prerequisite(s): BUS 101 or BUS 174

**IET 220 – Engineering Economics & Cost Analysis (3 credits):** This course introduces economic principles and cost analysis techniques used in engineering and industrial decision-making. Topics include cost estimation, time value of money, cash flow analysis, present and annual worth methods, rate of return, break-even analysis, and economic evaluation of alternatives. **Prerequisite(s):** MA 128

**BUS 270 – Financial Accounting I (3 Credits):** This is an introductory accounting course that will provide students with a strong basic knowledge of accounting terms, concepts, and procedures. Analyzing business transactions as they relate to the General Ledger and the use of special journals will be addressed as well as the various processes and procedures related to the full accounting cycle. The accounting principles described are those endorsed by the Financial Accounting Standards Board.

**OPS 101 -- Introduction to Operations Management (3 credits):** This course provides an overview of operations management principles, methods, and practices. Topics include operations strategy, process design, capacity planning, forecasting, inventory management, quality management, and continuous improvement methods including Lean and Six Sigma. The course emphasizes how operations management drives organizational competitiveness and customer satisfaction. Real-world case studies illustrate applications across manufacturing, services, and technology sectors. Prerequisite(s): None.

**OPS 254 -- Supply Chain Operations Management (3 credits):** This course covers supply chain strategy, design, and management. Topics include procurement, supplier management, logistics, inventory optimization, and supply chain collaboration. Students examine how technology enables supply chain visibility, coordination, and efficiency. Real-world case studies illustrate supply chain challenges and solutions across industries. Prerequisite(s): None.

**BUS 372 – Financial Management (3 Credits):** This course is designed to familiarize the student with the principles that guide a firm's financial resources management. The primary philosophy around which this course is organized is wealth maximization and the decision criterion used to achieve such a state. Topics such as capital management, fixed-asset investment, cost of capital, capital structure, long-term finance, mergers, leasing, and multinational finance are covered. In addition, accounting terminology and concepts relevant to financial analysis and decision making will be presented. **Prerequisite(s):** BUS 270 and MA 111 or MA 112

**BUS 410 – Strategic Management (3 Credits):** Designed to provide students with a general overview of systematic and continuous planning processes used by management to gain strategic and competitive advantage. The students are exposed to, and practice, the complex interrelationships between strategy, structure, culture, and management. Strategic and tactical strategies are explored using case studies, projects and discussions. Students develop and assess the role of management in strategy formulation, implementation and evaluation. **Prerequisite(s):** BUS 174, EN 101, and EN 102

**DS 101 – Introduction to Data Science (3 Credits):** Fundamental coursework on the standards and practices for collecting, organizing, managing, exploring, and using data. Topics include preparation, analysis, and visualization of data and creating analysis tools for larger data sets. **Corequisite(s):** MA 112

**DS 240 – Statistical Methods in Data Science (3 Credits):** Statistical concepts and applications related to data science including advanced exploratory data analysis, nonparametric inference and simulation for larger datasets, logistic regression modeling, statistical programming, and basics of machine learning. **Prerequisite(s):** DS 101

**BUS 375 – Technology Innovation & Entrepreneurship (3 Credits):** This course examines the processes and strategies involved in transforming technological ideas into viable products, services, and ventures. Students explore the innovation lifecycle from concept development and prototyping to commercialization and market entry. Emphasis is placed on opportunity recognition, feasibility analysis, intellectual property fundamentals, funding strategies, business model development, and go-to-market planning. A semester-long team project requires students to develop and pitch a technology-based business concept supported by technical validation and financial projections. **Prerequisite(s):** BUS 174 or junior standing.

**Approved Interdisciplinary Elective (3 Credits):** This elective allows students to select an approved upper-level course outside the primary engineering and business cores that complements the Integrated Business and Engineering curriculum. The course should enhance interdisciplinary understanding, broaden technical or managerial competencies, or support emerging areas relevant to technology-driven industries. Course selection is subject to departmental approval to ensure alignment with program learning outcomes. **Prerequisite(s):** Varies.

5. **Discussion of how general education requirements will be met, if applicable**

The Bachelor of Science in Integrated Business and Engineering satisfies general education expectations through a defined set of general education courses that develop written and oral communication, ethical reasoning, critical thinking, and awareness of social and organizational contexts. The program includes English composition (EN 101 and EN 102), humanities (HU 331 and a humanities elective), and social sciences (SS 351 and a social science elective). These requirements strengthen students' ability to communicate effectively, make ethical decisions, and understand the broader impacts of engineering and business decisions.

Quantitative reasoning and scientific literacy are addressed through required mathematics and basic sciences, including calculus, statistics, differential equations, calculus-based engineering physics, and chemistry. Together, these components provide a broad intellectual foundation supporting professional responsibility and effective participation in technology-driven environments.

6. **Identification of any specialized accreditation or graduate certification requirements for this program and its students**

The proposed program is structured as an engineering degree under CIP 14.0101 and will be subject to Capitol Technology University's internal academic review, assessment, and continuous improvement processes. At program launch, the university will ensure that curriculum design, learning outcomes, and assessment practices align with recognized expectations for engineering education, including rigorous engineering analysis and design integration through the senior design sequence.

The program is not a licensure-track degree in a single discipline (such as civil or mechanical engineering) and does not embed specific external licensure requirements as conditions for graduation. Depending on students' elective selections and career goals, coursework may support preparation for relevant industry-recognized certifications in areas such as project management, analytics, operations improvement, or technical systems. Certification attainment is not required for degree completion.

7. **Contracting with another institution or non-collegiate organization**

This program does not involve contractual agreements with another institution or non-collegiate organization. All instruction, curriculum oversight, and student support services will be provided directly by Capitol Technology University using existing faculty, facilities, and administrative resources.

**8. Assurance and evidence regarding student information and support**

Capitol Technology University will provide students with clear, complete, and timely information regarding curriculum requirements, course sequencing, modality expectations, and student support services. Program information will be published in the academic catalog and on the program webpage, including course descriptions, prerequisites, degree requirements, and expected learning outcomes.

Students will be assigned academic advisors to support degree planning, prerequisite tracking, and timely progress toward graduation. Course syllabi will specify faculty availability, methods of communication, assessment expectations, and technology requirements. Canvas is the university's learning management system and will be used to deliver course materials, manage assignments, and provide feedback. Technology and equipment requirements, including minimum hardware and software specifications, will be communicated through the university's published technology guidance and course syllabi.

Academic support services, including tutoring, library services, writing and academic support, and career development, are available to students and are communicated through the student handbook, university website, and advising processes. Tuition, fees, billing procedures, payment plans, and financial aid information are provided through the Business Office and Financial Aid Office, including guidance regarding scholarships, federal aid, and military benefits.

**9. Assurance regarding advertising, recruiting, and admissions materials**

Capitol Technology University affirms that all advertising, recruiting, and admissions materials for the Bachelor of Science in Integrated Business and Engineering will clearly and accurately represent the program, its curriculum, intended outcomes, and the services available. The Office of Marketing and Communications works in coordination with Admissions and academic leadership to ensure program materials are accurate, consistent with the approved curriculum, and updated as necessary.

Recruitment materials will present transparent information regarding program objectives, degree requirements, delivery modalities, technology expectations, advising and academic support services, tuition and fees, and financial aid options. Admissions counselors and faculty participating in recruitment activities will be provided program-specific information to ensure consistent and accurate communication during outreach events and transfer engagement activities.

## H. Adequacy of Articulation

**1. Discussion of how the program supports articulation with programs at partner institutions**

Capitol Technology University maintains multiple articulation and partnership agreements that support student transfer, degree completion, and academic collaboration. These partnerships align closely with the objectives of the proposed Bachelor of Science in Integrated Business and Engineering, which combines engineering fundamentals with structured business, analytics, and systems competencies.

The program is intentionally designed to be transfer-friendly and to leverage existing articulation agreements with partner institutions such as Cecil College, Community College of Baltimore County

(CCBC), Montgomery College, Prince George's Community College, Notre Dame of Maryland University, and other regional institutions. As articulation agreements are reviewed and updated, the Bachelor of Science in Integrated Business and Engineering will be incorporated into the university's portfolio of articulated undergraduate programs where appropriate.

The curriculum structure supports transfer from associate-level programs in engineering, engineering technology, computer science, business administration, information systems, and related STEM or applied business fields. Lower-division coursework in mathematics (including calculus), physics, introductory engineering, programming, business fundamentals, accounting, and general education is commonly offered at Maryland community colleges and can be aligned with the lower-division requirements of the program.

The program's design reflects the following articulation priorities:

• Alignment of general education coursework with commonly offered English, humanities, and social science courses at partner institutions.
• Acceptance of calculus-based mathematics and laboratory science coursework that satisfies foundational engineering requirements.
• Transfer of introductory engineering, programming, digital systems, and business core coursework where learning outcomes are substantially equivalent.
• Structured advising pathways to allow qualified transfer students to enter at the junior level and complete degree requirements efficiently.

In addition to postsecondary articulation, Capitol Technology University maintains outreach and collaboration with secondary education partners, including participation in Project Lead The Way (PLTW) initiatives and regional engineering advisory activities. These relationships support early exposure to engineering and technology pathways and encourage student transitions into engineering and interdisciplinary STEM programs.

The Integrated Business and Engineering curriculum has been organized to maximize transfer credit acceptance while preserving academic rigor and coherence consistent with a bachelor's-level engineering degree under CIP 14.0101. Foundational mathematics, calculus-based physics, and engineering analysis requirements ensure appropriate preparation for upper-division engineering coursework.

Capitol Technology University will continue to expand articulation agreements with Maryland community colleges and other partner institutions to strengthen transfer pipelines, support workforce development, and increase access to interdisciplinary engineering education. Updated articulation agreements and pathway documentation will be incorporated into institutional records and provided as supporting materials as they are finalized.

# I. Adequacy of Faculty Resources

## 1. Narrative demonstrating the quality of program faculty

The Bachelor of Science in Industrial Engineering Technology is supported by a highly qualified and multidisciplinary faculty team composed of full-time faculty, professors of practice, and adjunct instructors with relevant academic credentials and industry experience. Collectively, program faculty bring expertise in industrial engineering technology, manufacturing systems, operations research, quality and process improvement, systems engineering, computing, mathematics, physical sciences, and professional practice. This breadth of expertise ensures that students receive a rigorous, applied education aligned with workforce needs and contemporary industrial practice.

The program is administered within the School of Engineering and Technology and benefits from faculty who hold appropriate terminal degrees in engineering, engineering technology, applied sciences, mathematics, and related disciplines. Faculty members have extensive experience teaching applied engineering and technology courses and are actively engaged in laboratory-based instruction, project-based learning, and senior design supervision. Their combined academic and professional backgrounds support the program's emphasis on applied problem solving, quantitative analysis, systems thinking, and professional readiness.

Full-time faculty provide instructional continuity, curriculum oversight, assessment coordination, and academic advising for students in the program. Professors of practice and adjunct faculty contribute specialized expertise in areas such as supply chain operations, manufacturing processes, quality systems, operations management, automation, and emerging industrial technologies. This instructional model allows the program to maintain academic rigor while incorporating current industry practices and perspectives into the curriculum.

Faculty assignments are structured to ensure appropriate coverage of core industrial engineering technology courses, engineering and computing foundations, mathematics and science requirements, and the two-semester senior design sequence. Faculty qualifications, appointment types, academic ranks, and course assignments demonstrate that the institution has sufficient and appropriate instructional resources to support the proposed program at launch and as enrollment grows.

A summary list of faculty members, including appointment type, terminal degree and field, academic title or rank, employment status, and courses taught in the proposed program, is provided below in tabular form as required.

**Faculty Resources**

***Full-Time Faculty***

**Dr. Andrew Mehri** holds a Ph.D. in Computer Science, with additional degrees in information architecture and electronics engineering. He has held leadership roles in technical and vocational education and teaches courses in electronics, digital systems, and applied technical design

**Dr. Gregory P. Behrmann** holds a Ph.D. in Mechanical Engineering from The Catholic University of America. His background includes federally funded research, micro-manufacturing innovation, and STEM outreach. He teaches applied design, mechanics, and interdisciplinary project courses.

**Dr. Jeff Chi** holds a Ph.D. in Project Management from the University of Maryland. His professional background includes leadership of large-scale construction, infrastructure, sustainability, and capital management projects. He teaches courses in project management and professional practice.

**Dr. Kellep Charles**, Ph.D. in Cybersecurity (Capitol Technology University), M.S. in Telecommunication Management (University of Maryland University College), B.S. in Computer Science (North Carolina Agricultural and Technical State University). Dr. Charles teaches courses in artificial intelligence, cybersecurity, and autonomous systems.

**Dr. Mohamed Ghazy**, Ph.D. in Engineering (Purdue University), Dean of Academics and Chair of Engineering. Dr. Shehata provides academic leadership for the program and teaches courses in engineering design, control systems, systems engineering, and autonomous systems applications.

**Dr. Nisma M. Omar**, Ph.D. in Analytical Chemistry. Dr. Omar teaches foundational science courses and supports general education related to scientific literacy and technical communication

**Dr. Tahani Baabdullah** is an artificial intelligence and machine learning expert with research and industry experience in deep learning, cybersecurity, and blockchain-integrated AI systems. She holds a Ph.D. in Computer Science and has developed high-accuracy AI models for fraud detection, healthcare, and anomaly detection using Python, TensorFlow, and PyTorch. Her expertise spans neural networks, generative AI, federated learning, and ethical applications of AI across fintech, healthcare, and secure data environments

**Prof. Amelia Wear** is an Instructor and Lead Systems Engineer at Wabtec. She holds a B.S. in Mechanical Engineering and an M.S. in Software Engineering and brings industry expertise in systems integration, controls, and agile development to instruction in applied systems design and mechatronics.

**Prof. Jeffrey Volosin**, Director of the Astronautical Engineering program, holds a B.S. in Space Sciences and has more than two decades of senior leadership experience at NASA. He teaches systems engineering, applied project management, and interdisciplinary systems courses.

***Professors of Practice*** *(Part-Time)*

**Ms. Mary Smikle Peoples** is a Professor of Practice in Business and Management with more than 30 years of experience in higher education administration, financial aid leadership, and business operations. Her professional background includes senior administrative roles and applied experience in financial services, program administration, and organizational management.

***Adjunct Faculty*** *(Part-Time)*

**Ms. Megan Miskovish** holds an M.S. in Education and teaches English composition and humanities courses. Her instruction supports the development of written communication, critical thinking, and professional writing skills essential for effective leadership in technology operations and management.

**Faculty Teaching Assignments Summary**

| Faculty | Appointment Type | Courses Taught |
|---|---|---|
| Dr. Andrew Mehri | Full-Time | EL 200; IET 220; MA 261; MA 262 |
| Dr. Gregory P. Behrmann | Full-Time | PH 261; PH 262; EE 453; SDE 457; SDE 458 |
| Dr. Jeff Chi | Full-Time | BUS 174; BUS 301; OPS 101; BUS 410 |
| Dr. Kellep Charles | Full-Time | DS 101; DS 240 |
| Dr. Mohamed Ghazy | Full-Time | MA 340; EE 406; EE 205 |
| Dr. Nisma M. Omar | Full-Time | MA 114; MA 128; CH 120 |
| Dr. Tahani Baabdullah | Full-Time | CS 120; AIT 201 |
| Prof. Amelia Wear | Full-Time | EL 100; EL 204; EE 362 |
| Prof. Jeff Volosin | Full-Time | EE 340 |
| Prof. Mary Peoples | Part-Time | BUS 270; OPS 254; BUS 372; BUS 375 |
| Prof. Megan Miskovish | Part-Time | EN 101; EN 102; HU 331; SS 351 |

**2. Demonstration of how the institution will provide ongoing pedagogy training for faculty in evidence-based best practices**

Capitol Technology University is committed to continuous faculty development and instructional excellence to ensure high-quality teaching and student success across all academic programs. The

university's Center for Innovation in Teaching and Learning (CITL) provides structured and ongoing professional development opportunities focused on evidence-based pedagogical practices, instructional effectiveness, assessment, and the integration of instructional technologies.

**a) Pedagogy that meets the needs of students**

Faculty teaching in the Bachelor of Science in Industrial Engineering Technology participate in regular professional development activities that emphasize student-centered instruction, inclusive teaching strategies, formative assessment, and active learning methodologies. These training opportunities address the instructional needs of a diverse student population, including traditional undergraduate students, transfer students, adult learners, military-affiliated students, and working professionals.

Emphasis is placed on pedagogical approaches well suited to applied engineering technology education, including project-based learning, case-based instruction, applied problem solving, collaborative team activities, and integration of real-world industrial scenarios. Faculty are supported in designing learning experiences that promote engagement, practical competence, and measurable achievement of program learning outcomes.

**b) Learning management system**

Canvas is the university's official learning management system and is used consistently across all courses in the program. All faculty receive initial and ongoing training in Canvas through CITL-led workshops, online training modules, and individualized support. Training includes course organization and design, assessment tools, rubric development, learning analytics, accessibility compliance, and effective use of instructional resources to support student learning and engagement.

**c) Evidence-based best practices for distance education**

The Bachelor of Science in Industrial Engineering Technology is delivered primarily in a face-to-face modality, with selected courses offered in hybrid formats as appropriate to support transfer students and working professionals. Faculty teaching hybrid courses receive training in evidence-based best practices for blended instruction, including course alignment, student engagement strategies, assessment integrity, and effective use of instructional technologies. All hybrid offerings adhere to institutional policies and established quality standards for instructional delivery.

## J. Adequacy of Library Resources

### 1. Description of library resources available and measures to ensure adequacy in support of the proposed program

Capitol Technology University's Puente Library provides comprehensive academic and research support for students and faculty in the Bachelor of Science in Integrated Business and Engineering program. The library offers a broad range of physical and digital resources that are regularly evaluated and updated to ensure alignment with program learning objectives, curriculum content, and the interdisciplinary engineering–business focus of the program.

Students enrolled in the Integrated Business and Engineering program have access to extensive collections of journals, eBooks, reference materials, technical manuals, and business publications supporting engineering analysis, systems modeling, control systems, electronics, applied mathematics, engineering design, project management, finance, operations management, supply chain management, data science, artificial intelligence, and technology innovation.

Key electronic resources include IEEE Xplore, ScienceDirect, SpringerLink, JSTOR, and ProQuest, which provide full-text access to peer-reviewed journals, conference proceedings, and scholarly

publications across engineering, applied sciences, business, economics, analytics, and management disciplines. These resources support both technical engineering coursework and business strategy, financial analysis, and innovation-related studies.

The Puente Library also maintains access to standards databases and professional reference materials relevant to engineering practice and business operations. Students and faculty may access industry standards, technical specifications, management case studies, financial reporting guidance, and applied research publications supporting coursework in systems engineering, control systems, engineering economics, financial management, operations strategy, and entrepreneurship.

Textbooks and supplemental instructional materials supporting both foundational and advanced coursework are available in print and electronic formats. The library's digital holdings ensure that students in hybrid or technology-enhanced learning environments have equitable access to required academic resources.

To ensure the continued adequacy of library resources, academic leadership collaborates closely with library staff to assess program-specific needs and support targeted acquisitions. Faculty teaching in the Integrated Business and Engineering program may submit requests for new books, journals, databases, standards, or instructional resources. Requests are reviewed and prioritized based on curriculum updates, enrollment trends, capstone project needs, and evolving industry demands at the intersection of engineering and business.

Library services include online and in-person research assistance, interlibrary loan, citation management support, and formal instruction in information literacy. These services ensure that students develop the skills necessary to locate, evaluate, interpret, and apply technical and managerial information effectively in academic projects, senior design work, and professional practice.

Capitol Technology University affirms that the Puente Library's collections, services, and acquisition processes are fully adequate to support the launch and sustained operation of the Bachelor of Science in Integrated Business and Engineering program.

Measures to ensure adequate support include:

• Annual review of library holdings to ensure resources remain current and aligned with engineering, business, analytics, and innovation coursework.
• Acquisition of additional textbooks, standards, financial references, data analytics tools, and case study materials as needed to support interdisciplinary instruction.
• Ongoing collaboration between library staff and faculty to identify emerging resource needs in areas such as artificial intelligence, control systems, engineering economics, financial analysis, and technology commercialization.
• Continued expansion of electronic databases and digital resources to ensure equitable access for all students regardless of instructional modality.

## K. Adequacy of Physical Facilities, Infrastructure, and Instructional Equipment

### 1. Assurance that physical facilities, infrastructure, and instructional equipment are adequate to initiate the program

Capitol Technology University affirms that it possesses the physical facilities, infrastructure, and instructional equipment necessary to successfully launch and sustain the Bachelor of Science in Integrated Business and Engineering program. The university maintains modern instructional classrooms equipped with multimedia projection systems, wireless connectivity, collaborative learning technologies, and presentation capabilities that support lecture-based instruction, applied analysis, and team-oriented project work.

Existing laboratory facilities currently supporting programs in electrical engineering, computer engineering, engineering technology, systems engineering, robotics, and computing will be utilized to support the Integrated Business and Engineering program. These facilities are fully operational and sufficient to meet program needs at launch and as enrollment grows.

Laboratory spaces support hands-on instruction and project-based learning in areas including:

- Electrical and electronic systems
- Digital systems and embedded systems
- Microcontroller-based design and programming
- Control systems and automation
- Signals and systems analysis
- Robotics and cyber-physical systems
- Engineering design and systems integration

Laboratories are equipped with industry-standard instrumentation, oscilloscopes, power supplies, function generators, programmable logic controllers, microcontroller development boards, robotics platforms, and prototyping tools. Instructional software and analytical tools include MATLAB/Simulink, Multisim, CAD platforms, and data analysis software supporting engineering modeling, control systems design, systems analysis, and computational problem solving.

In addition to technical laboratories, the university maintains computing classrooms and collaborative project spaces that support coursework in data science, financial analysis, operations management, engineering economics, project management, and technology innovation. These spaces provide access to business analytics software, spreadsheet modeling tools, and statistical analysis platforms that support the integrated engineering–business curriculum.

Safety equipment, procedures, and institutional compliance protocols are in place to support laboratory and applied activities. Facilities are reviewed regularly to ensure continued adequacy, modernization, and alignment with industry-relevant technologies.

Faculty and staff offices are available and adequately equipped to support academic advising, capstone supervision, student mentoring, assessment activities, and program administration. Space utilization and infrastructure planning are reviewed periodically to accommodate enrollment growth and future faculty expansion.

**2. Assurance that students and faculty engaged in distance or hybrid education have adequate access to institutional resources**

Capitol Technology University ensures that students enrolled in and faculty teaching hybrid components of the Integrated Business and Engineering program have full access to the digital infrastructure required for effective instruction, communication, and academic support.

**a) Institutional electronic mailing system**

All students and faculty are provided with official university email accounts through Microsoft Office 365. These accounts serve as the primary channel for academic communication, course announcements, advising correspondence, and institutional notifications. The system ensures secure, consistent, and reliable communication across academic and administrative units.

**b) Learning management system**

Canvas serves as the university's official learning management system and provides comprehensive support for both on-campus and hybrid instruction. Canvas supports synchronous and asynchronous instructional delivery and includes tools for:

- Content distribution
- Assignment submission and grading
- Online assessments
- Discussion forums and collaborative projects
- Multimedia integration
- Feedback and academic progress tracking

Faculty receive training and ongoing support in instructional design and effective LMS utilization. Students receive orientation resources and technical support to ensure seamless access to course materials and institutional services.

Capitol Technology University affirms that its physical facilities, laboratory infrastructure, instructional equipment, computing resources, and digital systems collectively provide a comprehensive and adequate foundation to support the Bachelor of Science in Integrated Business and Engineering program in both traditional and hybrid instructional formats.

## L. Adequacy of Financial Resources with Documentation

**1. Table 1: Resources and Narrative Rationale**

The Bachelor of Science in Industrial Engineering Technology will be implemented using existing physical facilities, infrastructure, and instructional equipment currently available at Capitol Technology University. The university is well positioned to support the program through existing classrooms, laboratories, faculty offices, and instructional technologies that support engineering technology, operations, computing, and management programs.

**TABLE 1: RESOURCES**

| Resource Categories | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| 1. Reallocated Funds | $0 | $0 | $0 | $0 | $0 |
| 2. Tuition/Fee Revenue (c + g below) | $350,060 | $707,940 | $1,065,072 | $1,449,072 | $1,851,644 |
| a. Number of F/T Students | 8 | 16 | 24 | 32 | 40 |
| b. Annual Tuition/Fee Rate | $27,808 | $28,503 | $29,216 | $29,946 | $30,695 |
| c. Total F/T Revenue (a × b) | $222,464 | $465,048 | $701,184 | $958,272 | $1,227,800 |
| d. Number of P/T Students | 7 | 13 | 19 | 25 | 31 |
| e. Credit Hour Rate | $1,519 | $1,557 | $1,596 | $1,636 | $1,677 |
| f. Annual Credit Hours | 12 | 12 | 12 | 12 | 12 |

| | | | | | |
|---|---|---|---|---|---|
| g. Total P/T Revenue (d × e × f) | $127,596 | $242,892 | $363,888 | $490,800 | $623,844 |
| 3. Grants, Contracts and Other External Sources | $0 | $0 | $0 | $0 | $0 |
| 4. Other Sources | $0 | $0 | $0 | $0 | $0 |
| **TOTAL (Add 1–4)** | **$350,060** | **$707,940** | **$1,065,072** | **$1,449,072** | **$1,851,644** |

**Narrative Rationale for Table 1: Program Resources**

**a. Reallocated Funds**

No reallocated funds are required for the Bachelor of Science in Industrial Engineering Technology. The program is designed to leverage existing instructional, administrative, and laboratory resources. No existing programs will be reduced or eliminated to support this initiative.

**b. Tuition and Fee Revenue**

Tuition and fee revenue projections are based on conservative enrollment growth assumptions, beginning with 8 full-time and 7 part-time students in Year 1 and increasing to 40 full-time and 31 part-time students by Year 5. Tuition rates are based on the university's published rates and assume an average annual increase of approximately 2.5 percent.

Part-time revenue assumes a 12-credit annual load per student. These projections align with Capitol Technology University's strategic emphasis on applied, workforce-oriented engineering technology programs and are sufficient to support instructional staffing, academic support services, and program operations.

**c. Grants, Contracts, and External Sources**

No external funding is included in the initial financial model. The university may pursue workforce development grants, applied STEM education grants, and industry partnerships in later years to support curriculum enhancement, applied projects, internships, and student scholarships.

**d. Other Sources**

No additional funding sources are anticipated at launch. Future opportunities may include philanthropic support, employer-sponsored initiatives, or state innovation programs.

**2. Table 2: Program Expenditures and Narrative Rationale**

**TABLE 2: EXPENDITURES**

| Expenditure Category | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| 1. Faculty (b + c) | $113,468 | $155,071 | $238,421 | $325,843 | $417,486 |
| a. # FTE | 1.5 | 2 | 3 | 4 | 5 |
| b. Total Salary | $94,557 | $129,226 | $198,684 | $271,536 | $347,905 |
| c. Total Benefits (20%) | $18,911 | $25,845 | $39,737 | $54,307 | $69,581 |
| 2. Administrative Staff (b + c) | $5,942 | $6,091 | $6,244 | $6,400 | $6,559 |
| a. # FTE | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| b. Total Salary | $4,952 | $5,076 | $5,203 | $5,333 | $5,466 |
| c. Total Benefits | $990 | $1,015 | $1,041 | $1,067 | $1,093 |
| 3. Support Staff (b + c) | $59,885 | $92,076 | $125,837 | $161,230 | $198,313 |
| a. # FTE | 1 | 1.5 | 2 | 2.5 | 3 |
| b. Total Salary | $49,905 | $76,730 | $104,864 | $134,358 | $165,261 |
| c. Total Benefits | $9,980 | $15,346 | $20,973 | $26,872 | $33,052 |
| 4. Technical Support and Equipment | $840 | $1,425 | $2,320 | $3,145 | $4,140 |
| 5. Library | $0 | $0 | $0 | $0 | $0 |
| 6. New or Renovated Space | $0 | $0 | $0 | $0 | $0 |
| 7. Other Expenses | $5,850 | $14,210 | $25,370 | $39,330 | $56,090 |
| **TOTAL (Add 1–7)** | **$185,985** | **$268,873** | **$398,192** | **$535,948** | **$682,588** |

**Narrative Rationale for Table 2: Program Expenditures**

1. **Faculty** costs include salaries and benefits (estimated at 20 percent) for instructors teaching industrial engineering technology, operations, computing, management, and senior design courses. Faculty staffing increases from 1.5 FTE in Year 1 to 5 FTE by Year 5, reflecting enrollment growth and expanded course offerings. Instruction is delivered through a combination of full-time faculty and adjunct instructors.

2. **Administrative Staff** includes a fractional allocation (0.08 FTE) to support advising coordination, scheduling, reporting, and student services. Costs reflect standard institutional rates with modest annual adjustments.

3. **Support Staff** includes laboratory coordinators, technical assistants, and instructional support personnel required for hands-on labs and applied projects. Staffing increases from 1 FTE to 3 FTE by Year 5 to support expanded laboratory utilization and enrollment growth.

4. **Technical Support and Equipment** costs include software licenses, equipment maintenance, consumable materials, and instructional technology. Increases reflect greater student usage and expanded laboratory activity.

5. **Library** expenditures are not required, as the program relies on existing digital and physical library resources supporting industrial engineering technology, operations, computing, and management.

6. **New or Renovated Space** is not required. Existing classrooms and laboratories are sufficient to support the program.

7. **Other Expenses** include marketing, faculty development, program assessment, and continuous improvement activities that scale with enrollment growth.

Total expenditures increase from $185,985 in Year 1 to $682,588 in Year 5. Tuition and fee revenue substantially exceed expenditures by Year 2, demonstrating that the Bachelor of Science in Industrial Engineering Technology is financially sustainable and can be delivered without reliance on reallocated or external funding.

## M. Adequacy of Provisions for Evaluation of Program

### 1. Procedures for Evaluating Courses, Faculty, and Student Learning Outcomes

Capitol Technology University maintains comprehensive institutional processes to evaluate the quality, effectiveness, and continuous improvement of all academic programs, including the Bachelor of Science in Integrated Business and Engineering.

Course Evaluation

Courses are evaluated at the conclusion of each semester through standardized student course evaluations. These evaluations assess instructional effectiveness, course organization, clarity of learning objectives, appropriateness of assessment methods, availability of learning resources, and overall student experience. Results are reviewed by the department chair and the Dean of Academic Affairs and are incorporated into faculty performance reviews and curricular refinement discussions.

Faculty Evaluation

Faculty performance is evaluated using multiple measures, including:

- Student course evaluations
- Peer observations where applicable
- Course portfolio reviews (syllabi, assignments, assessment instruments, and grading rubrics)
- Annual performance evaluations conducted by the department chair and Dean

Evaluations emphasize instructional quality, student engagement, rigor of assessment, alignment with program learning outcomes, scholarly and professional contributions, and participation in continuous improvement activities.

Evaluation of Student Learning Outcomes

Student learning outcomes are assessed at both the course and program levels. Faculty teaching courses mapped to specific program outcomes collect assessment data using direct measures such as:

- Exams and analytical problem sets
- Engineering design projects
- Business case analyses
- Laboratory exercises
- Data analysis assignments
- Team-based projects
- Senior Design I and II capstone deliverables

Standardized rubrics are used to ensure consistent evaluation across sections and instructors. Assessment results are reviewed annually during departmental meetings and formal program review cycles to identify strengths, address areas requiring improvement, and guide adjustments in curriculum sequencing, instructional strategies, and assessment practices.

The two-course Senior Design sequence serves as the culminating integrative assessment of the program. It evaluates students' ability to synthesize engineering analysis, business decision-making, systems thinking, financial evaluation, and professional communication within a comprehensive project framework.

**2. Evaluation of Educational Effectiveness**

The educational effectiveness of the Bachelor of Science in Integrated Business and Engineering will be evaluated through a systematic, data-driven process aligned with the university's institutional assessment framework.

Assessment of Student Learning Outcomes

Program learning outcomes are mapped to required courses across engineering, mathematics, science, and business domains. Data from embedded assessments and the capstone sequence are collected each semester and analyzed annually. Findings are used to support curricular refinement, strengthen integration between engineering and business coursework, and ensure alignment with industry expectations.

Student Retention, Progression, and Graduation

Program-level retention, progression, and graduation rates are monitored regularly. Academic advising, early alert systems, tutoring services, faculty mentoring, and structured capstone supervision are used to promote persistence and timely degree completion. Data trends are reviewed to identify barriers to student success and to implement targeted interventions when needed.

Student and Faculty Satisfaction

Student satisfaction is evaluated through course evaluations and periodic institutional surveys addressing instructional quality, advising, facilities, technology resources, and overall program experience. Faculty satisfaction and engagement are also assessed through annual review processes and structured feedback mechanisms.

Survey results and qualitative feedback are reviewed by program faculty and academic leadership to identify opportunities for improvement in curriculum delivery, resource allocation, and instructional support.

Cost-Effectiveness and Sustainability

The Office of Academic Affairs and the Business and Finance Division conduct periodic reviews of enrollment trends, faculty workload, instructional costs, laboratory utilization, and program expenditures. These reviews ensure that the program remains financially sustainable while maintaining academic rigor, instructional quality, and adequate student support services.

Advisory and Industry Input

Input from industry partners and the program advisory board will be incorporated into periodic program reviews. Advisory feedback will focus on:

- Relevance of engineering and business integration
- Emerging technologies and digital transformation trends
- Workforce skill expectations
- Professional and leadership competencies

This external perspective supports ongoing alignment with employer needs and regional workforce priorities.

## N. Consistency with the State's Minority Student Achievement Goals

### 1. Discussion of how the proposed program addresses minority student access and success, and the institution's cultural diversity goals and initiatives

The Bachelor of Science in Integrated Business and Engineering aligns with Maryland's Minority Student Achievement Goals and the objectives articulated in COMAR 13B.02.03.05 and the Maryland State Plan for Postsecondary Education. The program is structured to expand access, promote persistence, and

support degree completion among underrepresented student populations in STEM and business-related fields.

Capitol Technology University maintains a strong institutional commitment to increasing participation of African American, Hispanic/Latino, female, first-generation, military-affiliated, and adult learners in high-demand technical disciplines. Engineering and related quantitative fields have historically demonstrated disparities in participation and completion rates among minority populations. The Integrated Business and Engineering program addresses these gaps by providing an interdisciplinary, application-oriented pathway that combines rigorous engineering preparation with business leadership competencies.

The program supports minority student access and success through the following strategies:

• **Transfer-Friendly Design.** The curriculum is structured to facilitate articulation with Maryland community colleges, many of which serve diverse student populations. Clear prerequisite sequencing and credit alignment allow transfer students to enter at the junior level when appropriate, reducing time to degree and financial burden.

• **Integrated Academic Advising and Early Intervention.** Students receive structured academic advising, degree planning assistance, and access to early alert systems that identify academic challenges and provide timely intervention.

• **Financial Accessibility.** Students have access to institutional scholarships, federal and state financial aid, military education benefits, and employer-sponsored tuition assistance programs. These mechanisms reduce financial barriers that disproportionately affect underrepresented populations.

• **Applied and Project-Based Learning.** The program emphasizes experiential, team-based, and applied learning approaches—including laboratory coursework and the two-semester Senior Design sequence. Research consistently indicates that structured experiential learning improves engagement and retention for minority students in STEM disciplines.

• **Career-Relevant Outcomes.** By integrating engineering analysis with business decision-making, the program broadens career pathways into technical management, operations leadership, innovation strategy, and entrepreneurship. This interdisciplinary structure may increase participation among students who seek leadership-oriented or applied technical careers but may not otherwise enroll in a traditional engineering-only program.

• **Inclusive Pedagogy and Faculty Development.** Faculty are supported through professional development initiatives that emphasize culturally responsive instruction, inclusive classroom practices, and Universal Design for Learning (UDL) principles to ensure equitable engagement and academic support.

In addition to program-level initiatives, Capitol Technology University advances institutional diversity goals through inclusive recruitment practices, multicultural programming, student organizations, and integration of equity-focused objectives into strategic planning and assessment processes.

The Bachelor of Science in Integrated Business and Engineering supports Maryland's statewide priorities by:

• Advancing **Student Access** through expanded pathways into engineering and technology education for underrepresented populations.
• Supporting **Student Success** through structured advising, applied instruction, and integrated academic support systems.
• Contributing to workforce equity by preparing diverse graduates for leadership roles in engineering-driven industries and technology-enabled enterprises.

Through these coordinated institutional and programmatic efforts, the proposed program contributes meaningfully to Maryland's objectives for minority student achievement, educational equity, and economic opportunity in high-demand STEM and business-integrated fields.

## O. Relationship to Low Productivity Programs Identified by the Commission

**1. If the proposed program is directly related to an identified low productivity program, discuss how fiscal resources may be redistributed.**

The proposed Bachelor of Science in Integrated Business and Engineering is not a continuation, replacement, or restructuring of a low-productivity program identified by the Maryland Higher Education Commission. The program has been developed as part of Capitol Technology University's strategic academic planning process in response to evolving workforce demand and institutional enrollment trends.

Although the program is not formally tied to a designated low-productivity program, it reflects a strategic realignment and optimization of existing institutional resources. The interdisciplinary structure allows the university to enhance instructional efficiency and improve overall program productivity through integrated use of faculty expertise, shared infrastructure, and coordinated course offerings.

Specifically, the program will:

• Leverage existing full-time faculty across engineering, mathematics, computing, and business disciplines, including faculty whose instructional capacity may otherwise be underutilized due to enrollment fluctuations in specialized programs.
• Utilize existing classrooms, laboratories, engineering equipment, and computing infrastructure without requiring significant new capital investment.
• Share administrative, advising, assessment, and library support structures already in place for engineering and business programs.
• Improve overall enrollment productivity by attracting transfer students, workforce-oriented learners, and students seeking interdisciplinary technical-management pathways.

Through this approach, the Bachelor of Science in Integrated Business and Engineering strengthens institutional sustainability and resource efficiency while supporting workforce-aligned growth. The program represents a strategic enhancement of existing academic capacity rather than the redistribution of resources from a formally designated low-productivity program.

## P. Adequacy of Distance Education Programs

### 1. Affirmation of eligibility to provide distance education

Capitol Technology University is authorized by the Maryland Higher Education Commission (MHEC) to offer distance education programs. The institution has established experience delivering online and hybrid

instruction across undergraduate and graduate programs in engineering, technology, computing, and business.

The university is also an approved participant in the National Council for State Authorization Reciprocity Agreements (NC-SARA), which authorizes the institution to offer distance education to students residing in other SARA member states. This participation confirms compliance with applicable state and national regulatory requirements for distance education delivery.

**2. Compliance with C-RAC guidelines as they relate to the proposed program**

Capitol Technology University affirms compliance with the Council of Regional Accrediting Commissions (C-RAC) guidelines for distance education. Institutional policies and academic oversight ensure that distance-delivered instruction maintains the same standards of quality, rigor, and student engagement as on-campus instruction.

The institution ensures that:

• Curriculum quality and learning outcomes are consistent across on-campus, hybrid, and online modalities.
• Faculty maintain regular and substantive interaction with students through structured communication, assignment feedback, virtual meetings, and collaborative activities.
• Student identity verification and academic integrity are supported through secure authentication protocols within the Canvas learning management system and related assessment tools.
• Distance students have full access to academic advising, tutoring, library resources, technical support, financial aid services, and career development resources.
• Faculty teaching online or hybrid courses receive training in effective online pedagogy and LMS utilization.
• Institutional technology infrastructure supports reliable access to course materials, communication systems, and instructional software.

The Bachelor of Science in Integrated Business and Engineering is designed to be delivered primarily in an on-campus format due to its laboratory components, applied engineering coursework, and senior design experience. However, selected courses—particularly in general education, business, analytics, and computing—may be offered in hybrid or online formats when appropriate.

All distance-delivered components will adhere fully to institutional policies, C-RAC standards, and applicable accreditation and regulatory requirements.