CAPITOL
Technology University

Bradford L. Sims, PhD
President

January 22, 2020

Dr. James D. Fielder, Jr.
Secretary of Maryland Higher Education
Maryland Higher Education Commission
6 N. Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder,

Capitol Technology University is requesting approval to offer a **Bachelor of Science (B.S.) in Construction Information Technology (IT) and Cybersecurity**. The degree curriculum will be taught using the existing faculty at our university and will be supported by the development of new courses. The mission of Capitol Technology University is to provide a practical education in engineering, computer science, information technology, and business that prepares individuals for professional careers and affords the opportunity to thrive in a dynamic world. A central focus of the university's mission is to advance practical working knowledge in areas of interest to students and prospective employers within the context of Capitol Tech's degree programs. The university believes that a **B.S. in Construction IT and Cybersecurity** is consistent with this mission.

Construction IT and cybersecurity is an emerging field that is experiencing significant growth along with other specialized areas of cybersecurity. This program is in response to that need. The **B.S. in Construction IT and Cybersecurity** degree is primarily for experienced construction personnel and newcomers who desire to advance in their careers by earning a bachelor's degree in a growing technical field.

To respond to the needs of the emerging construction IT and cybersecurity field, we respectfully submit for approval a B.S. in Construction IT and Cybersecurity. The required proposal is attached as well as the letter from me, as university president, confirming the adequacy of the university's library to serve the needs of the students in this degree.

Respectfully,

Bradford L. Sims, PhD

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Technology University

Bradford L. Sims, PhD
President

January 22, 2020

Dr. James D. Fielder, Jr.
Secretary of Maryland Higher Education
Maryland Higher Education Commission
6 N. Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder,

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 (B.S.) in Construction Information Technology (IT) and Cybersecurity**. As president of the university, I confirm that the library resources, including support staff, are more than adequate to support the **B.S. in Construction IT and Cybersecurity**. In addition, the university is dedicated to, and has budgeted for, continuous improvement of its library resources.

Respectfully,

Bradford L. Sims, PhD

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

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

Department Proposing Program	Department of Cybersecurity	
Degree Level and Degree Type	Bachelor of Science (B.S.)	
Title of Proposed Program	B.S. in Construction IT and Cybersecurity	
Total Number of Credits	121	
Suggested Codes	HEGIS: 701	CIP: 11
Program Modality	( ) On-campus ( ) Distance Education (*fully online*) (●) Both	
Program Resources	(●) Using Existing Resources ( ) Requiring New Resources	
Projected Implementation Date	(●) Fall ( ) Spring ( ) Summer Year: 2020	
Provide Link to Most Recent Academic Catalog	URL: https://www.captechu.edu/current-students/academic-resources	
Preferred Contact for this Proposal	Name: Professor Soren Ashmall	
	Title: Director, Assessment and Accreditation	
	Phone: (571) 332-4344	
	Email: spashmall@captechu.edu	
President/Chief Executive	Type Name: Dr. Bradford Sims	
	Signature: [signature]	Date: 1-22-20
Approval/Endorsement by Governing Board	Type Name: Dr. Bradford Sims	
	Signature: [signature]	Date: 1-22-20

Revised 5/15/18

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 2020
Projected Implementation Date

Bachelor of Science
(B.S.)
Award to be Offered

Bachelor of Science in Construction Information Technology and Cybersecurity
Title of Proposed Program

0701
Suggested HEGIS Code

11.1003
Suggested CIP Code

Cybersecurity
Department of Proposed Program

Dr. William Butler
Name of Department Head

Prof. Soren Ashmall
Director, Assessment and Accreditation

spashmall@captechu.edu
Contact E-Mail Address

571-332-4344
Contact Phone Number

1-22-20
Signature and Date

President/Chief Executive Approval

JAN. 22, 2020
Date

Date Endorsed/Approved by Governing Board

Proposed Bachelor of Science in Construction Information Technology and Cybersecurity
Department of Cybersecurity
Capitol Technology University
Laurel, Maryland

A. Centrality to Institutional Mission and Planning Priorities:

1. **Provide a description of the program, including each area of concentration (if applicable), and how it relates to the institution's approved mission.**

   Bachelor of Science in Construction Information Technology and Cybersecurity Program Description:

   The **Bachelor of Science (B.S.) in Construction Information Technology (IT) and Cybersecurity** program is designed to meet the growing needs of today's construction industry where construction IT and Cybersecurity are now major considerations. The **B.S. in Construction IT and Cybersecurity** provides a first-rate education where the latest construction IT and Cybersecurity capabilities are reviewed and analyzed with a laser focus. Throughout the program, the latest technological developments, applications, and considerations in the construction industry are explored and applied to real-life industry challenges. Students will learn optimum methods and techniques to define resources, risks, and threats in order to maintain the protection, safety, and profitability of construction sites. The **B.S. degree in Construction IT and Cybersecurity** will prepare students for entry-level IT and Cybersecurity positions throughout the construction industry and related businesses.

   Relationship to Institutional Approved Mission:

   The **B.S. in Construction IT and Cybersecurity** is consistent with the University's mission to educate individuals for professional opportunities in engineering, computer science, information technology, and business. The University provides relevant learning experiences that lead to success in the evolving global community. The **B.S. in Construction IT and Cybersecurity** supports that philosophy in an important growth area. The **B.S. in Construction IT and Cybersecurity** degree also complements the University's existing degree programs.

   The **B.S. in Construction IT and Cybersecurity** degree will be offered on-ground in a traditional classroom environment and online using the Canvas Learning Management System and Zoom. The result is the convenience required by the 21st Century learner and provides the interaction with faculty and fellow students that is critical to the high-level learning experience. The curriculum provides the student with the necessary learning tools that the University believes critical to be successful in the Construction IT and Cybersecurity field. The degree is also consistent with the interdisciplinary nature of the University.

2. **Explain how the proposed program supports the institution's strategic goals and provide evidence that affirms it is an institutional priority.**

   Capitol Technology University operates on four strategic goals:

1. **Expand Educational Offerings, Increase Program Completion:** *Capitol Technology University is an institution that offers career-relevant curricula with quality learning outcomes. The strategy includes continuing to expand educational offerings, increasing program completion, and raising learner qualifications and outcomes.*

2. **Increase Enrollment and Institutional Awareness:** *Capitol will accelerate its goal pursuit to become more globally renowned and locally active through student, faculty and staff activities. Enrollment will grow to 650 undergraduates, 350 masters' students and 250 doctoral candidates.*

3. **Improve the Utilization of University Resources and Institutional Effectiveness While Expanding Revenue**: *Capitol will likely continue to be 80% financially dependent on student tuition and fees. We plan to enhance our resources by expanding the range and amount of funding from other streams and aligning costs with strategic initiatives.*

4. **Increase the Number and Scope of Partnerships**: *Capitol's service to our constituents and sources of financial viability both depend upon participation with continuing and new partner corporations, agencies, and schools.*

The proposed **B.S. in Construction IT and Cybersecurity** program supports all the University's four strategic goals. The proposed degree builds upon the existing areas of degrees at the undergraduate level: B.S. in Astronautical Engineering, B.S. in Business Analytics and Data Science, B.S. in Computer Engineering, B.S. in Computer Engineering Technology, B.S. in Computer Science, B.S. in Construction Management and Critical Infrastructure, B.S. in Construction Safety, B.S. in Cyber Analytics, B.S. in Cybersecurity, B.S. in Electrical Engineering, B.S. in Electrical Engineering Technology, B.S. in Engineering Technology, B.S. in Facilities Management and Critical Infrastructure, B.S. in Information Technology, B.S in Management of Cyber and Information Technology, B.S. in Mechatronics Engineering, B.S. in Mechatronics and Robotics Engineering Technology, B.S. in Software Engineering, and B.S. in Technology and Business Management, and B.S in Unmanned and Autonomous Systems. The proposed degree supports the existing areas of degrees of graduate study, including the Master of Business Administration (M.B.A.), Master of Science (M.S.) in Aviation, Master of Science (M.S.) in Aviation Cybersecurity, Master of Science (M.S.) in Computer Science, Master of Science (M.S.) in Construction Cybersecurity, Master of Science (M.S.) in Construction Safety, Master of Science (M.S.) in Critical Infrastructure, Master of Science (M.S.) in Cyber Analytics, Master of Science (M.S.) in Cybersecurity, Master of Science (M.S.) in Information Systems Management, Master of Science (M.S.) in Engineering Technology, Master of Science (M.S.) in Internet Engineering, Technical Master of Business Administration (T.M.B.A.) in Business Analytics and Data Science, and Technical Master of Business Administration (T.M.B.A.) in Cybersecurity, Master of Science (M.S.) in Unmanned and Autonomous Systems Policy and Risk Management, Doctor of Science (D.Sc.) in Cybersecurity, Doctor of Philosophy (Ph.D.) in Artificial Intelligence, Doctor of Philosophy (Ph.D.) in Aviation, Doctor of Philosophy (Ph.D.) in Business Analytics and Decision Sciences, Doctor of Philosophy (Ph.D.) in Construction Science, Doctor of Philosophy (Ph.D.) in Critical Infrastructure, Doctor of Philosophy (Ph.D.) in Manufacturing, Doctor of Philosophy (Ph.D.) in Occupational Health and Safety, Doctor of Philosophy (Ph.D.) in Product Management, Doctor of Philosophy (Ph.D.) in Technology, Doctor of Philosophy (Ph.D.) in Technology/Master of Science (M.S.) Research Methods Combination Program, Doctor of Philosophy (Ph.D.) in Unmanned Systems Applications. The University's programs have been preparing professionals for the rapid advances in information technology,

intense global competition, and increasingly complex technological environments for decades. The **B.S. in Construction IT and Cybersecurity** follows that tradition.

The proposed **B.S. in Construction IT and Cybersecurity** is fully supported by the University's Vision 2025 and Strategic Plan 2017-2025. Funding to support the **B.S. in Construction IT and Cybersecurity** is already available within the existing budget.

If approved, the new **B.S. in Construction IT and Cybersecurity** will use the Capitol Technology University's Information Literacy Path in the same manner as all of the other degrees at the institution. Information Literacy is infused in to the University's curriculum and the undergraduate experience. Capitol Technology University's Information Literacy Path begins during Orientation and Freshman Seminar. The experience continues every semester through the university's Writing Across the Curriculum program where there are writing assignments in all courses -- some of which require significant research. During the Freshman year, students are required to take English Communications I (EN-101) and English Communications II (EN-102). Both courses have a series of writing assignments that begin during Week 1 and continue to Week 16 of the semester. In addition to examining literature, EN-102 requires a team project in global research. There are two other courses that are required by every degree at the University: Ethics (SS-351) and Arts and Ideas (HU-331). Both courses are focused on research and experiential learning. All students also have access to information videos on the University's portal that support Information Literacy through the University Library. All students at the University will experience all the markers in the Information Literacy Path regardless of learning modality (i.e., online, on ground, and hybrid).

The University has active partnerships in the private and public areas (e.g., Parson Corporation, Leidos, Patton Electronics, Lockheed Martin, Northrup Grumman, Cyber Security Forum Initiative, IRS, and NCS). The **B.S. in Construction IT and Cybersecurity** degree will provide new opportunities for partnerships. The increase in partnerships and placement of our graduates in our partner institutions will serve to expand the University's enrollment and reputation. While additional enrollment will increase financial resources, additional partnerships and grants in the Construction IT and Cybersecurity fields will help diversify and increase financial resources.

3. **Provide a brief narrative of how the proposed program will be adequately funded for at least the first five years of program implementation. (Additional related information is required in section L.)**

Capitol Technology University will support the proposed program through the same process and level of support as the University's existing programs. The University has also budgeted funds to support program and course development, online support, office materials, travel, professional development, and initial marketing. There is no substantial impact to the institution due to the advanced budgeting of these funds. If approved, the program is expected to be self-sustaining going forward.

4. **Provide a description of the institution's commitment to:**

   a. **Ongoing administrative, financial, and technical support of the proposed program**

   The proposed degree is an integral part of the University's Strategic Plan for FY 2017-2025 and forward. Funding for the administrative, financial, and technical support of the new

degree has been included in the institutional and departmental budgets for FY 2019-2020 as well as the forecasted budgets going forward.

b. Continuation of the program for a period of time sufficient to allow enrolled students to complete the program.

Capitol Technology University is fully committed to continuing the proposed **B.S. in Construction IT and Cybersecurity** degree program for a sufficient period to allow enrolled students to complete the program.

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

1. Demonstrate demand and need for the program in terms of meeting present and future needs of the region and the State in general based on one or more of the following:

a. The need for advancement and evolution of knowledge.

Leaders in the construction industry are facing an ever-increasing need to expand the application of new technology to their industry in order to remain competitive, efficient, and viable now and in the future. Construction companies today depend and thrive on timely, accurate and relevant information. As technology enables the creation and capture of ever-increasing amounts of data, the effective use of IT and Cybersecurity are becoming an enormous challenge. Effective leadership in this portion of the construction industry can only be achieved with a holistic approach and the advanced skills that will be covered in this proposed degree.

> Today, new technologies in construction are being developed at a breakneck pace. What seemed like future tech 10, 20 years ago like connected equipment and tools, telematics, mobile apps, autonomous heavy equipment, drones, robots, augmented and virtual reality, and 3D printed buildings are here and being deployed and used on job sites across the world.
>
> ...[V]enture capitalists are betting big on the future of construction tech. A report from James Long LaSalle, Inc. released earlier this year shows that venture capital firms invested $1.05 billion in global contech startups during the first half of 2018. That's a nearly 30% increase over the amount invested for all of 2017. Since 2009, investors have closed 478 funding deals totaling $4.34 billion.
>
> Here's a look at some of the major areas where technology is impacting and improving the construction industry:
>
> Productivity: According to research from McKinsey & Company, construction productivity has remained flat for decades. The traditional method of design-bid-build makes construction disjointed and siloed. Every construction site is different, presenting its own unique set of challenges and risks. This makes it difficult to streamline processes and increase productivity the way industries like manufacturing and retail have been able to do.

Software & Mobile Apps: Today there are software and mobile solutions to help manage every aspect of a construction project. From preconstruction to scheduling, from project management and field reporting to managing your back office, there's a software solution out there to help streamline your processes and improve productivity. Most software solutions are cloud-based, allowing changes and updates to documents, schedules, and other management tools to be made in real-time, facilitating better communication and collaboration.

Mobile technology allows for real-time data collection and transmission between the job site and project managers in the back office. Cloud-based solutions enable on-site employees to submit timecards, expense reports, requests for information (RFIs), work records, and other verified documentation. This can save hundreds of hours per year in data entry and automatically organizes critical files—no more shuffling through files looking for old reports.

More and more software providers are forming strategic partnerships to allow you to seamlessly integrate your data with your other software solutions, making it easier than ever to run your business.

Offsite Construction: Offsite construction is typically used on projects with repetitive floorplans or layouts in their design such as apartment buildings, hotels, hospitals, dormitories, prisons, and schools. Offsite is performed in a controlled environment and it works similarly to an auto manufacturing plant. At each station, workers have all the tools and materials to consistently perform their tasks, whether that be constructing a wall frame or installing electrical wiring. This assembly plant method of construction reduces waste and allows workers to be more productive.

Offsite construction typically comes in two forms: modular and prefabricated. With modular construction, entire rooms can be built complete with MEP, finishes, and fixtures already installed. They can be rooms as small as bathrooms or modules can be fitted together on-site to create larger spaces like apartment units. The modular units are transported to the construction site and then inserted and attached to the structural frame.

With prefabricated construction, building components are built offsite and then assembled or installed once they have been transported to the construction site. Prefabricated building components cover everything from framing, internal and external wall panels, door and window assemblies, floor systems, and multi-trade racks, which are panels with all the ductwork, wiring and plumbing packaged together.

AI & Machine Learning: Construction firms are now using data to make better decisions, increase productivity, improve job site safety and reduce risks. With artificial intelligence (AI) and machine learning systems, firms can turn the mountains of data they have collected over the years on projects to predict future outcomes on projects and gain a competitive advantage when estimating and bidding on construction projects.

AI can improve worker productivity by reducing the amount of time wasted moving about the construction site to retrieve tools, materials, and equipment to perform certain tasks. Workers are tracked throughout the day using smartphones or wearables.

Sensors installed on materials and equipment track how everything else is moving about the construction site. Once enough data sets are collected, AI can analyze how workers move about and interact with the site to come up with solutions to reorganize the placement of tools and materials to make them more accessible to workers and reduce downtime.

Robots and artificial intelligence (AI) are also being used to monitor job-site progress with real-time, actionable data to improve job site productivity. Autonomous drones and rovers are equipped with high-definition cameras and LiDAR to photograph and scan the construction site each day with pinpoint accuracy. AI then uses those scans to compare against your BIM models, 3D drawings, construction schedule, and estimates to inspect the quality of the work performed and to determine how much progress has been made each day.

Deep-learning algorithms are then used to identify and report errors in work performed. This can be anything from the excavation and site work to the mechanical, electrical and plumbing systems. The AI can recognize a building component based on its shape, size and location even if only a portion of the component is visible.

By classifying and measuring quantities installed, these systems can tell you how much work was done each day, which it can then compare against your construction schedule and alerts you if your project is falling behind. The AI also detects deviations between installed components and onsite work with models so you can quickly identify errors and avoid costly rework.

Safety & Training: As technology adoption continues to ramp up in the construction industry, one area getting a lot of attention is improving safety. Of the 4,963 worker deaths in 2016, 991 were in construction. Worker safety should be the number one priority of every construction company and technology solutions are making it easier to properly train and monitor workers to prevent accidents and reduce the rate of serious injuries and worker deaths.

Augmented & Virtual Reality: Safety training and equipment operator training are two areas where virtual reality (VR) could have a strong impact on the construction industry. With VR, workers could get exposure to environments such as confined spaces or working at height in a safe, controlled environment.

VR simulators have been used for years to train soldiers, pilots, and surgeons and could be used in the same way to train workers on everything from operating cranes and excavators to doing welding and masonry work.

Augmented reality (AR) is another technology that can greatly improve safety on the construction site. Whether it's allowing for a more detailed safety plan to be developed or providing training on heavy equipment using actual equipment on real sites with

augmented hazards, there are a number of ways that AR can be deployed on the job site.

Workers could walk to a specific area of a job site and have a safety checklist, specific to the task at hand, pop up on a display integrated into a smart hard hat or safety goggles to make sure they have the proper personal protective equipment on and are performing their tasks safely. Safety managers and trainers could monitor exactly what the workers are seeing and walk them through tasks as they work.

Wearables: Wearables are being used to monitor workers and their environment to make job sites safer. Wearable tech in construction is being embedded into apparel and personal protective equipment (PPE) already common on construction sites like hard hats, gloves, safety vests and work boots.

Construction wearables are being outfitted with biometrics and environmental sensors, GPS and location trackers, Wi-Fi, voltage detectors, and other sensors to monitor workers' movements, repetitive motions, posture, and slips and falls. Geofencing allows the site or safety supervisors to establish restricted or hazardous areas that will alert workers with a combination of alarms and lights that they have entered an area that is off-limits.

Smart clothing, or e-textiles, that can monitor vital signs like respiration rate, skin temperature, and heart rate will also make their way to the construction site. These wearables will be able to monitor a worker's posture, track movements, determine if they are suffering from fatigue and whether they are intoxicated or under the influence of narcotics. Keeping a watchful eye on workers can help predict an accident before it occurs.

Site Sensors: Site sensors that can be deployed across a construction site to monitor things like temperature, noise levels, dust particulates, and volatile organic compounds to help limit exposure to workers.

The sensors are mounted throughout the construction site and can alert workers immediately when they are at risk from permissible exposure levels being reached. Data from the sensors are collected and can be analyzed to mitigate exposure levels and keep workers safe and stay compliant with OSHA regulations...

Drones: Drones are being used on job sites in a number of ways. Drones can be used to quickly conduct job site inspections and identify potential hazards each day. They can also be used to monitor workers throughout the day to ensure everyone is working safely. Drones are being used to take photos of as work progresses to create as-built models of job sites to keep everyone informed of the changing work conditions each day.

Drones are also being used to tackle more dangerous jobs, like bridges and building inspections. This won't eliminate the need for workers, but it will mean that workers will need to be trained on how to use the technology to perform these tasks.

Robots: Current robots are good at doing simple, repetitive tasks which is why we are seeing things like bricklaying robots or rebar tying robots. Once set up, these robots can work continuously to complete tasks faster than human workers without needing to take breaks or go home for a good night's sleep. Robots don't get tired from lifting bricks, applying mortar and setting them in place or constantly bending over to tie rebar.

In both these examples, humans are still needed to perform some of the work. Both still require workers to set up the robots and get them started. For the bricklaying robot, a mason is needed to oversee the work, ensure bricks are correctly placed and clean up the mortar after they've been set. The rebar tying robot still needs humans to correctly place and space the rebar before it gets set in motion.

Instead of replacing workers, most construction robots are there to aid and augment a worker's performance, enabling them to be more productive.

Autonomous Heavy Equipment: Autonomous heavy equipment, using similar technology for self-driving cars, is currently being used on job sites to perform excavation, grading, and site work. This type of technology allows operators to be completely removed from the machine, allowing companies to do the same amount of work with fewer workers.

These machines use sensors, drones, and GPS to navigate the construction site and conduct site work based on 3D models of the terrain to accurately excavate and grade the site. Augmented GPS, a combination of onsite base stations and satellites, can be used to geofence the site and allow autonomous equipment to move around the site with precision accuracy.

The benefit of adopting technology like drones, robots, and autonomous or self-controlled equipment are twofold. First, within the next decade, workers entering the workforce that has grown up using tablets and smartphones their entire life, so operating these machines will be second nature to them. Second, younger workers, regardless of what field they go into, are going to expect to be using technology to perform their jobs…

Mobile Technology: Smartphones and mobile apps have made communication and collaboration on projects easier. Instead of driving to the office for impromptu meetings, firms can use mobile technology to facilitate a meeting of the minds that lead to definitive conclusions without interrupting the day's work.

Being able to communicate in real-time ensures that any issues on the job site get resolved quickly and effectively and that every stakeholder can have a say. Integrated solutions that sync in real-time allow different stakeholders to add notes, change drawings and responds to RFIs instantly and then share that information with everyone involved with the project at the same time.

BIM: Building Information Modeling (BIM) is a process that incorporates digital representations of buildings in 3D models to facilitate better collaboration among all stakeholders on a project. This can lead to better design and construction of buildings.

Changes to the BIM model occur in real-time, so any changes or updates to the model are instantly communicated to all team members when they access the model. Everyone is working with the most up-to-date information at all times. Because the schedule can be simulated, a visual representation of the construction process allows team members to plan out each phase of construction.

The type of immersive visualization made possible by VR paired with BIM will lead to better collaboration and communication. Virtual reality will also lead to greater acceptance and implementation of BIM. Most virtual reality applications being developed for the AEC industry are using BIM models as the basis to create virtual environments.

With AR, a project manager or contractor could walk through a construction site and easily view an overlay of a BIM model on top of as-built construction and compare the two. At the same time, they could be accessing checklists completing a daily report using a heads-up display. The project manager could instantly take photos or record the augmented reality walkthrough and send it back to the design team for clarification as issues arise…

Companies that are researching and implementing technology are reaping the rewards with increased productivity, better collaboration, and completing projects on time and under budget—resulting in higher profit margins.

(Source: https://www.constructconnect.com/blog/technology-reshaping-construction-industry)

b. Societal needs, including expanding educational opportunities and choices for minorities and educationally disadvantaged students at institutions of higher education.

Capitol Technology University is a diverse multiethnic and multiracial institution with a long history of serving minority populations. The University has a 51% minority student population with 7% undisclosed. The Black/African American population is 34%. The university has a military/veteran population of 22%. The University also has a 22% female population – a significant percentage given its status as a technology institution. If approved, the proposed **B.S. in Construction IT and Cybersecurity** will expand the field of opportunities for minorities and disadvantaged students.

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, the university is a diverse multiethnic and multiracial institution with a long history of serving minority populations. The University has a 51% minority student population with 7% undisclosed. The Black/African American population is 34%. The University has a military/veteran population of 22%. The university also has a 22% female population – a significant percentage given its status as a technology institution. If approved, the proposed **B.S. in Construction IT and Cybersecurity** will expand the field of opportunities for minorities and disadvantaged

students.

A report from the Business-Higher Education Forum notes that African Americans and Hispanics represent just 6 and 7% respectively of STEM employment, even though they represent more than twice that much of the U.S. population. Given the substantial minority population of Capitol Technology University, it is reasonable to assert that the **B.S. in Construction IT and Cybersecurity** program will add to the base of minority participation in the emerging Construction IT and Cybersecurity profession.

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

3. **Provide evidence that the perceived need is consistent with the Maryland State Plan for Postsecondary Education.**

The 2017-2021 Maryland State Plan for Postsecondary Education articulates three goals for postsecondary education:

1. Access
2. Success
3. Innovation

Goal 1: Access

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

Capitol Technology University is committed to ensuring equitable access to affordable post-secondary education for all Maryland residents. The University meets its commitment in this arena through its diverse campus environment, admissions policies, and academic rigor.

The Capitol Technology University community is committed to creating and maintaining a mutually respectful environment that recognizes and celebrates diversity among all students, faculty, and staff. The University values human differences as an asset and works to sustain a culture that reflects the interests, contributions, and perspectives of members of diverse groups. The University delivers educational programming to meet the needs of diverse audiences. We also seek to instill those values, understanding, and skills to encourage leadership and service in a global multicultural society.

The University's commitment to diversity is reflected in its student body. Capitol Technology University has a 51% minority student population with 7% undisclosed. The Black/African American population is 34%. The University has a military/veteran population of 22%. The University also has a 17% female population – a significant percentage given its status as a technology university.

Achievement gaps: The University provides leveling courses in support of individuals attempting a career change to a field of study not necessarily consistent with their current skills. There are situations where undergraduate courses best serve student needs in subject areas. The University makes those courses available.

The University engages in diversity training for its institutional population, including students. Diversity and inclusiveness are built into the curriculum allowing graduates to operate effectively in a global environment. The University supports multiple diversity enhancing actions, including team projects and grants across degrees. This has proven effective at supporting multiple aspects of diversity.

Capitol Technology University does not discriminate on the basis of race, color, national origin, sex, age, sexual orientation, or handicap in admission, employment, programs, or activities.

Through its academic programs, Capitol Technology University seeks to prepare all of its graduates to demonstrate four primary characteristics:

- **Employability:** The ability to enter and advance in technical and managerial careers, appropriate to their level and area of study, immediately upon graduation.
- **Communications:** Mastery of traditional and technological techniques of communicating ideas effectively and persuasively.
- **Preparation of the Mind:** The broad intellectual grounding in technical and general subjects required to embrace future technical and managerial opportunities with success.
- **Professionalism:** Commitment to life-long learning, ethical practice, and participation in professions and communities.

The proposed **B.S. in Construction IT and Cybersecurity** program and University financial aid will be available to all Maryland residents who qualify academically for admission. The University has successfully managed to support Financial Aid for its students since its founding in 1927.

The **B.S. in Construction IT and Cybersecurity** program, with its academic rigor, will produce Construction IT and Cybersecurity professionals for this critical field of study and employment. The University has a proven record of rigorous high-quality education. The University is fully accredited by five accrediting organizations. The University receives its regional accreditation from the Middle States Commission on Higher Education (MSCHE). The University also has specialized accreditation from the International Accreditation Council of Business Education (IACBE), Accreditation Board for Engineering and Technology (ABET), and National Security Agency (NSA)/Department of Homeland Security (DHS). The **B.S. in Construction IT and Cybersecurity** program is consistent with the MSCHE criteria for regional accreditation of the delivery of high-quality higher education.

Goal 2: Success

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

The courses for the **B.S. in Construction IT and Cybersecurity** degree will be offered on-ground in a traditional classroom environment and online using the Canvas Learning Management System and Zoom. The University provides a tuition structure that is competitive with its competitors. The University tuition structure does not differentiate between in-state and out-of-state students. Student services are designed to provide advising, tutoring, virtual job fair attendance, and other activities supporting student completion and employment for both on-ground and online students.

Students receive information throughout the admissions process regarding the cost to attend the University. The information is also publicly available on the University website. The University's Admissions Office and Office of Financial Aid identify potential grants, scholarships, and state plans for each student to reduce potential student debt. The net cost versus gross costs is identified clearly for the student. Students receive advising from Financial Aid Advisors prior to enrolling in classes for the first time. Admissions personnel, Student Services Counselors and Departmental Chairs advise students of the need for academic readiness as well as the degree requirements. A specific success pathway is developed for each student.

The University's tuition increases have not exceeded 3%. The University also has a tuition guarantee for undergraduates, which means full-time tuition is guaranteed not to increase more than 1% per year at the rate applied at the time of enrollment. The tuition remains at this rate if the student remains enrolled full-time without a break in attendance.

The University has in place services and learning tools to guide students to successful degree completion. Programs such as Early Alert provide the University's faculty and staff opportunities for early student intervention on the pathway to graduation. This applies to all students regardless of the mode of course delivery or degree program. Capitol Technology University is also a transfer-friendly institution and participates in multiple programs for government and military credit transfer. Capitol Technology University participates in the Articulation System for Maryland Colleges and Universities (ARTSYS) and has multiple transfer agreements with local institutions at all degree levels.

The University has in place services, tutoring, and other tools to help ensure student graduation and successful job placement. The University hosts a career (job) fair twice a year. The University has an online career center available to all students covering such topics as career exploration, resume writing, job search techniques, social media management, mock interviews, and assistance interpreting job descriptions, offers, and employment packages.

The University also works with its advisory boards, alumni, partners, and faculty to help ensure the degrees offered at the University are compatible with long-term career opportunities in support of the state's knowledge-based economy.

Goal 3: Innovation

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

Capitol Technology University's past, present, and future are inextricably intertwined with innovation. The University has a long tradition of serving as a platform for the use of new and transformative approaches to delivering higher education. New technology and cutting-edge techniques are blended with proven strategies with the goal of enabling student success in all classroom modalities as well as in a successful career after graduation. As a small institution, Capitol Technology University has the agility to rapidly integrate new technologies into the curriculum to better prepare students for the work environment. The University designs curriculum in alliance with its accreditation and regulating organizations and agencies.

The University also employs online virtual simulations in a game-like environment to teach the application of knowledge in a practical hands-on manner. The University is engaged with a partner creating high-level virtual reality environments for use by doctoral students pursuing this degree. This use of current technology occurs in parallel with traditional proven learning strategies. These elements of the University's online learning environment are purposeful and intended to improve the learning environment for both the student and faculty member. In addition, these elements are intentionally designed to increase engagement, improve outcomes, and improve retention and graduation rates. The University believes that innovation is the key to successful student and faculty engagement.

Example: The University engages its students in 'fusion' projects, which allows students to contribute their skills in interdisciplinary projects such as those in our Astronautical Engineering and Cyber Labs. In those labs, students become designers, builders, and project managers (e.g., to send a CubeSat on a NASA rocket) and data analysts (e.g., to analyze rainforest data for NASA). The University's students recently launched another satellite aboard a NASA rocket from a location in Norway at the beginning of the 2019 Fall Semester. We are also recruiting additional partners for the proposed **B.S. in Construction IT and Cybersecurity** for which real-world projects will provide students integrative learning opportunities.

The University also supports prior learning assessment. A portfolio analysis is available. The University accepts professional certifications for credit for specific courses. In addition, the University allows students to take a competency exam for credit for required courses up to the current state limits.

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

1. **Describe potential industry or industries, employment opportunities, and expected level of entry (*ex: mid-level management*) for graduates of the proposed program.**

Graduates with a **B.S. in Construction IT and Cybersecurity** will be expected to fill entry-level positions in commercial companies as well as local, state, and federal government with a variety of titles such as:

- Construction Information Technology Specialist
- Construction Cyber Operations Team Leader
- IT and Cybersecurity Supervisor
- Construction Information Specialist
- Cybersecurity Analyst
- Construction TI/Cyber Strategist
- Construction Cyber Security Consultant

Graduates will also possess the required knowledge in Construction IT and Cybersecurity to serve as a subject matter expert and form their own private company.

2. **Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.**

Constructor magazine recently listed the industry's hiring expectations, top five software technology investments, and top five ways construction companies are currently using mobile software technology.

(Source: https://www.constructor-digital.com/ngcs/0119_march_april_2019/MobilePagedArticle.action?articleId=1466614#articleId1466614)

At the same time, cyber-attacks in the construction industry are rising significantly. The legal experts at the online knowledge provider JD Supra provided a summary of the threat in their recent article, "Cybersecurity in the Construction Industry: Protecting Against a Growing Threat":

> Why Cyber Threats to Construction are on the Rise. The construction industry, like so many other sectors of the economy, is increasingly dependent on the internet and on internet-enabled technologies. Shared resources like integrated project delivery and building information modeling increase the risk that an authorized user will unintentionally introduce malware into shared systems. The widespread use of vendors and subcontractors who have connectivity to shared information technology (IT) networks increases the risk that a cyber incident involving one company will become a vulnerability for many companies. In addition, the steady growth in connected and remote-controllable devices – broadly known as the "Internet of Things" – has vastly increased the potential attack surface for cyber threats. Perhaps the most famous example of the ways in which these threats can intersect with and magnify each other is the Target department store data breach, in which millions of Target customers' credit card information was exposed, and Target suffered millions of dollars in breach response costs, litigation fees, lost revenue, and incalculable reputational harm. The breach originated with an HVAC vendor who was responsible for managing "smart" thermostats at Target facilities. Once inside the network, the hackers were able to traverse the connected IT architecture and penetrate Target's payment card information databases.

What is at Risk? Cyber threats can expose all of a company's digital assets: business plans and acquisition strategies; proprietary construction plans and designs; customer, contractor, and supplier lists and pricing; personally identifiable information of employees and contractors; protected health information of personnel; and facilities security information. Cyber risk can also cause business interruption and reputational harm: for example, a ransomware attack might not lead to a loss of information, but by shutting down a company's computer networks, and potentially destroying information, it can cause an enormous amount of lost productivity and business delay. And the ability for cyber attackers to hijack physical devices – from security cameras to vehicle telematics to industrial control systems – means that there is an ever-increasing risk of property damage and personal injury due to cybersecurity incidents.

(Source: https://www.jdsupra.com/legalnews/cybersecurity-in-the-construction-22150/#FollowSection)

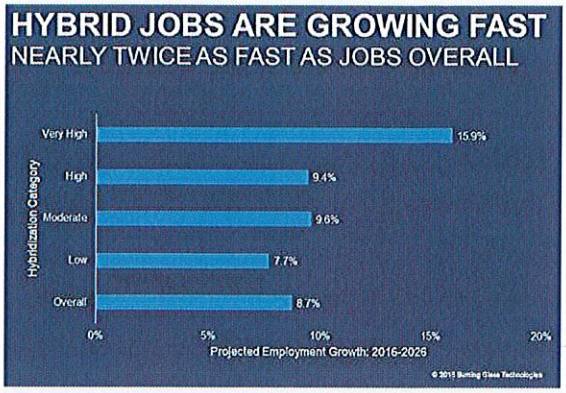
3. **Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.**

The combination of IT and cybersecurity skills tailored to the construction industry is a new and market survey that does not exist yet for this specialty. However, the trend toward interdisciplinary degrees that lead to hybrid jobs is growing much faster than those focused on only one discipline. In a recent article, "Hybrid Jobs Projected to Grow Twice as Fast as Jobs Overall," Burning Glass Technologies explains how the market is changing.

"Hybrid jobs" represent a major shift in the makeup of occupations—and hybrid jobs growth is increasing twice as fast as the rest of the job market.

Hybrid jobs are a challenge and an opportunity for educators and job seekers alike because they meld skills from different disciplines. For example, mobile application developers have to understand programming, design, data analysis, user experience, and core marketing skills. Those who possess the right combination of these skills are highly sought – twice as much in demand as compared to skills requested in the overall job market.

Burning Glass Technologies has developed a hybridization score for jobs, based on the extent to which they draw on skills from different fields. Our projections, based on our analysis of labor market demand via job postings, show jobs with a "very high" hybridization score will grow nearly 16% by 2026, compared to 8.7% for jobs overall. Jobs with a low hybridization score, where skills are concentrated in one field, are only projected to grow by 7.7%.



In a 12-month period, we found that more than a quarter-million job postings sought this kind of hybrid talent…

The good news: Those with the needed skills can command salaries comparable to those for positions with more advanced technical requirements. The challenge: these skills aren't traditionally thought of as linked…The takeaway for educators: hybrid job growth will require students to mix skill sets, which means there's an opportunity for institutions that make it easier for students to combine courses and disciplines into these hybrid skill sets.

(Source: http://burning-glass.com/hybrid-jobs-growth/)

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

According to The Cyber Edge, the projected shortage of skilled workers is increasing to nearly 2 million for cybersecurity professionals.

> The cybersecurity workforce gap is real, and it's growing. Based on a state-by-state analysis on CompTIA's cyberstates.org, there are currently 320,000 open cyber jobs in the United States. By 2022, the projected shortage of cybersecurity professionals worldwide will reach 1.8 million, according to the Center for Cyber Safety and Education.

Concurrently, two studies on the projected supply and demand for graduates in the construction field from accredited institutions of higher education shows a significant workforce shortage of graduates in the field that has been growing since 2000.

> In 1997 the Department of Construction Science at Texas A&M University conducted a survey of accredited construction programs and construction companies that consistently hired from these programs to identify if the demands of the industry were being met by the supply of construction graduates. A time-series regression analysis was used to predict the demand for construction graduates from accredited construction programs. The model showed that there was an increase in demand for construction graduates of approximately 593 students per annum. The supply of students, however, was reported as remaining static for the next five years indicating the prospect of gap between supply and demand. The results of this research were presented at the annual conference of the Associated Schools of Construction in 2000. In 2005 the study was repeated to see if there had been any change in the supply and demand for construction education

graduates. In the 2005 study, 64 accredited construction education programs were surveyed to quantify the number of "construction graduates" who were produced by accredited construction programs. The study surveyed 551 construction companies across the United States, who hired construction graduates to quantify the demand for construction graduates. The study then compared the supply and demand figures. In 2005, findings from the accredited universities indicated a production level of approximately 3596 construction graduates. The industry survey indicated demand in 2005 for approximately 7877 construction graduates. The intent of the study is to provide a representation of the current production level of, and the demand for construction graduates, for the purpose of comparing supply and demand. Actual demand figures are given for the years 2000 through 2005. Demand projections are given for the years 2006, 2007, 2008, 2009, 2010. Supply figures are based upon the average production of construction graduates, from each identified university, during the years 2000 through 2005. The results of the survey data indicate an increasing demand for construction education graduates of approximately 754 students per annum. Additionally, the survey data reveals the supply of construction graduates is increasing by only 160 students annually and is not currently meeting the demands of the construction industry, nor will it be meeting the industry demands in the future.

(Source: https://www.researchgate.net/publication/238071959_A_Study_of_the_Supply_and_Demand_for_Construction_Education_Graduates_in_the_United_States [accessed Dec 20 2018].)

The proposed **B.S. in Construction IT and Cybersecurity** will be the first degree in the nation to blend the needs of IT and cybersecurity specific to the construction industry. It will send its graduates to the leadership positions in industry with the ability to chart the course of their organization and its success in the future. The program graduates will be in the position to earn the maximum amount of income in construction IT and cybersecurity by filling the requirement for groundbreaking knowledge to protect the construction industry.

D. Reasonableness of Program Duplication

1. Identify similar programs in the State and/or the same geographical area. Discuss similarities and differences between the proposed program and others in the same degree to be awarded.

There are no **B.S. in Construction IT and Cybersecurity** programs in the State of Maryland. Morgan State University (MSU) has a B.S. in Construction Management focused on construction management. MSU has a B.S. in Information Systems focused on the broader area of the design and development of automated systems that are used in enterprises. MSU also has a non-degree program that provides training for Security+ certifications – an element of cybersecurity. However, MSU does not offer a B.S. in Construction IT and Cybersecurity. The University of Maryland Eastern Shore (UMES) has a B.S. in Construction Management Technology focused on the much broader field of the design, construction, and maintenance of residential and commercial structures. However, UMES does not offer a B.S. in Construction IT and Cybersecurity.

Table 1
SIMILARITY ANALYSIS OF CURRICULA BY COURSE

BETWEEN CAPTIOL TECH AND UMES DEGREES

Capitol Technology University B.S. in Construction IT and Cybersecurity		UMES B.S. in Construction Management Technology	
Computer Science		**Computer Science**	
CS-200 Programming in C++	3		
CS–220 Database Management	3		
CS–230 Data Structures	3		
CS–310 Computer Algorithms	3		
Computer Programming		**Computer Programming**	
CT-102 Introduction to Internet Applications	3		
CT-152 Introduction to UNIX	3		
CT-206 Scripting Languages	3		
CT-376 Javascript	3		
CT-406 Web Programming Languages	3		
Cybersecurity		**Cybersecurity**	
NT–150 Intro to Computer Networking	3		
IAE–201 Introduction to IA Concepts	3		
IAE–250 Comprehensive Computer/Network Security	3		
IAE–260 Secure Systems Administration and Operation	3		
IAE–325 Secure Data Communications and Cryptography	3		
IAE–402 Introduction to Incident Handling/Malicious Code	3		
Construction Software		**Construction Software**	
CIT-200 Construction IT and Cybersecurity Issues	3		
CIT-220 BIM and Graphic Software	3	CMTE 323 BIM Technology I	3
CIT-240 Estimating Software	3		
CIT-260 Scheduling Software	3		
CIT-280 Construction Project Management Software	3	CMTE 205 Comp. Applic. In Const.	3
		EDTE 131 Tech Drawing I (CAD)	3
		CMTE 324 BIM Technology II	3
Critical Infrastructure		**Critical Infrastructure**	
CRI-210 Critical Infrastructure I	3		
CRI-310 Critical Infrastructure II	3		
CRI-410 Critical Infrastructure III	3		
Construction		**Construction**	
CM-120 Intro to Construction Management	3		
CM-125 Construction Graphics and Plan Reading	3	CMTE 201 Architec. Drawing	3

CM-220 Construction Methods and Materials	3	CMTE 230 Construction Materials	3
CM-250 Legal Issues in Construction	3		
		CMTE 214 Constr. Surveying	3
		CMTE 286 Constr. Planning & Sched.	3
		CMTE 295 Constr. Mang. Internship I	2
		CMTE 319 Statics & Strength of Materials	3
		CMTE 320 Building Structures	4
		CMTE 325 Constr. Methods & Equipment	3
		CMTE 326 Building Systems	3
		CMTE 342 Estimating I	3
		CMTE 350 Green Building I	3
		CMTE 395 Constr. Mang. Internship II	2
		CMTE 425 Constr. Mgt. I	3
		CMTE 427 Soils & Site Development	3
		CMTE 445 Estimating II	3
		CMTE 426 Constr. Mgt. II	3
		CMTE 440 Constr. Safety Management	3
		CMTE 450 Green Building II	3
		CMTE 458 Senior Seminar	2
Business		**Business**	
		BUAD (Elective)	3
		BUAD (Elective)	3
		BUAD 307 Industrial Relations	3
		ECON 201 Prin. Of Economics I	3
		ECON 202 Prin. Of Economics II	3
		ACCT 201 Intro to Financial Acct.	3
General Education		**General Education**	
Gen Ed Computer Science		**Gen Ed Computer Science**	
CS–130 Intro to Programming Using Java	3		
CS–150 Intro to Programming Using C	3		
Physical Science		**Physical Science**	
CH-120 Chemistry	3		
PH-201 General Physics I	3	PHYS 121 Gen. College Physics	4
		PHYS 122 Gen. College Physics II	4
		ENVS101 Environmental Science	3
Mathematics		**Mathematics**	
MA-112 Intermediate Algebra	3		
MA-114 Algebra & Trigonometry	4	MATH 111 Elem. Math Analysis	4
MA-124 Discrete Mathematics	3		
		MATH 112 Calculus I	4
English		**English**	
EN-101 English Communications I	3	ENGL 101 Basic Composition I	3
EN-102 English Communications II	3	ENGL 102 Basic Composition II	3

		ENGL 203 Fund. Contem. Speech	3
		ENGL 305 Technical Writing	3
		ENGL 328 World Literature I	3
Social Science		**Social Science**	
SS-351 Ethics	3		
Social Science Elective	3		
		SOCI 201 Social Problems	3
Humanities		**Humanities**	
HU-331 Arts and Ideas	3	ARTS 101 Exploration of Visual Arts	3
Humanities Elective	3		
		EDTE 100 First Year Exper Seminar	1
Total Degree Credits	**121**	**Total Degree Credits**	**126**

Table 2
SIMILARITY ANALYSIS OF CURRICULA BY COURSE CREDIT BETWEEN CAPTIOL TECH AND UMES DEGREES

Capitol Technology University B.S. in Construction IT and Cybersecurity		**UMES B.S. in Construction Management Technology**	
CORE CURRICULUM			
Total Core Curriculum Credits	**81**	**Total Core Curriculum Credits**	**85**
Core Curriculum: Four courses similarity out of 27 Capitol Tech/29 UMES total courses. 14.8% - 13.9% Similarity of Credits			
Computer Science Course Credits	**12**	**Computer Science Course Credits**	**0**
Computer Science: No course similarity. Only Capitol Tech has these courses.			
Computer Programming Course Credits	**15**	**Computer Programming Course Credits**	**0**
Computer Programming: No course similarity. Only Capitol Tech has these courses.			
Cybersecurity Course Credits	**18**	**Cybersecurity Course Credits**	**0**
Cybersecurity: No course similarity. Only Capitol Tech has these courses.			

Construction Software Course Credits	15	Construction Software Course Credits	12
Construction Software: Two-course similarity (i.e., BIM and Construction Project Management Software)			
Critical Infrastructure Course Credits	9	Critical Infrastructure Course Credits	0
Critical Infrastructure: No course similarity. Only Capitol Tech has these courses.			
Construction Course Credits	12	Construction Course Credits	54
Construction: Two courses similarity (i.e., Construction Graphics/Plans and Construction Materials)			
Business Course Credits	0	Business Course Credits	18
Business: No course similarity. Only UMES has these courses.			
GENERAL EDUCATION CURRICULUM			
Total General Education Credits	40	Total General Education Credits	41
GenEd Total: Four courses similarity out of 12 Capitol Tech/13 UMES total courses 40.0-41.4% Similarity of Credits in COMAR Mandated GENERAL EDUCATION			
Gen Ed Computer Science Course Credits	6	Gen Ed Computer Science Course Credits	0
Gen Ed Computer Science: No course similarity. Only Capitol Tech has these courses.			
Physical Science Course Credits	6	Physical Science Course Credits	10
Physical Science: One-course similarity (i.e., General Physics I).			
Mathematics Course Credits	10	Mathematics Course Credits	8
Mathematics: One-course similarity (i.e., Algebra and Trigonometry).			

English Course Credits	**6**	**English Course Credits**	**15**
English: Two-course similarity (i.e., English I, English II).			
Social Science Course Credits	**6**	**Social Science Course Credits**	**3**
Social Science: No course similarities.			
Humanities Course Credits	**6**	**Humanities Course Credits**	**3**
Humanities: No course similarities.			
Tech and Engineering Ed Course Credits	**0**	**Tech and Engineering Ed Course Credits**	**1**
Tech and Engineering Ed: No course similarities. Only UMES has this course.			
Total Degree Credits	**121**	**Total Degree Credits**	**126**

An analysis of the Capitol Technology University's **B.S. in Construction IT and Cybersecurity** and UMES' B.S in Construction Management degrees, shows the two programs are very different in the core curriculum. Table 1 shows the similarity by course. Table 2 examines the similarity by course credits. Table 1 and Table 2 show that the Capitol Technology University degree is focused on the construction IT and cybersecurity areas; it is primarily a computer science/cybersecurity-focused degree. Table 1 and Table 2 show how the UMES degree is primarily a construction management degree with a strong focus on business.

In the core curriculum area, the Capitol Technology University and UMES degrees share only a 14.8% - 13.9% similarity of credits – only 4 core curriculum courses out of 27 Capitol Tech and 29 UMES total courses. In the Code of Maryland Regulations (COMAR) mandated area of GENERAL EDUCATION, the Capitol Technology University and UMES degrees share 40.0-41.5% similarity of credits. There are 4 General Education courses out of 12 Capitol Tech and 13 UMES total courses that are similar in subject matter (even if different in the number of credits). COMAR mandates specific GENERAL EDUCATION subjects (e.g. English, Science, etc.); so, many similarities are expected since all universities are required to offer courses in those subject areas.

The analysis shows Capitol Technology University's proposed B.S. in Construction IT and Cybersecurity degree program is different; the proposed B.S. degree program is solely focused on the area of Construction IT and Cybersecurity.

2. **Provide justification for the proposed program.**

The proposed **B.S. in Construction IT and Cybersecurity** program is strongly aligned with the University's strategic priorities and is supported by adequate resources. The proposed **B.S. in Construction IT and Cybersecurity** degree will strengthen and expand upon existing technology, management, and applied engineering degree programs at the University. In addition, the **B.S. in Construction IT and Cybersecurity** program will be an option for all students as the field integrates well with the market needs of the University's other technical programs. There is a thorough discussion of the need for the program in Sections B and C of this document.

E. Relevance to high-demand programs at Historically Black Institutions (HBIs):

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

The University does not anticipate any impact on the implementation or maintenance of high-demand programs at HBIs. There are no **B.S. in Construction IT and Cybersecurity** programs in the State of Maryland. Morgan State University (MSU) has a B.S. in Construction Management focused on construction management. MSU has a B.S. in Information Systems focused on the broader area of the design and development of automated systems that are used in enterprises. MSU also has a non-degree program that provides training for Security+ certifications – an element of cybersecurity. However, MSU does not offer a B.S. in Construction IT and Cybersecurity. The University of Maryland Eastern Shore (UMES) has a B.S. in Construction Management Technology focused on the much broader field of the design, construction, and maintenance of residential and commercial structures. However, UMES does not offer a B.S. in Construction IT and Cybersecurity. **The analysis in Section D.1 shows Capitol Technology University's proposed B.S. in Construction IT and Cybersecurity degree program is different; the proposed B.S. degree program is solely focused on the area of Construction IT and Cybersecurity.**

F. Relevance to the identity of Historically Black Institutions (HBIs):

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

The University does not anticipate any impact on the uniqueness and institutional identities and missions of HBIs. There are no **B.S. in Construction IT and Cybersecurity** programs in the State of Maryland. Morgan State University (MSU) has a B.S. in Construction Management focused on construction management. MSU has a B.S. in Information Systems focused on the broader area of the design and development of automated systems that are used in enterprises. MSU also has a non-degree program that provides training for Security+ certifications – an element of cybersecurity. However, MSU does not offer a B.S. in Construction IT and Cybersecurity. The University of Maryland Eastern Shore (UMES) has a B.S. in Construction Management Technology focused on the much broader field of the design, construction, and maintenance of residential and commercial structures. However, UMES does not offer a B.S. in Construction IT and Cybersecurity. **The analysis in Section D.1 shows Capitol Technology University's proposed B.S. in Construction IT and Cybersecurity degree program is different; the proposed B.S. degree program is solely focused on the area of Construction IT**

and Cybersecurity.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes (as outlined in COMAR 13B.02.03.10):

1. Describe how the proposed program was established, and also describe the faculty who will oversee the program.

The University's New Programs Group established the proposed program through a rigorous review of unmet needs. The group includes selected representation from the University's faculty, administrators, and Executive Council. The program will be overseen by a diverse faculty with backgrounds in computer science, computer programming, cybersecurity, critical infrastructure, and construction. Please see Section I for a detailed list of the faculty's backgrounds and qualifications.

2. Describe educational objectives and learning outcomes appropriate to the rigor, breadth, and (modality) of the program.

Educational Objectives:

a. Students will be prepared to critically analyze problems and to identify relevant and useful information to support the attainment of desired outcomes.
b. Students will be able to think critically by drawing appropriate conclusions from examining the output of the application of cybersecurity tools and related IT.
c. Students will be able to conceptualize, apply and integrate effective strategies to acquire, store, analyze, deploy and secure information effectively.
d. Students will be able to evaluate and employ cybersecurity tactics, techniques, and procedures in the context of the construction industry IT, computer security, and privacy regulations.

Learning Outcomes:

Upon graduation:

a. Graduates will be prepared for employment in the field of construction IT and cybersecurity with a strong proficiency in cybersecurity, computer programming, computer science, and team management skills.
b. Graduates will understand the laws, regulations, and customary expectations as they relate to information system and network security, individually identifiable information and related privacy concerns.
c. Graduates will demonstrate computer security operations and administration, a working knowledge of infrastructure and operational security, access controls, security analysis and monitoring.
d. Graduates will demonstrate the principles of risk, response and recovery.
e. Graduates will be able to conceptualize, apply, and integrate effective strategies to acquire, store, analyze and deploy information effectively and securely using IT appropriate to the construction industry.

3. Explain how the institution will:

a) Provide for assessment of student achievement of learning outcomes in the program

Capitol Technology University will assess student achievement of the learning outcomes per the regulations specified by the University's regional accreditation organization: the Middle States Commission on Higher Education (MSCHE).

Under MSCHE, the University will use Standard V, Educational Effectiveness Assessment, of the Standards for Accreditation and Requirements of Affiliation. Standard V requires:

> Assessment of student learning and achievement demonstrates that the institution's students have accomplished educational goals with their program of study, degree level, the institution's mission, and appropriate expectations for institutions of higher education.
>
> (Source: https://www.msche.org/standards/, retrieved 7/22/2019)

Per the MSCHE's accreditation requirements, Capitol Technology University will measure Standard V by using the following criteria:

> An accredited institution possesses and demonstrates the following attributes or activities:
>
> 1. clearly stated educational goals at the institution and degree/program levels, which are interrelated with one another, with relevant educational experiences, and with the institution's mission;
>
> 2. organized and systematic assessments, conducted by faculty and/or appropriate professionals, evaluating the extent of student achievement of institutional and degree/program goals. Institutions should:
>
> > a. define meaningful curricular goals with defensible standards for evaluating whether students are achieving those goals;
> >
> > b. articulate how they prepare students in a manner consistent with their mission for successful careers, meaningful lives, and, where appropriate, further education. They should collect and provide data on the extent to which they are meeting these goals;
> > c. support and sustain assessment of student achievement and communicate the results of this assessment to stakeholders;
>
> 3. consideration and use of assessment results for the improvement of educational effectiveness. Consistent with the institution's mission, such uses include some combination of the following:
>
> > a. assisting students in improving their learning;
> > b. improving pedagogy and curriculum;
> > c. reviewing and revising academic programs and support services;
> > d. planning, conducting, and supporting a range of professional development activities;
> > e. planning and budgeting for the provision of academic programs and services;
> > f. informing appropriate constituents about the institution and its programs;

g. improving key indicators of student success, such as retention, graduation, transfer, and placement rates;
h. implementing other processes and procedures designed to improve educational programs and services;

4. if applicable, adequate and appropriate institutional review and approval of assessment services designed, delivered, or assessed by third-party providers; and

5. periodic assessment of the effectiveness of assessment processes utilized by the institution for the improvement of educational effectiveness.

(Source: http://www.msche.org/wp-content/uploads/2018/06/RevisedStandardsFINAL.pdf)

4. Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements.

Program description, as it will appear in the catalog:

The **Bachelor of Science (B.S.) in Construction Information Technology (IT) and Cybersecurity** program is designed to meet the growing needs of today's construction industry where construction IT and Cybersecurity are now major considerations. The **B.S. in Construction IT and Cybersecurity** provides a first-rate education where the latest construction IT and Cybersecurity capabilities are reviewed and analyzed with a laser focus. Throughout the program, the latest technological developments, applications, and considerations in the construction industry are explored and applied to real-life industry challenges. Students will learn optimum methods and techniques to define resources, risks, and threats in order to maintain the protection, safety, and profitability of construction sites. The **B.S. degree in Construction IT and Cybersecurity** will prepare students for entry-level IT and Cybersecurity positions throughout the construction industry and related businesses.

Description of program requirements:

Entrance Requirements

To be fully accepted into the program, students must be accepted to the University.

Degree Requirements:

The following is a list of courses for the **B.S. in Construction IT and Cybersecurity** degree. Students expecting to complete this degree must meet all prerequisites for the courses listed below.

Bachelor of Science in Construction Information Technology and Cybersecurity
Courses
Total Credits: 121

COMPUTER SCIENCE CORE COURSES: 12 CREDITS

CS-200 Programming in C++ (3 Credit)
Students learn how to program in C++ using an object-oriented approach. Design of classes and objects. Inheritance and polymorphism: Use of pointers and data structured based projects. Prerequisite CS-130 or CS-150. (2-2-3)

CS–220 Database Management (3 Credit)
An overview of database systems, with an emphasis on relational databases. Terminology, basic analysis and design using Entity-Relationship diagrams and relational schemas. Database implementation, queries, and updates in a modern relational database management system. An overview of database administration, transactions, and concurrency. Data warehouses. Projects, which are assigned as homework, are implemented in Oracle. Prerequisite: CS-130 or CS-150. You may take this course and CS-130 concurrently. (3-0-3)

CS–230 Data Structures (3 Credit)
Advance pointers and dynamic memory usage. Concepts of object-oriented design and programming. Includes classes, friend functions, templates, operator overloading, polymorphism, inheritance, exception handling, containers, iterators, and the standard template library. Applications involve the use of simple data structures such as stacks, queues, linked lists, and binary trees. Recursion, searching and sorting algorithms. The above concepts are implemented through a series of hands-on programming projects, all of which are completed as part of the homework requirements. Prerequisite: CS-225 or CS-200. Corequisite: MA-124. (3-0-3)

CS–310 Computer Algorithms (3 Credit)
Mathematical fundamentals of algorithms and algorithmic techniques. Running Time Analysis of an algorithm. Searching, Sorting, and other techniques associated with retrieving information. Advanced Data structures such as Binary Search Trees and Heaps. Graph algorithms. Dynamic Programming (Knapsack, Floyd, DNA Algorithms, ..). Greedy algorithms (Coins, Scheduling, Huffman encoding, etc.) The course requires written programming assignments. Prerequisites: CS-130 and MA-124. Offered spring semester only. (3-0-3)

COMPUTER PROGRAMMING CORE COURSES: 15 CREDITS

CT-102 Introduction to Internet Applications (3 Credits)
Introduces students to dynamic HTML Web pages, designed using tables, style sheets, cascading style sheets (CSS), images, and dynamic images, with emphasis on page layout, navigation bars, and forms. Scripting languages are used to enhance Web page features. Graphic, video, and audio file standards, such as GIF, TIF, JPEG, WAV, and MIDI are discussed. SGML and XML are defined, and the role of XML in enabling the communication of data between disparate applications is discussed. Students are required to complete assignments as part of the homework requirements. (3-0-3)

CT-152 Introduction to UNIX (3 Credits)
Unix file and operating system. Understanding multi-user and multitasking concepts. Editors, X-windows, Awk, email, Internet commands, shell commands, and shell scripts. Projects, which provide practical experience, are completed as part of the homework requirements. Prerequisite: CS-100 or placement test score. (3-0-3)

CT-206 Scripting Languages (3 Credits)

Introduces students to the use of scripting and the scripting languages of Perl and Python. The class will cover the use of scripting to solve short problems, automate routine tasks, integrate across pieces of software, and prototype code ideas. The merits of code-complete design versus on-the-fly coding as well as coding and code documentation styles will be discussed. Tasks involving input/out, regular expressions, and file operations are included. Students are expected to fully script solutions for real-world tasks assigned as part of the course. Prerequisites: CS-130 or CS-150. (3-0-3)

CT-376 Javascript (3 Credits)
This course introduces the student to client-side web programming. Students learn javascript. Topics include programming fundamentals using javascript, functions, event handlers, how to create and use javascript libraries. Labs include how to use the prototype and scriptaculous libraries for visual effects. Use of google maps from a programmer's perspective. Debugging of javascript code. Other topics include CSS style sheets, XML, JSON, and AJAX. Programming projects are assigned as part of the homework requirements. Prerequisites: CS-130. (2-2-3)

CT-406 Web Programming Languages (3 Credits)
This course will explore how to make a dynamic website using Enterprise Java frameworks, which may include: Java Servlets, Java Server Pages, Java Server Faces, Web Services, Java Persistence API, among others. Students will use the Model-View-Controller design pattern to produce N-tier applications. These applications will be built on top of a modern Web Server and Relational Database Management System. Prerequisites: CS-220 and CS-225 or CS-200 or CS-230. (3-0-3)

CYBERSECURITY CORE COURSES: 18 CREDITS

NT–150 Intro to Computer Networking (3 Credits)
This course is a continuation of NT-100 with major emphasis on local network equipment, network software and addressing schemes. Students build, configure, test and troubleshoot a network in the laboratory. Routers and switches are included. This material can be used as a basis for studying for CISCO's ICND1. (1-4-3)

IAE–201 Introduction to IA Concepts (3 Credits)
This course covers topics related to the administration of network security. Topics include a survey of encryption and authentication algorithms; threats to security; operating system security; IP security; user authentication schemes; web security; email security protocols; intrusion detections; viruses; firewalls; Virtual Private Networks; network management and security policies and procedures. Laboratory projects are assigned as part of the homework requirements. This course prepares students for the (ISC)2 Systems Security Certified Practitioner (SSCP) Certification. Prerequisites: MA-110 or MA-112 or MA-114 or MA-261. (3-0-3)

IAE–250 Comprehensive Computer/Network Security (3 Credits)
Building on IAE-201, this course provides learners with detailed and hands-on knowledge of computer and network security. The course emphasizes current topics such as network security, compliance, and operational security, threats and vulnerabilities, application security, access control, as well as cryptography. Additionally, underlying theory and concepts are presented in order to extend learners' understanding of computer and network security. Weekly laboratory exercises are utilized to reinforce practical, real-world security techniques. Classes are a mixture

of lectures, current event discussions, and laboratory exercise reviews and will prepare learners for the CompTIA Security+ certification. Pre-requisite: IAE-201 (3-0-3) *FORMERLY IAE-301

IAE–260 Secure Systems Administration and Operation (3 Credits)
This course is an overview of securing the UNIX operating system. The content will include a basic introduction of shell programming, process management, and processor management, storage management, scheduling algorithms, resource protection, and system programming. The course will include programming projects focused on Information Assurance problem solving utilizing the C programming language primarily. Students are expected to be familiar with virtual machines, the UNIX command-line interface (CLI) and a basic programming language. Prerequisites: IAE-201, CS-150, and CT-152. FORMERLY IAE-315 (3-0-3)

IAE–325 Secure Data Communications and Cryptography (3 Credits)
This course follows the protocol education provided in IAE-250 with a more detailed and practical look at secure transactions and correspondence, as well as protection of data in storage. Within the confines of the ISO-OSI model, this course discusses data communication with an emphasis on the security available at the layers, secure sockets layer, and both wired and wireless security topics. One-way message digests/hashes and encryption history and protocols are explored in-depth. Topics include virtual private networks, one-way hashes/message digests, digital signatures, secret-key, and public-key cryptography processes and algorithms. Prerequisite: IAE-250 and CT-152 (3-0-3)

IAE–402 Introduction to Incident Handling/Malicious Code (3 Credits)
This course provides a detailed understanding of incidents from attacks of malicious software. This course addresses the history and practice of coding that occurs in viruses, worms, spyware, Trojan horses, remote management back doors and root kits. Students learn preventative measures and tools and explore how to rid systems of malicious software and prevent re-infection. Recovery processes and backup methods are explored. In addition to covering basic incident handling preparation, response and recovery practices, and the course goes into detail regarding malicious software. Prerequisite: IAE-260 (3-0-3)

CONSTRUCTION SOFTWARE CORE COURSES: 15 CREDITS

CIT-200 Construction IT and Cybersecurity Issues (3 Credits)
An overview of issues in construction information technology departments effecting both the home office and field office locations and cybersecurity issues effecting construction companies. Prerequisite: CM-120 and IAE-201 (3-0-3)

CIT-220 BIM and Graphic Software (3 Credits)
Building Information Modeling (BIM) is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct and manage buildings and infrastructure. An introduction to construction graphics, sketching, 3D CADD systems. Prerequisite: CM-125 (3-0-3)

CIT-240 Estimating Software (3 Credits)
Construction cost estimating software is computer software designed for contractors to estimate construction costs for a specific project. A cost estimator will typically use estimating software to estimate their bid price for a project, which will ultimately become part of a resulting construction contract. Prerequisite: CM-220 (3-0-3)

CIT-260 Scheduling Software (3 Credits)
Scheduling in project management is the listing of activities, deliverables, and milestones within a project. A schedule also usually includes the planned start and finish date, duration, and resources assigned to each activity. Effective project scheduling is a critical component of successful time management. Prerequisite: CM-220 (3-0-3)

CIT-280 Construction Project Management Software (3 Credits)
Construction project management software is a tool used by professionals to simplify construction management processes. It is used to streamline day to day tasks to improve the delivery of projects, which ultimately impacts the bottom line of construction companies. Prerequisite: CM-250 (3-0-3)

CRITIAL INFRASTRUCTURE CORE COURSES: 9 CREDITS

CRI-210 Critical Infrastructure I (3 Credits)
This course will introduce participants to the key terms, policy, guidance, and preparedness efforts required to safeguard the Nation's critical infrastructure. Students will learn relevant policy and guidance, discuss the risk management framework, describe Federal critical infrastructure security and resilience and information sharing programs, and relate critical infrastructure programs to individual actions. The primary focus will be on incorporating Critical Infrastructure protection into the construction of facilities in six of the sixteen critical infrastructure sectors: chemical facilities, commercial (e.g., retail, entertainment, lodging), communications facilities, critical manufacturing facilities, dams, and energy facilities. Students will complete hands-on Critical Infrastructure projects related to the construction of those types of facilities. Prerequisite: None. (3-0-3)

CRI-310 Critical Infrastructure II (3 Credits)
The national and economic security of the United States depends on the reliable functioning of critical infrastructure. This course examines collaboration efforts among the entities responsible for constructing physical and cybersecurity protection as well as the development of integrated risk management strategies for our Nation's critical infrastructure. The primary focus will be on incorporating Critical Infrastructure protection into construction and renovation of facilities in five of the sixteen critical infrastructure sectors: Defense industrial facilities, emergency services facilities, financial services facilities, government facilities, and public healthcare facilities. Students will complete hands-on Critical Infrastructure projects related to the construction and renovation of those types of facilities. Prerequisite: CRI-210. (3-0-3)

CRI-410 Critical Infrastructure III (3 Credits)
This course will explore how threats, vulnerabilities, and consequences determine risk as it relates to the protection of Critical Infrastructure. The primary focus will be on incorporating Critical Infrastructure protection into the construction of facilities in five of the sixteen critical infrastructure sectors: food and agriculture facilities, Information Technology facilities, nuclear facilities, transportation facilities, and water/wastewater facilities. Students will complete hands-on Critical Infrastructure projects related to the construction, hardening, and recovery of those types of facilities. Prerequisite: CRI-310. (3-0-3)

CONSTRUCTION CORE COURSES: 12 CREDITS

CM-120 Intro to Construction Management (3 Credits)
This course will introduce the basic history and management concepts of the construction industry to students with the expectation that upon completion students will have an overview of the industry. Career choices, industry firms, and key players in the Construction Management process will be explored. Prerequisite: None. (3-0-3)

CM-125 Construction Graphics and Plan Reading (3 Credits)
This is an introductory course designed to prepare students to identify, read and interpret construction drawings. The course will be delivered from an applied perspective with an emphasis on understanding the processes involved in construction and interpreting them from drawings. Prerequisite: CM-120. (3-0-3)

CM-220 Construction Methods and Materials (3 Credits)
This course focuses on vertical construction, emphasizing comprehensive analysis of materials, design and specifications, installation methods, testing and inspection, and appropriate construction methodology for application. Prerequisite: CM-120 and MA-114 (3-0-3)

CM-250 Legal Issues in Construction (3 Credits)
The course is an overview of standard construction contracts traditionally used between contractors, owners, design professionals and subcontractors from a general contractor's point of view. Prerequisites: EN-102 and CM-220. (3-0-3)

GENERAL EDUCATION COURSES: 40 CREDITS

COMPUTER SCIENCE COURSES: 6 CREDITS

CS–130 Intro to Programming Using Java (3 Credit)
Introduces students to the discipline, methodologies, and techniques of software development. The emphasis is on developing essential programming skills, an understanding of object-oriented design and good software engineering practices using the Java programming language. Program constructs include selection, looping, arrays, graphical output of data, the use of the standard Java class library, and construction of simple user-defined classes. Programming projects are assigned as part of the homework requirements. Prerequisite: MA-110. MA-112 or MA-114. (3-2-3)

CS–150 Intro to Programming Using C (3 Credit)
This introductory course in programming will enable students to understand how computers translate basic human instructions into machine-executable applications. The language of choice for this course is C. The C syntax that will be covered includes functions; variables and memory allocations including pointer notation; conditional statements and looping. Students will also learn binary to hexadecimal and decimal conversions along with basic computer architecture. Memory management, data input-output, and file manipulations will be among some other topics discussed and applied during this course. Prerequisite: MA-111 or MA-112 and CS-100 or placement test score. (3-2-3)

PHYSICAL SCIENCE COURSES: 6 CREDITS

CH-120 Chemistry (3 Credits)

Metric system and significant figures; stoichiometry; fundamental concepts of atomic structure and its relationship to the periodic table; electron configuration; bonds and electronegativity; gases; oxidation states and redox; solutions, acids and bases, changes of state, thermodynamics, chemical kinetics, and equilibrium. Prerequisites: MA-114 (2-2-3)

PH-201 General Physics I (3 Credits)
Non-calculus physics. The course will cover mechanics (units), conversion factors (vector diagrams), translational equilibrium (uniformly accelerated motion), projectiles (Newton's Law), work energy and power (kinetics and potential energy), conservation of energy (impulse and momentum), heat (temperature scales), thermal properties of matter, heat and temperature change, heat and change of phase, and the physics of heat transfer (applications). Prerequisite: MA-114. (2-2-3)

MATHEMATICS COURSES: 10 CREDITS

MA-112 Intermediate Algebra (3 Credits)
Designed for students needing mathematical skills and concepts for MA-114 and MA-216. In this course, students are introduced to equations and inequalities and learn the language of algebra and related functions, including polynomial, rational, exponential and logarithmic functions. Other topics include solving equations, inequalities, and systems of linear equations; performing operations with real numbers, complex numbers, and functions; constructing and analyzing graphs of functions and using mathematical modeling to solve application problems. Prerequisite: MA-005 or placement test score. (3-0-3)

MA-114 Algebra & Trigonometry (4 Credits)
Prerequisite: MA-112 or placement test score: Designed for students needing mathematical skills and concepts for MA-216; topics in this course are as follows. Algebra: basic operations on real and complex numbers, fractions, exponents, and radicals. Determinates. The solution of linear, fractional, quadratic and system equations. Trigonometry: definition and identities, angular measurements, solving triangles, vectors, graphs, and logarithms. Prerequisite: MA-112 or acceptable based on the placement test score. (4-0-4)

MA-124 Discrete Mathematics (3 Credits)
Logic sets and sequences; algorithms, divisibility, and matrices; proof, induction and recursion; counting methods and probability; relations, closure and equivalence relations, graphs and trees; Boolean algebra. Prerequisite: MA-112, MA-114 or placement test score. (3-0-3)

ENGLISH COMPOSITION AND COMMUNICATIONS COURSES: 6 CREDITS

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 2 essays and 2 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. Prerequisites: acceptance based on placement test scores (3-0-3)

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. The course includes group work. Presentations are required. Prerequisite: EN-101 (3-0-3)

SOCIAL SCIENCES COURSES: 6 CREDITS

SS-351 Ethics (3 Credits)
Prerequisite: EN-102: 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 for this course. Prerequisite: None. (3-0-3)

Social Science Elective (3 Credits)

ARTS AND HUMANITIES: 6 CREDITS

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 a 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: EN-102. (3-0-3)

Humanities Elective (3 Credits)

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

   The general education requirements will meet or exceed the specifications in The Code of Maryland Regulations (COMAR). Please see Section G.4 to review the general education requirements for the proposed degree.

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

   The University is accredited regionally by the Middle States Commission in Higher Education (MSCHE) and through four specialized accrediting organizations: International Accreditation Council of Business Education (IACBE), Accreditation Board for Engineering and Technology (ABET), NSA, and DHS. All five accrediting organizations have reviewed the University's distance education program as part of their accreditation process. Capitol Technology University is fully accredited by MSCHE, IACBE, ABET, NSA, and DHS. The University is in good standing with all its accrediting bodies. This program is designed to meet the requirements of the MSCHE.

7. **If contracting with another institution or non-collegiate organization, provide a copy of the written contract.**

The University will not be contracting with another institution or non-collegiate organization.

8. **Provide assurance and any appropriate evidence that the proposed program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.**

   The **B.S. in Construction IT and Cybersecurity** program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, Learning Management System, availability of academic support services and financial aid resources, and costs and payment policies.

   Curriculum, course and degree information will be available on the university website and via e-mail as well as regular mail (by request). The expectations for faculty/student interaction are available to students during virtual open house events, literature, website, etc. In addition, this information is part of the material distributed for each course. Students receive guidance on proper behavior/interaction with their Department Chair and faculty members both in-person and online to facilitate a high-level experience. Technology competence and skills and technical equipment requirements are part of the material distributed for each course. The technical equipment requirements are also listed on our website and provided to students in the welcome package.

   The University's academic support services, financial aid resources, costs and payment policies, and Learning Management System are covered in the University Open Houses, the application process, the Welcome Aboard process, Orientation, Student Town Halls, and individual counseling.

9. **Provide assurance and any appropriate evidence that advertising, recruiting, and admissions materials will clearly and accurately represent the proposed program and the services available.**

   The **B.S. in Construction IT and Cybersecurity** program's advertising, recruiting, and admissions materials will clearly and accurately represent the proposed program and the services available. The material for every new program is derived from the new program request sent to the Maryland Higher Education Commission.

H. Adequacy of Articulation:

1. **If applicable, discuss how the program supports articulation with programs at partner institutions. Provide all relevant articulation agreements.**

   This program does not currently have articulation partners. However, the articulation process will work as it does for the University's current degrees. The University is very active with its transfer partners throughout the state and beyond. The goal of the University is to work with partners to make the transfer as seamless as possible and to maximize the student's transfer credits as possible. There are University

transfer admissions personnel to guide the student through the process.

I. Adequacy of Faculty Resources (as outlined in COMAR 13B.02.03.11):

1. **Provide a brief narrative demonstrating the quality of the program faculty. Include a summary list of the faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, or adjunct) and the course(s) each faculty member will teach.**

   Almost all of the core curriculum faculty listed below have been engaged with the University for several years or more. Dr. Bajracharya, Dr. Bajwa, Dr. Baker, Prof. Gary Burke, Dr. Butler, Prof. Rick Hanson, Dr. Hosseini, and Dr. Steele are full-time faculty members. Ten of the twelve faculty members hold terminal degrees. Dr. Butler is the Department Head of the Cybersecurity Department. Dr. Steele is the Department Head of the Computer Science Department. The University leadership is confident in the quality of the faculty and their abilities to provide a learning environment supportive of the University goals for student success.

Instructors who will be engaged with the **B.S. in Construction IT and Cybersecurity** core curriculum are:

INSTRUCTOR	BACKGROUND	COURSES ALIGNED TO BE TAUGHT
Dr. Chandra Bajracharya Full time	Ph.D. Electrical and Computer Engineering M.S. Applied Computing M.S. Electrical Power Engineering B.E. Electrical Engineering	All CS courses
Dr. Garima Bajwa Full time	Ph.D. Computer Science and Engineering M.S. Electrical and Computer Engineering B.S. Electronics and Communication Engineering	All CS courses
Dr. Richard Baker Full time	Ph.D. Information Systems M.S. Computer Science B.S. Mathematics F-4 Pilot	All CM courses
Dr. William Butler Full time	D.Sc. Cyber Security M.S. Strategic Studies B.S. Computer Science NSTISSI No. 4011 CNSSI No. 4012 NSTISSI No. 4015 CNSSI No. 4016	All IAE and CS courses
Dr. Jami Carroll Adjunct	D.Sc. Cyber Security M.S. Cyber Security M.B.A.	All IAE Courses

Prof. Gary Burke Full time	MBA B.S. Building Science	All CM courses
Prof. Rick Hanson Full time	M.S. Computer Science B.S. Electrical Engineering	All IAE and CS courses
Dr. Soheil Sadat Hosseini Full time	Ph.D. Engineering, Electrical Engineering & Computer Science M.Sc. Electrical Engineering B.S. Electrical Engineering	All CS courses
Dr. Raymond Letteer Adjunct	D.Sc. Cyber Security M.S. Information Assurance	All IAE courses
Dr. Mark Moss Adjunct	PhD Computer Science M.S. Computer Science B.S. Mathematics	All CS courses
Dr. Bradford Sims Full time	Ph.D. Curriculum Instruction Design M.S. Building Construction Management B.S. Building Construction Technology	All CM courses
Dr. Robert Steele Full time	Ph.D. Computer Science BSc (Honors) Computer Science BSc Math and Computer Science	All CS, CT, and NT courses

1. Dr. William Butler, Chair, Cyber and Information Security, Director, Critical Infrastructures and Cyber Protection Center (CICPC). Dr. Butler is currently Director, Critical Infrastructures and Cyber Protection Center (CICPC) at Capitol Technology University. Prior to this appointment in 2013, Dr. Butler worked in the networking and IT industries as a network engineer and consultant for over 20 years. Dr. Butler also served as a joint qualified communications information systems officer in the U.S. Marine Corps and retired as a Colonel with 30 years of service (active and reserve). Dr. Butler holds a Doctorate in cybersecurity earned from Capitol Technology University focusing on preserving cellphone privacy and countering illegal cell towers (IMSI catchers).

2. Prof. Rick Hanson has been President for APS GLOBAL LLC leading projects and programs to address cybersecurity & technology challenges. He has worked with large organizations and startups who require creative thinking and innovation to meet challenges. His accomplishments include: Cybersecurity consulting for vulnerability assessment, cybersecurity architecture, and key management for new and upgraded DoD IoT systems and communications & control (C2) networks and has managed and served as technical lead for $29M in contracts for DOD Technology Modernization for medical operations and research. Tasks included Technology Evaluation and Development, Cybersecurity & Information Assurance, research, and program management. Prof. Hanson also served as Clinical Program Manager and Information Security Lead (Cyber/IA) for technology development for Air Force and the National Institutes of Health contracts.

3. Prof. Gary Burke has forty years of experience either working in the construction industry or teaching construction and construction safety courses. He is a certified OSHA authorized construction trainer and managed his own residential construction company as a licensed general contractor for fourteen years where job site safety was part of his daily responsibility. He is a full-time Associate Professor with Capitol Technology University with program oversight.

4. Dr. Sims has extensive experience in construction science and the construction industry. He worked for ten years for multiple construction companies before moving into academia. He founded an online construction education company. He served as the faculty founder and Department Chair for the Construction Management program at Western Carolina University. He was the Assistant Secretary General of the International Council for Research and Innovation in Building and Construction. During his career, he has also served as a professor of construction management at the University of Florida and a visiting professor of building construction management at Purdue University.

5. Dr. Baker has significant senior management experience in the construction industry. D. Baker served for six years as a Senior Director for Information Technology at Turner Construction Company – one of the largest construction companies in the United States and a wholly-owned subsidiary of HOCHTIEF AG, Germany. HOCHTIEF AG, Germany is of the five largest construction companies in the world. Dr. Baker was responsible for strategy development, risk management, major benchmarking, and data mining at Turner Construction Company. During his distinguished follow-on career in academia, he has also served as the instructor for eight construction courses at Indiana State University.

2. Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidence-based best practices, including training in:

a) Pedagogy that meets the needs of the students

The primary pedagogy for faculty at Capitol Technology University is the Active Learning model. The university believes strongly in a highly-interactive, thinking, and hands-on experience for students in each class to the maximum extent possible.

> It was two Missouri State professors, historian Charles Bonwell and psychologist James Eison, who coined the term "active learning." In their 1991 book on the subject, Active Learning: Creating Excitement in the Classroom, they offered this definition of the concept: "active learning involves students in doing things and thinking about the things they are doing."
>
> The definition, though it seems circuitous, marks a definitive pedagogical shift in college teaching and learning. Rather than think about what they are watching, hearing, or reading, students are first encouraged to be "doing" something in class, and then to apply critical thought and reflection to their own classroom work and activity. Their argument was backed up by research. Even Bligh, 20 years earlier, had pointed out that the immediate rehearsal of new information and knowledge had a significant impact on learning.

> This approach is as helpful in the sciences as it is in the arts or humanities: whether it's organic chemistry, creative writing, or behavioral economics, concepts are all best understood through repeated practice and open, social exploration. The central tenet of active learning is that practice matters, and that classroom time is better spent giving students opportunities to work with concepts over and over, in a variety of ways and with opportunities.
>
> The central tenet of active learning — that practice and interaction matters— can be applied across disciplines for immediate feedback, so that knowledge can take hold in their own minds.
>
> (Source: Preville, P. Active Learning: The Perfect Pedagogy for the Digital Classroom: An Essential Guide for the Modern Professor)

All faculty receive regular periodic and recurring pedagogical training during the academic year. Those training sessions occur in a hybrid format – simultaneously live online and live on-ground in the classroom. The sessions are designed to reach all faculty, both fulltime and adjunct, in order to ensure everyone receives the training. Additionally, the sessions are recorded for those faculty who are unable to attend the live training session due to other professional and teaching commitments.

b) The Learning Management System

The University's Department of Online Learning and Information Technology Division supports the online program needs of faculty and students. The Department of Online Learning and the IT Help Desk provide 24-hour support to the faculty. Canvas is the University's online Learning Management System. When a new faculty member is assigned to teach an online course, the Department of Online Learning provides formal training for the instructor. New faculty are assigned an experienced faculty mentor to ensure a smooth transition to the online environment as well as to ensure compliance with the institution's online teaching pedagogy. The University believes this provides the highest-level learning experience for the faculty member and, in turn, students attending online classes.

c) Evidenced-based best practices for distance education, if distance education is offered.

Faculty at Capitol Technology University receive training in Keller's ARCS Motivational Model and his associated strategies for distance education/online learning.

> A model used in the online delivery of teaching and learning to increase learner motivation is Keller's ARCS motivational model. This model has been considered an important element in online education because of its implications on increased learner motivation and learning outcomes. The Keller's model consists of motivating students by maintaining and eliciting attention (A), such as virtual clinical simulations; making the content and format relevant (R), by modeling enthusiasm or relating content to future use; facilitating student confidence (C), by providing "just the right challenge"; and promoting learner satisfaction (S), by providing reinforcement and praise when appropriate. Examples of Keller's model include increasing motivation including the arousal of curiosity of students, making the connection between learning objectives and future learning goals, autonomous thinking and learning, and fostering student satisfaction.

Keller's ARCS model has been researched by various educational online programs to analyze student motivation and learning outcomes. Keller's model serves as an example and guide for instructors to motivate and increase online engagement with their students as wells as research purposes.

A qualitative study by Chan Lin investigated online student learning and motivation. Discussion boards, student projects, and reflection data were collected and analyzed from a 12-week web-based course. Respondents indicated the importance of online feedback from the instructor and peer modeling of course tasks to visualize learning progress. The study revealed using Keller's ARCS strategies fosters greater student online engagement by fostering self-efficacy and a sense of accomplishment.

In a mixed-method study, assessing the use of Keller's ARCS on instructional design, the use of educational scaffolding fostered positive levels of student motivation. Relevancy, attention, confidence, and satisfaction were all common factors associated with student success in the course and course completion.

(Source: Pinchevsky-Font T, Dunbar S. Best Practices for Online Teaching and Learning in Health Care Related Programs. The Internet Journal of Allied Health Sciences and Practice. January 2015. Volume 13 Number 1.)

All faculty receive regular periodic and recurring training on evidence-based practices for distance education/online learning during the academic year. Those training sessions occur in multiple formats: asynchronous, synchronous (i.e., live online), hybrid (i.e., simultaneously live online and live on-ground), and on-ground in the classroom. The sessions are designed to reach all faculty, both fulltime and adjunct, to ensure all members receive the training. Additionally, the live sessions are recorded for those faculty who are unable to attend the live training session due to other professional commitments or who are teaching classes at the training delivery time.

J. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12):

1. **Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed program. If the program is to be implemented within existing institutional resources, include a supportive statement by the President for library resources to meet the program's needs.**

Library Services: The Puente Library offers extensive services and a wide collection for Capitol Technology University students to be academically successful. Library resources are available digitally. The library also provides a mailing service for materials borrowed through the Maryland system. The library is currently supporting the following degrees at the undergraduate level: B.S. in Astronautical Engineering, B.S. in Business Analytics and Data Science, B.S. in Computer Engineering, B.S. in Computer Engineering Technology, B.S. in Computer Science, B.S. in Construction Management and Critical Infrastructure, B.S. in Construction Safety, B.S. in Cyber Analytics, B.S. in Cybersecurity, B.S. in Electrical Engineering, B.S. in Electrical Engineering Technology, B.S. in Engineering Technology, B.S. in Facilities Management and Critical Infrastructure, B.S. in Information Technology, B.S in Management of Cyber and Information Technology, B.S. in Mechatronics Engineering, B.S. in Mechatronics and Robotics Engineering Technology, B.S. in Software Engineering, and B.S. in Technology and Business Management, and B.S in Unmanned and Autonomous Systems. The library is currently

supporting the following degrees at the graduate level: M.S. in Aviation, M.S. in Aviation Cybersecurity, M.S. in Computer Science, M.S. in Critical Infrastructure, M.S. in Cyber Analytics, M.S. in Cybersecurity, M.S. in Engineering Technology, M.S. in Information Systems Management, M.S. in Internet Engineering, M.S. in Unmanned and Autonomous Systems Policy and Risk Management, M.B.A., T.M.B.A. Business Analytics and Data Science, T.M.B.A. in Cybersecurity, D.Sc. in Cybersecurity, Ph.D. in Artificial Intelligence, Ph.D. in Aviation, Ph.D. in Business Analytics and Decision Sciences, Ph.D. in Construction Science, Ph.D. in Critical Infrastructure, Ph.D. in Manufacturing, Ph.D. in Occupational Health and Safety, Ph.D. in Product Management, Ph.D. in Technology, Ph.D. in Technology/M.S. in Research Methods Combination Program, and Ph.D. in Unmanned Systems Applications. Therefore, the library is fully prepared to support a **B.S. in Construction IT and Cybersecurity.**

Services provided to online students include:

- "Ask the Librarian"
- Research Guides
- Tutorials
- Videos
- Online borrowing

The John G. and Beverley A. Puente Library provides access to management, decision science, and research methods materials through its 10,000-title book collection, e-books, and its 90 journal subscriptions. The library will continue to purchase new and additional materials in the management, decision science, and research methods area to maintain a strong and current collection in this subject area. Students can also access materials through the library's participation in Maryland's Digital eLibrary Consortium. This online electronic service provides access to numerous databases (Access Science, NetLibrary) that supply students with the materials they need. Available databases include ProQuest, EBSCO, ACM, Lexis Nexis, Taylor Francis, and Sage Publications.

The Puente Library can provide access to historical management and decision science materials through its membership in the Maryland Independent College and University Association (MICUA) and the American Society of Engineering Education (ASEE). Reciprocal loan agreements with fellow members of these organizations provide the library access to numerous research facilities that house and maintain archives of management and decision science documents. The proximity of the University of Maryland, College Park and other local area research and academic libraries provide the Puente Library with quick access to these materials as well.

The library currently supports the needs students at the undergraduate, masters and doctoral levels.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment (as outlined in COMAR 13B.02.03.13):

1. **Provide an assurance that the physical facilities, infrastructure, and instruction equipment are adequate to initiate the program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences. If the program is to be implemented within existing institutional resources, include a supportive**

statement by the President regarding adequate equipment and facilities to meet the program's needs.

No new facilities are required for the program. The on-ground traditional classrooms are properly equipped. The online class platform is web-based and requires no additional equipment for the institution. The current Learning Management System, Canvas, and Zoom meet the needs of the degree program. The Business and Technology lab, Computer Science Lab, Cyber Lab, Robotics Lab, and Unmanned Systems Lab meet the potential research needs of the students. The labs provide both local and virtual support.

2. **Provide assurance and any appropriate evidence that the institution will ensure students enrolled in and faculty teaching in distance education will have adequate access to:**

a. An institutional electronic mailing system

Capitol Technology University provides an institutional electronic mailing system to all students and faculty. The capability is provided to all students and faculty in all the institution's modalities of course delivery. Capitol Technology University students and faculty are required to use the institution's email addresses (e.g., xxxxxxxx@captechu.edu) in all University matters and communications. The University uses the email capabilities in Microsoft Office 365 and Microsoft Outlook.

b. A Learning Management System that provides the necessary technological support for distance education

Capitol Technology University provides a robust Learning Management Systems (LMS) through the use of the Canvas LMS by Instructure (www.canvaslms.com). The University pairs Canvas with Zoom (zoom.us) to provide a platform for every student and faculty member to meet face-to-face in a synchronous "live" mode of communication. The use of Canvas is required for every course offered at the University; as a result, every course has a classroom on Canvas and Zoom. All syllabi, grades, and assignments must be entered into Canvas on a timely basis throughout the semester.

Canvas provides the world's most robust LMS. It is a 21st Century LMS; Canvas is a native cloud, Amazon Web Service hosted system. The system is adaptable, reliable, and customizable. Canvas is easy to use for students and faculty. The system is fully mobile and has proven to be timesaving when compared to other systems. The following list provides the features of the system:

Time and Effort Savings

- CANVAS DATA
  Canvas Data parses and aggregates more than 280 million rows of Canvas usage data generated daily.
- CANVAS COMMONS
  Canvas Commons makes sharing a whole lot easier.
- SPEEDGRADER ANNOTATIONS
  Preview student submissions and provide feedback all in one frame.

- GRAPHIC ANALYTICS REPORTING ENGINE
  Canvas Analytics helps you turn rich learner data into meaningful insights to improve teaching and learning.
- INTEGRATED MEDIA RECORDER
  Record audio and video messages within Canvas.
- OUTCOMES
  Connect each learning outcome to a specific goal, so results are demonstrated in clearly measurable ways.
- MOBILE ANNOTATION
  Open, annotate, and submit assignments directly within the Canvas mobile app.
- AUTOMATED TASKS
  Course management is fast and easy with automated tasks.
- NOTIFICATION PREFERENCES
  Receive course updates when and where you want - by email, text message, even Twitter or LinkedIn.
- EASE OF USE
  A familiar, intuitive interface means most users already have the skills they need to navigate, learn, and use Canvas.
- IOS AND ANDROID
  Engage students in learning anytime, anywhere from any computer or mobile device with a Web-standard browser.
- USER-CUSTOMIZABLE NAVIGATION
  Canvas intelligently adds course navigation links as teachers create courses.
- RSS SUPPORT
  Pull feeds from external sites into courses and push out secure feeds for all course activities.
- DOWNLOAD AND UPLOAD FILES
  Work in Canvas or work offline—it's up to you.
- SPEEDGRADER
  Grade assignments in half the time.

Student Engagement

- ROBUST COURSE NOTIFICATIONS
  Receive course updates when and where you want—by email, text message, and even Facebook.
- PROFILE
  Introduce yourself to classmates with a Canvas profile.
- AUDIO AND VIDEO MESSAGES
  Give better feedback and help students feel more connected with audio and video messages.
- MULTIMEDIA INTEGRATIONS

Insert audio, video, text, images, and more at every learning contact point.

- EMPOWER GROUPS WITH COLLABORATIVE WORKSPACES
  By using the right technologies in the right ways, Canvas makes working together easier than ever.
- MOBILE
  Engage students in learning anytime, anywhere from iOS or Android, or any mobile device with a Web-standard browser.
- TURN STUDENTS INTO CREATORS
  Students can create and share audio, video, and more within assignments, discussions, and collaborative workspaces.
- WEB CONFERENCING
  Engage in synchronous online communication.
- OPEN API
  With its open API, Canvas easily integrates with your IT ecosystem.
- BROWSER SUPPORT
  Connect to Canvas from any Web-standard browser.
- LTI INTEGRATIONS
  Use the tools you want with LTI integrations.
- MODERN WEB STANDARDS
  Canvas is built using the same Web technologies that power sites like Google, Facebook, and Twitter.

Lossless Learning

- CANVAS POLLS
  Gauge comprehension and incorporate formative assessment without the need for "clicker" devices.
- MAGICMARKER
  Track in real-time how students are performing and demonstrating their learning.
- QUIZ STATS
  Analyze and improve individual assessments and quiz questions.
- LEARNING MASTERY FOR STUDENTS
  Empower students to take control of their learning.

(Source: https://www.canvaslms.com/higher-education/features)

Capitol Technology University has been using Canvas for over four years. Canvas has proven to be a completely reliable LMS system that provides the necessary technological support for distance education/online learning.

L. Adequacy of Financial Resources with Documentation (as outlined in COMAR 13B.02.03.14):

1. **Table 1: Resources. Finance data for the first five years of the program implementation**

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)	$245,530	$555,957	$854,671	$1,251,689	$1,639,362
a. Number of F/T Students	7	15	23	31	39
b. Annual tuition/Fee rate	$25,830	$26,475	$27,137	$27,815	$28,510
c. Total F/T Revenue (a x b)	$180,810	$397,125	$624,151	$862,265	$1,111,890
d. Number of P/T Students	5	12	17	28	37
e. Credit Hour Rate	$1,077	$1,103	$1,130	$1,159	$1,188
f. Annual Credit Hour	12	12	12	12	12
g. Total P/T Revenue (d x e x f)	$64,620	$158,832	$230,520	$389,424	$527,472
3. Grants, Contracts and Other External Sources	0	0	0	0	0
4. Other Sources	0	0	0	0	0
TOTAL (Add 1 – 4)	$296,460	$555,957	$854,671	$1,251,689	$1,639,362

A. Provide a narrative rationale for each of the resource categories. If resources have been or will be reallocated to support the proposed program, briefly discuss those funds.

1. Reallocated Funds

The University will not need to reallocate funds for the program.

2. Tuition and Fee Revenue

Tuition is calculated to include an annual 2.5% tuition increase. A 20% attrition rate has been calculated.

3. Grants and Contracts

There are currently no grants or contracts.

4. Other Sources

There are currently no other sources of funds.

5. Total Year

No additional explanation or comments needed.

2. **Table 2: Program Expenditures. Finance data for the first five years of program implementation.**

TABLE 2: EXPENDITURES

Expenditure Category	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b + c below)	$110,700	$151,289	$232,607	$317,894	$407,304
a. #FTE	1.5	2	3	4	5
b. Total Salary	$92,250	$126,074	$193,839	$264,912	$339,420
c. Total Benefits (20% of salaries)	$18,450	$25,215	$38,768	$52,982	$67,884
2. Admin Staff (b + c below)	$5,090	$5,243	$5,374	$6,464	$6,832
a. #FTE	.07	.07	.07	.07	.07
b. Total Salary	$4,207	$4,333	$4,441	$5,508	$5,646
c. Total Benefits	$883	$910	$933	$956	$1,186
3. Support Staff (b + c below)	$58,406	$89,830	$122,767	$157,296	$193,475
a. #FTE	1.00	1.5	2	2.5	3
b. Total Salary	$48,668	$74,858	$102,306	$131,080	$161,229
c. Total Benefits	$9,738	$14,972	$20,461	$26,216	$32,246
4. Technical Support and Equipment	$780	$1,890	$3,000	$4,720	$6,460
5. Library	$0	$0	$0	$0	$0
6. New or Renovated Space	$0	$0	$0	$0	$0
7.Other Expenses	$3,480	$10,530	$19,600	$34,810	$52,440
TOTAL (ADD 1-7)	$168,456	$258,782	$383,348	$521,184	$666,511

A. Provide a narrative rationale for each expenditure category. If expenditures have been or will be reallocated to support the proposed program, briefly discuss those funds.

a. Faculty

Table 2 reflects the faculty hours in total, but this does not necessarily imply that these are new hire requirements.

b. Administrative Staff

Capitol Technology University will continue with current the administrative staff through the proposed time period.

c. Support Staff

Capitol Technology University will add additional support staff to facilitate the program.

d. Equipment

Software for courses is available free to students or is freeware. Additional licenses for the LMS will be purchased by the University at the rate of $65 per student in Year 1. The rate is estimated to increase by $5 per year.

e. Library

Money has been allocated for additional materials to be added to the on-campus and virtual libraries to ensure the literature remains current and relevant. However, it has been determined that the current material serves the needs of this degree due to the extensive online database.

f. New or Renovated Space

No new or renovated space is required.

g. Other Expenses

Funds have been allocated for office materials, travel, professional development, course development, marketing, and additional scholarships.

h. Total Year

No additional explanation or comments needed.

M. Adequacy of Provisions for Evaluation of Program (as outlined in COMAR 13B.02.03.15):

1. Discuss procedures for evaluating courses, faculty and student learning outcomes.

The assessment process at the University consists of a series of events throughout the Academic Year. The results of each event are gathered by the University Assessment Team and stored in Canvas for analysis and use in annual reports, assessments, etc. The University Assessment Team analyzes the results, develops any necessary action plans, and monitors the implementation of the action plans.

Academic Year Assessment Events:

Fall Semester:

- At the August Faculty Retreat, the faculty reviews any outstanding student learning challenges that have not been adequately addressed. The issues are brought to the Academic Deans for review and development of implementation plans.

- Faculty submit performance plans consistent with the mission and goals of the University and department. The documents are reviewed and approved by the Academic Deans.
- Department Chairs and Academic Deans review the Graduating Student Survey data.
- Department Chairs and Academic Deans review student internship evaluations.
- Department Chairs and Academic Deans review grade distribution reports from the spring and summer semesters.
- Department Chairs and Academic Deans review student course evaluations from the Summer Semester.
- Departments conduct Industrial Advisory Board meetings to review academic curriculum recommendations. The Advisory Board meets to begin curriculum review or address special issues that may arise related to the curriculum. Based on an analysis and evaluation of the results, the Academic Deans, faculty and advisory boards will develop the most effective strategy to move the changes forward.

    - NOTE: A complete curriculum review for degrees occurs every 2 years. In most cases, the changes only require that the Academic Deans inform the University President and provide a report that includes a justification and the impact of the changes as well as a strategic plan. Significant changes normally require the approval of the Executive Council.

- The Academic Deans attend the Student Town Hall and review student feedback with Department Chairs.
- Department Chairs conduct interviews with potential employers at our Career Fair.
- Post-residency, the Academic Deans meet with the faculty to review the student learning progress and discuss needed changes.

Spring Semester:

- Faculty Performance Plans are reviewed with faculty to identify issues of divergence and to adjust the plan as needed.
- Department Chairs and Academic Deans review grade distribution reports from the Fall Semester.
- Department Chairs and Academic Deans review the Graduating Student Survey data.
- Department Chairs and Academic Deans review student course evaluations from the Fall Semester and the Spring Semester (in May before the Summer Semester begins).
- Department Chairs and Academic Deans meet to review the content of the graduating student, alumni, and course surveys to ensure the surveys continue to meet the university's assessment needs.
- At the Annual Faculty Summit in May, the faculty review and discuss student learning challenges from the past academic year and provide recommendations to the Academic Deans for review and development of implementation plans.
- Department Chairs conduct interviews with potential employers at our Career Fair.
- Departments conduct Industrial Advisory Board meetings to review academic curriculum recommendations.

In addition to these summative assessments, the Academic Deans meet with the Department Chairs on a weekly basis to review current student progress. This formative assessment allows for immediate minor changes, which increase faculty effectiveness and, ultimately, student outcomes.

The Faculty Senate meets monthly from August through April. The Faculty Senate addresses issues that impact student outcomes as those issues emerge. The leadership of the Faculty Senate then provides a report on the matter to the Academic Deans. The report may include a recommendation or a request to move forward with a committee to further examine the issue. In most cases, the changes only require the Academic Deans to inform the University President and provide a report that includes a justification and the impact of changes as well as a strategic plan. Significant changes normally require the approval of the Executive Council.

1. **Explain how the institution will evaluate the proposed program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.**

Student Learning Outcomes:

Student learning outcomes for the proposed **B.S. in Construction IT and Cybersecurity** will be measured using the instruments identified in Section G and Section M as well as the assigned rubrics and assessment measures (e.g., competency exams/projects, case study exams) dictated by the accreditation requirements of the University's regional accreditor [i.e., Middle States Commission in Higher Education (MSCHE)] and our degree-specific accrediting organizations (i.e., IACBE, ABET, NSA, DHS). This program is designed to meet the requirements of MSCHE. The University is in good standing with all its accrediting bodies.

Student Retention:

The University maintains a comprehensive student retention program under the Vice President for Student Engagement. The program assesses student retention at all levels, including the individual course, major, and degree. During the semester and term, the University's Drop-Out Detective capability, within its Learning Management System (i.e., Canvas), provides an early alert at the course level to potential issues related to retention. Within the Office of Student Life, Academic Advisors monitor Drop-Out Detective and contact students who appear to have issues affecting their academic performance. The Academic Advisors work with each student to create a plan to remove any barriers to success. The Academic Advisors also work with the course instructors as needed to gain additional insight that may be helpful in correcting the situation.

Each student also meets with their Academic Advisor each semester to evaluate their progress toward degree completion. An updated plan of action is developed for each student for their next semester's registration and each succeeding semester through degree completion.

The Vice President for Student Engagement also meets on a regular basis with the Vice President of Academic Affairs and Academic Deans to review student retention within each degree program and address any issues that appear to be impediments to degree completion.

Student and Faculty Satisfaction:

Evaluations and assessment of Student and Faculty satisfaction occur every semester. Faculty members are evaluated every semester by students enrolled in their courses. Students are required to complete a course evaluation online within a specified time frame at the end of the semester for every enrolled course or they are locked out of Canvas (the University's Learning Management System) until they complete each survey. Every faculty member is also required to review each of their courses for the semester.

The Department Chairs and Academic Deans review the student evaluations for every course offered at the university. The Department Chairs and Academic Deans also review faculty satisfaction every semester. If changes are needed at the course level, the changes are developed and implemented by the faculty responsible for the courses upon approval of the Academic Deans. If changes are needed at the faculty level, the Department Chairs will make the changes. At the end of this cycle, an evaluation is repeated and the results are analyzed with the appropriate stakeholders regarding the effectiveness of the changes. This is an ongoing process.

Cost Effectiveness:

Based on the year-long inputs, evaluations, and reviews described in Section M.1 from faculty, students, industry representatives, and Department Chairs, the University Academic Deans prepare the proposed academic budget for each program for the upcoming year. Budget increases are tied to intended student learning improvements and key strategic initiatives.

Each academic program is also monitored by the Interim Vice President for Finance and Administration throughout every semester and term for its cost-effectiveness. Additionally, the revenue and costs of every University program are reviewed annually by the Executive Council and Board of Trustees prior to approving the next year's budget.

N. Consistency with the State's Minority Student Achievement goals (as outlined in COMAR 13B.02.03.05 and in the State Plan for Post-Secondary Education):

1. **Discuss how the proposed program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.**

   Capitol Technology University is a majority/minority school. Our programs attract a diverse set of students who are multiethnic and multicultural. The University actively recruits minority populations for all undergraduate and graduate-level degrees. Special attention is also provided to recruit females into the STEM and multidisciplinary programs at all degree levels – undergraduate, master's, and doctoral. The same attention will be given to the **B.S. in Construction IT and Cybersecurity.**

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 the fiscal resources (including faculty, administration, library resources, and general operating expenses) may be redistributed to this program.**

   This program is not associated with a low productivity program identified by the Commission.

P. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

1. **Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.**

   Capitol Technology University is fully eligible to provide distance education. The University has a long history of providing high-quality distance education. The University is accredited regionally by the Middle States Commission in Higher Education (MSCHE) and through four

specialized accrediting organizations: International Accreditation Council of Business Education (IACBE), Accreditation Board for Engineering and Technology (ABET), NSA, and DHS. All five accrediting organizations have reviewed the University's distance education program as part of their accreditation process. Capitol Technology University is fully accredited by MSCHE, IACBE, ABET, NSA, and DHS. The University is in good standing with all its accrediting bodies.

2. **Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed program.**

   Capitol Technology University has a long history of providing high quality distance education/online learning that complies with the Council of Regional Accrediting Commissions (C-RAC) Interregional Guidelines for the Evaluation of Distance Education. The University will also continue to comply with the C-RAC guidelines with the proposed **B.S. in Construction IT and Cybersecurity**.

   a. **Council of Regional Accrediting Commissions (C-RAC) Interregional Guidelines for the Evaluation of Distance Education.**

      1. **Online learning is appropriate to the institution's mission and purposes.**

         Online learning is consistent with the institution's mission, purpose, and history. Please refer to Section A of this proposal.

      2. **The institution's plans for developing, sustaining, and, if appropriate, expanding online learning offerings are integrated into its regular planning and evaluation processes.**

         All programs at the University – online, hybrid, and on-ground – are subject to the same regular planning, assessment, and evaluation processes. Please see Section M of this proposal for the detailed process.

      3. **Online learning is incorporated into the institution's systems of governance and academic oversight.**

         All programs at the University – online, hybrid, and on-ground – are subject to the same regular planning, assessment, and evaluation processes. Please see Section M of this proposal for the detailed process.

      4. **Curricula for the institution's online learning offerings are coherent, cohesive, and comparable in academic rigor to programs offered in traditional instructional formats.**

         Online programs/courses meet the same accreditation standards, goals, objectives, and outcomes as traditional instruction at the University. The online course development process incorporated the Quality Matters research-based set of standards for quality online course design to ensure academic rigor of the online course is comparable to the traditionally offered course. The University Academic Deans, chairs, and faculty review curriculum annually. Courses are reviewed at the end of each term of course delivery. This process applies to online and traditional courses. In addition, advisory boards are

engaged in the monitoring of course quality to ensure quality standards are met regardless of the delivery platform.

5. **The institution evaluates the effectiveness of its online learning offerings, including the extent to which the online learning goals are achieved, and uses the results of its evaluations to enhance the attainment of the goals.**

   Online programs/courses meet the same accreditation standards, goals, objectives, and outcomes as traditional classroom delivery. Learning platforms are chosen to ensure high standards of the technical elements of the course. The University Academic Deans monitor any course conversion from in-class to online to ensure the online course is academically equivalent to the traditionally offered course and that the technology is appropriate to support the expected rigor and breadth of the course.

6. **Faculty responsible for delivering the online learning curricula and evaluating the students' success in achieving the online learning goals are appropriately qualified and effectively supported.**

   The Department of Cybersecurity, where this degree will be sponsored, is staffed by a qualified Department Chair, Dr. William Butler. He is supported in this program by fulltime faculty who are computer science experts: Dr. Bajracharya, Dr. Bajwa, Dr. Hosseini, Prof. Hanson, and Dr. Steele. Dr. Steele is also the Department Head of the Computer Science Department. Other appropriately credentialed faculty will be added as needed as part of the delivery process.

   The evaluation of the courses in the program will be done using the same processes as all other programs at the University. (Please see Section M.) All Capitol Technology University faculty teach in the traditional classroom environment and online. (Please see faculty qualifications in Section I of this document.)

7. **The institution provides effective student and academic services to support students enrolled in online learning offerings.**

   Students can receive assistance in using online learning technology via several avenues. Student aides are available to meet with students and provide tutoring support in both subject matter and use of the technology. Tutors are available in live real-time sessions using Zoom or other agreed-upon tools. Pre-recorded online tutorials are also available.

   In addition to faculty support, on-ground and online tutoring services are available to students in a one-on-one environment.

   Laboratories (on ground and virtual) are available for use by all students and are staffed by faculty and tutoring staff who provide academic support.

   Library services and resources are appropriate and adequate. Please refer to Section J of this document and the attached letter from the University President. The library adequately supports the students learning needs.

8. **The institution provides sufficient resources to support and, if appropriate, expand its online learning offerings.**

The University has made the financial commitment to the program (please refer to Section L). The University has a proven record of accomplishment in supporting degree completion.

9. **The institution assures the integrity of its online offerings.**

Current faculty serve on internal advisory boards that examine possible for program changes, including course and program development. All faculty are selected on domain expertise and program-related teaching experience.

When new faculty or outside consults are necessary for the design of courses offered, the University's Human Resource Department initiates a rigorous search and screening process to identify appropriate faculty to design and teach online courses. Again, all faculty are selected on domain expertise and program-related teaching experience

The University online platforms offer several avenues to support instructors engaged in online learning. The Director of Online Learning Division is highly skilled and trained in faculty development. Several seminars and online tutorials are available to the faculty every year. Mentors are assigned to new faculty. Best practice sharing is facilitated through the Academic Deans, Department Chairs, and formal meetings.

The assessment for online learning classes/students is the same as for all academic programs at the University. Faculty provide required data on student achievement. The Learning Management System provides data on student achievement. Proof of these assessments is available during the class and following class completion to the Academic Deans and Department Chairs. On an annual basis, the information is reported to the University's accreditation authorities such as MSCHE and NSA/DHS.