October 14, 2022

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 Critical Infrastructure**. The degree curriculum will be taught using a significant number of existing faculty at our university and will be supplemented by new courses supporting the **B.S. in Critical Infrastructure**. This is also in response to a request by potential students who are seeking careers in the various fields of homeland security. The mission of Capitol Technology University is to provide practical education in engineering, computer science, information technology, counterterrorism, security 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's degree programs. The university believes that a **B.S. in Critical Infrastructure** is consistent with this mission.

Tremendous career opportunities exist in multiple government agencies and industries who are reporting significant workforce shortages of technical management personnel with a Bachelor's degree and experience in critical infrastructure and security. This program is in response to that need. The **B.S. in Critical Infrastructure** degree is for new Bachelor's students and non-traditional students (i.e., experienced personnel) who desire to advance in their careers by gaining skills in government and industry related directly and indirectly to critical infrastructure and security technologies.

To respond to needs of the intelligence and security field, we respectfully submit for approval of a **Bachelor of Science in Critical Infrastructure.** 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
President

October 14, 2022

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 a **Bachelor of Science (B.S.) in Critical Infrastructure**. As president of the university, I confirm that the library resources, including support staff, are more than adequate to support the **B.S. in Critical Infrastructure**. In addition, the university is dedicated to, and has budgeted for, continuous improvement of its library resources.

Respectfully,

Bradford L. Sims, PhD
President

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

Institution Submitting Proposal	

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

- ◉ New Academic Program
- ○ New Area of Concentration
- ○ New Degree Level Approval
- ○ New Stand-Alone Certificate
- ○ Off Campus Program

- ○ Substantial Change to a Degree Program
- ○ Substantial Change to an Area of Concentration
- ○ Substantial Change to a Certificate Program
- ○ Cooperative Degree Program
- ○ Offer Program at Regional Higher Education Center

Payment Submitted: ◉ Yes ○ No	Payment Type: ○ R*STARS # 93287 ◉ Check # 93287	Payment Amount: $850.00	Date Submitted: 10/15/202

Department Proposing Program	Intelligence and Security Studies
Degree Level and Degree Type	Bachelor of Science (B.S.)
Title of Proposed Program	B.S. in Critical Infrastructure
Total Number of Credits	121
Suggested Codes	HEGIS: 908.01 CIP: 43.0303
Program Modality	○ On-campus ◉ Distance Education (*fully online*)
Program Resources	◉ Using Existing Resources ○ Requiring New Resources
Projected Implementation Date	○ Fall ○ Spring ◉ Summer Year: 2023
Provide Link to Most Recent Academic Catalog	URL: https://www.captechu.edu/current-students/academic-resources

Preferred Contact for this Proposal	Name:	Dr. Richard Baker
	Title:	Associate Dean, Graduate Programs
	Phone:	(812) 249-9188
	Email:	rebaker@captechu.edu

President/Chief Executive	Type Name: Dr. Bradford Sims
	Signature: Date: 10/15/2022
	Date of Approval/Endorsement by Governing Board: 10/15/2022

Revised 1/2021

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

Summer 2023
Projected Implementation Date

Bachelor of Science (B.S.)	**Bachelor of Science in Critical Infrastructure**
Award to be Offered	Title of Proposed Program
0908.01	**43.0303**
Suggested H.E.G.I.S. Code	Suggested C.I.P. Code
Intelligence and Security Studies	**Dr. Joshua Sinai**
Department of Proposed Program	Name of Department Head

Dr. Richard Baker   rebaker@captechu.edu   **301-369-3612**
Associate Dean,   Contact E-Mail Address   Contact Phone Number
Graduate Programs

BMSC 10-13-22   President/Chief Executive Approval
　　　Signature and Date

OCT. 13, 2022   Date Endorsed/Approved by Governing Board
　　　Date

Proposed Bachelor of Science in Critical Infrastructure
Department of Intelligence and Security Studies
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 Critical Infrastructure Program Description:

   The Bachelor of Science (B.S.) degree in Critical Infrastructure is a unique interdisciplinary program designed to meet the demand for highly skilled professionals to upgrade, secure and manage the nation's Critical Infrastructure. The program addresses one of the greatest technical challenges of the 21st century – how to create a robust and sustainable infrastructure that is resilient against multiple threats and hazards as well as build operational, systems, and programmatic capabilities for detection, protection, prevention, mitigation and response. The program provides the necessary knowledge, skills, and training to become a professional and leader in this diverse field. The degree provides a firm foundation in Critical Infrastructure policy, risk management, operations, and mission planning. Students will understand each Critical Infrastructure sector and will apply the latest techniques, including cybersecurity technology, to devise plans and policy for protection and rapid response.

   The need for an B.S. in Critical Infrastructure is a direct outgrowth of the aftermath of the terrorist attacks on September 11, 2001, severe weather events during the past 16 years, and the evolving threats to the nation's Critical Infrastructure.

   The laws enacted over the past 16 years also require a new level of expertise to help lead the efforts of every level of government, national laboratories, critical infrastructure owners and operators, and other cross-sector coordinating entities. The National Cybersecurity and Critical Infrastructure Protection Act of 2014 - Title I passed on July 28, 2014. Section 102 of the Act of 2014, Securing the Nation Against Cyber Attack, amended the Homeland Security Act of 2002 (HSA) to require the Secretary of Homeland Security to conduct cybersecurity activities, including the provision of shared situational awareness among federal entities to enable real-time, integrated, and operational actions to protect from, prevent, mitigate, respond to, and recover from cyber incidents.

   Section 103 of the Act of 2014 directs the Secretary to coordinate with federal, state, and local governments, national laboratories, critical infrastructure owners and operators, and other cross-sector coordinating entities to: (1) facilitate a national effort to strengthen and maintain critical infrastructure from cyber threats; (2) ensure that Department of Homeland Security (DHS) policies and procedures enable critical infrastructure owners and operators to receive appropriate and timely cyber threat information; (3) seek industry sector-specific expertise to develop voluntary security and resiliency strategies and to ensure that the allocation of federal resources is cost effective and reduces burdens on critical infrastructure owners and operators; (4) upon request, provide risk management assistance to entities and education to critical infrastructure

owners and operators; and (5) coordinate a research and development strategy for cybersecurity technologies.

The Act of 2014 also directs the Secretary: (1) to manage federal efforts to secure federal civilian information systems (excluding national security, Department of Defense [DOD], military, and intelligence community systems) using a risk-based and performance-based approach and, upon request, to support the efforts of critical infrastructure owners and operators to protect against cyber threats; (2) to direct a DHS entity to serve as a federal civilian entity by and among federal, state, and local governments, private entities, and critical infrastructure sectors to share cyber threat information; (3) to promote national awareness and educate the public regarding information system security; (4) upon request, to facilitate cyber incident response and recovery assistance and provide analysis and warnings related to threats to, and vulnerabilities of, critical information systems, crisis and consequence management support, and other remote or on-site technical assistance to federal, state, and local government entities and private entities for cyber incidents affecting critical infrastructure; and (5) to engage with international partners and conduct outreach to educational institutions.

A new advanced degree is now required to infuse a higher level of expertise and leadership into every area associated with Critical Infrastructure as well as each of its 16 sectors.

Relationship to Institutional Approved Mission:

The B.S. in Critical Infrastructure is consistent with the University 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. Fundamental to the degree programs in the Department of Intelligence and Security Studies are opportunities to produce highly skilled systems-oriented professionals. The B.S. in Critical Infrastructure is consistent with that philosophy. This same philosophy is supported by existing degree programs and learning opportunities. The degree is an integral part of the strategic plan for FY 2019-2020 and forward. Funding to support the new degree has been included in institutional and departmental budgets for FY 2019-2020 and forecasted budgets going forward.

The degree will be offered online. This modality provides the convenience required by the 21st century learner and allows live interaction with faculty and fellow students critical to the high-level learning experience. The curriculum provides students real-world opportunities through labs, case studies, and the use of the latest technology; as a result, it provides the student with the necessary practical experience the University believes critical to success in the modern global environments. The degree is consistent with the interdisciplinary nature of the University. This opportunity will be available to all University students.

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 five strategic goals:

    1. **Elevating Education and Academic Quality:** *The University is an institution that offers career relevant curriculum with quality learning outcomes.*

2. **Expand Enrollment and Reputation:** *The University will become more globally renowned and locally active through student, faculty, and staff activities.*

3. **Diversify and Increase Financial Resources**: *The University will enhance its financial resources by expanding the range and amount of funding available to the institution, aligning costs with strategic initiatives, and expanding corporate relationships.*

4. **Maintain Institutional Viability**: *The University is committed to providing relevant learning in a quality learning environment.*

5. **Extend Our Family of Organizational Partners**: *The mission of Capitol Technology University is to provide relevant learning experiences that lead to success in the evolving global community.*

The B.S. in Critical Infrastructure program supports all the university's five strategic goals. It does so, in part, because of the cross disciplinary nature of the program. This approach builds upon already successful areas of study, including undergraduate and graduate degrees in Astronautical Engineering, Business Analytics and Decision Sciences, Computer Engineering, Computer Science, Counterterrorism, Cyber and Information Systems, Cybersecurity, Electrical Engineering, Information Systems Management, Internet Engineering, Intelligence and Global Security, Management of Cyber and Information Technology, Mobile Computing, Software Engineering, and Technology, Capitol Technology University's programs are structured to teach students the leadership and technical skills necessary to meet the needs of a modern technology-dependent society. These programs have been preparing professionals for rapid advances in technology, intense global competition, and more complex technical environments for decades. The B.S. in Critical Infrastructure degree is in line with this tradition and will allow our students to move their skills and careers to the next level within the evolving global technical community.

The new B.S. in Critical Infrastructure is fully supported by the university's Vision 2025 and Strategic Plan 2017-2021. Funding to support the degree has been included in forecasted budgets going forward.

The University has active partnerships (e.g., Leidos, Patton Electronics, Lockheed Martin, Northrup Grumman, Cyber Security Forum Initiative, IRS, NCS, and SAS) in the private and public arenas. The B.S. in Critical Infrastructure degree will provide new opportunities for partnerships as well as research. Potential partnerships for internships were identified at the most recent job fair held at the university. These partnerships include *IEEE (Institute of Electrical and Electronic Engineering, a leading international professional and educational association) and* Infragard (the FBI – Private Sector Partnership), with whom the university has established chapters for the students and faculty, with partnerships being formalized with the International Association of Law Enforcement and Intelligence Analysts (IALEIA), and ASIS International. The increase in alliances and the placement of our graduates in these and other partner institutions will serve to expand the University's enrollment and reputation. While additional students will increase financial resources, new partnerships, and grants in the Intelligence and Global Security field will help diversify and increase financial resources.

The Department of Homeland Security has identified 16 Critical Infrastructure sectors. Those sectors span every sector of government and industry. The Department of Homeland Security considers the assets, systems, and networks of each sector so vital to the United States that their incapacitation or destruction would have a debilitating effect on national security, national

economic security, and national public health and safety. As a result, there is a pressing need to educate and train Critical Infrastructure professionals so the protection of those assets, systems, and networks are considered at inception, not afterwards. Graduates with the B.S. in Critical Infrastructure degree will fill this need, making the degree extremely relevant now and in the future.

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 will be self-sustaining going forward.

4. **Provide a description of the institution's a 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. The institutional and departmental budgets for FY 2021-2022, as well as the forecasted budgets going forward, include funding for the administrative, financial, and technical support of the new degree.

   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 B.S. in Critical Infrastructure degree program for a period of time sufficient 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.**

   Our nation, state, and society are faced with an urgent need to build newer, more secure Critical Infrastructure and to protect better the existing Critical Infrastructure. Capitol Technology University believes it is imperative to position the state of Maryland to take advantage of this urgent need, rather than standing on the sidelines while there is a nationwide demand for properly educated and trained talent in the Critical Infrastructure field.

   Today's high levels of interconnectivity and exposure have spawned serious challenges for every sector of Critical Infrastructure. In a recent article, the World Economic Forum

described how our nation's Critical Infrastructure has become more vulnerable than in the past.

> Subway cars stuck in a tunnel. Electricity blackouts. A breached dam. Jammed telecommunications. These and other potential consequences of critical infrastructure security breaches can at best cause just inconvenience; at worst, they can lead to death or destruction on a shocking scale. Power outages in the Ukraine in 2015 and 2016 represent two such cases in point.
>
> In today's hyperconnected world, such infrastructure is more vulnerable than ever to cybersecurity threats, whether from nation states with bad intentions, criminal organizations or individuals. This new vulnerability stems from fundamental changes in the critical infrastructure of organizations' technology systems. Such organizations — healthcare providers, utilities, chemical producers, manufacturers, defence agencies, first responders, banks, transportation systems — have long owned and operated two types of technology systems. Their Information Technology (IT) systems run basic office functions, such as email, payroll and human resources systems; while their Operational Technology (OT) systems control physical equipment and personnel essential for carrying out their mission, such as generating and transmitting power.
>
> In the past, OT consisted of stand-alone systems that used little-known, proprietary protocols — their very obscurity made them secure. But now, OT systems run on the same commonly-known software and hardware platforms as IT systems. These systems are well understood by hackers and therefore significantly less secure.
>
> What has led to this convergence of OT with IT? It's the growing demand for seamless access to information — access that hinges on the use of "smart" digital technologies, including sensors, cameras and wearables. For instance, a utility gathers online data on power outages from smart meters so it can swiftly identify problem locations and restore power to customers. A homeowner remotely adjusts the thermostat at her residence to lower the temperature while she's on vacation. A doctor views patients' insulin use on an office computer. Companies remotely monitor the status and location of trains, buses and trucks; the flow of oil and gas through pipelines; or water or electricity consumption to manage these services effectively and efficiently.
>
> While the technologies in these examples improve our lives and infuse efficiencies into our economy, they can also make us more vulnerable. When customers of three Ukrainian power utilities lost power because of a cyber incident, those utilities were able to fall back on manual operations to restore power. This would not be possible in a number of other countries where manual operations no longer exist…
>
> As the number of interconnected devices continues to increase, the number of potential access points for hackers to disrupt critical infrastructure grows as well. All of these devices need to be designed, implemented and deployed in ways that make them less vulnerable to attacks.

(Source: https://www.weforum.org/agenda/2017/02/our-critical-infrastructure-is-more-vulnerable-than-ever-it-doesn-t-have-to-be-that-way/)

In 2013, Presidential Policy Directive 21 (PPD-21) called for a national unity of effort in the Critical Infrastructure arena.

> The Nation's critical infrastructure provides the essential services that underpin American society. Proactive and coordinated efforts are necessary to strengthen and maintain secure, functioning, and resilient critical infrastructure – including assets, networks, and systems – that are vital to public confidence and the Nation's safety, prosperity, and well-being.

> The Nation's critical infrastructure is diverse and complex. It includes distributed networks, varied organizational structures and operating models (including multinational ownership), interdependent functions and systems in both the physical space and cyberspace, and governance constructs that involve multi-level authorities, responsibilities, and regulations. Critical infrastructure owners and operators are uniquely positioned to manage risks to their individual operations and assets, and to determine effective strategies to make them more secure and resilient.

> Critical infrastructure must be secure and able to withstand and rapidly recover from all hazards. Achieving this will require integration with the national preparedness system across prevention, protection, mitigation, response, and recovery.

(Source: https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil)

The prevention, protection, mitigation, response, and recovery of Critical Infrastructure is highly dependent on the understanding of infrastructure and cybersecurity. Future professionals must be educated in the knowledge gained since the 9/11 Terrorist Attacks and lessons learned so U.S. industry can take a proactive approach in a national unity of effort to protect our Critical Infrastructure.

The Security Industry Association (SIA) recently conducted an interview with security expert Jerry Bowman on January 18, 2018 regarding Critical Infrastructure in an article for the SIA Blog. Bowman highlighted the pressing need for properly trained professionals who use the latest techniques and skillsets to protect our Critical Infrastructure.

> SIA: Can you tell us a little bit about your background and how you were inspired to present on the topic of "Protecting Critical Infrastructure from Our Bad Habits" at ISC West?

> Bowman: While I've been involved in protection of critical infrastructure most of my professional life, I became more focused in 2014 when I was voted onto the Board of Directors for the FBI's InfraGard Public-Private partnership. During my three years there and in the final year as president, I was exposed to even more detail concerning the threats to the high-profile critical sectors.

> SIA: Briefly, what do you anticipate are key important takeaways concerning bad habits and human error…?

Bowman: U.S. National Institute of Standards and Technology, International Organization for Standardization, and National Geospatial-Intelligence Agency all focus on identification and management of key assets as the first step in protection. This bottoms up focus along with the emerging priority on respect for the business' outcomes, expands the remit of all security professionals and moves them away from checklists and into a mindset that customizes all security countermeasures to fit the business' tolerance for risk.

SIA: Anecdotally, how much of a threat are "bad habits" to the security of critical infrastructure? Is the "people factor" fully considered in most security planning?

Bowman: A significant percentage of incidents are attributable to the "people" aspect of security risk management. Development of sound policy and processes along with training programs can significantly reduce or eliminate the effectiveness of emerging threats. Both physical and cyber security would benefit from awareness and training of both security professionals and all other stakeholders of any critical sector. Imagine how many threats would be mitigated if backdoors were eliminated from converged facilities equipment plugged into the production network?

SIA: What's an example of a common mistake made by people that introduces risk into a security paradigm?

Bowman: Staying with the management theme, it is absolutely critical for those in the Communications Sector (IT) to know what they have through bottoms up audits and lifecycle tracking of data assets. Shadow IT and risk introduced by unauthorized personal devices would be significantly reduced if data center and network managers simply knew what they had and physically where it was located.

SIA: How do security managers best work to mitigate human error or bad habits?

Bowman: Break the mentality of thinking about security as a checklist. We can't successfully protect any critical infrastructure that way, because we no longer have a static list of threats. With the bad guys constantly thinking up new attack vectors we now must protect against what we don't know.

SIA: What's one thing you would like folks to think about…?

Bowman: Think about the 16 critical sectors identified by the Department of Homeland Security and how many of them they are charged with protecting in their jobs or businesses. Some may only have one, but others might have four or five. I would encourage them to think about the dependencies between them and which good habits could enhance security quickly (80/20 rule).

(Source: https://www.securityindustry.org/2018/01/18/protecting-critical-infrastructure-bad-habits/)

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 Critical Infrastructure 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 Critical Infrastructure will expand the field of opportunities for minorities and disadvantaged students. Given the substantial minority population of Capitol Technology University, it is also reasonable to assert that the B.S. in Critical Infrastructure program will add to the base of minority participation in the Intelligence and Global Security field.

2. **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 postsecondary 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 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 additional graduate and/or 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 in to 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 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 Critical Infrastructure program and university financial aid will be available to all Maryland residents who qualify academically for admission.

The B.S. in Critical Infrastructure program, with its academic rigor, will produce highly qualified Intelligence and Global Security practitioners with the highest level of skills and abilities to advance their careers. The University has a proven record of rigorous high-quality education in all of its degrees. 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), National Security Agency (NSA), and Department of Homeland Security (DHS). The B.S. in Critical Infrastructure 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 Critical Infrastructure will be offered online. This provides learning opportunities for students unable or unwilling to attend an on-campus institution of higher education. 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 through admissions regarding the cost to attend the University. The information is also publicly available on the University website. Admissions and financial aid identify potential grants, scholarships, and state plans for each student to reduce potential student debt. The net cost versus gross costs are identified clearly for the student. Students receive advising from financial aid prior to enrolling in classes for the first time. Admissions, student services 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 lock, which means full-time tuition is locked at the rate applied at 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 staff and faculty opportunities for early student intervention in the pathway to graduation. This applies to all students regardless of mode of course delivery or degree program. Capitol Technology University is 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 is 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 the classroom 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/agencies.

The University also employs online virtual simulations in a game-like environment to teach practical hands-on application of knowledge. The university is engaged with a partner creating high-level virtual reality environments for specific courses in the degree. This use of current technology occurs in parallel with traditional proven learning strategies. These elements of the university 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 that allow 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 launched their latest satellite aboard a NASA rocket from a location in Norway in the 2019 Fall Semester. We are also recruiting additional partners for the proposed B.S. in Critical Infrastructure for which real-world projects will provide students integrative learning opportunities in the Intelligence and Global Security field. This will include partnering with firms that apply risk assessment software tools, which are used in the intelligence and global security field.

The university also supports prior learning assessment. 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.**

   Opportunities exist at all levels of government, private industry, and cross-sector organizations for professionals with the proposed B.S. in Critical Infrastructure. There are currently 785 jobs listed on glassdoor.com for under Critical Infrastructure.

   (Source: ttps://www.glassdoor.com/Job/jobs.htm?suggestCount=0&suggestChosen=false&clickSource=se

archBtn&typedKeyword=critical+infrastructure+protection&sc.keyword=critical+infrastructure+protection&locT=&locId=&jobType=)

Graduates with the B.S. in Critical Infrastructure will be expected to fill mid-level management positions in existing government organizations and private companies with titles such as:

- Trusted & Resilient Systems Director
- Principal Advisor for Critical Infrastructure Protection
- Director, Corporate Planning and Analysis
- Director, Critical Infrastructure
- Intelligence Analyst – Critical Infrastructure Protection
- Infrastructure Security Researcher

Graduates will also possess the required knowledge in Critical Infrastructure to serve as a subject matter expert and form their own commercial 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.**

The urgent need for more properly trained Critical Infrastructure professionals was described in a recent expert panel discussion by TechTarget – an industry watchdog organization. TechTarget's expert Critical Infrastructure panel was a follow-on discussion to an article on the same subject by Information Security magazine.

> Like many organizations, the owners of critical infrastructure facilities face a widening skills gap. Many facilities lack individuals with the right technical staff to assess security threats and respond to them. Coupled with aging systems long past their prime and a very limited set of administrators that are capable of maintaining them, most facilities are implementing security improvements at a snail's pace.

> During the past five or six years, organizations have moved away from doing the fundamentals properly in a lot of spaces. In the late 1990s and early 2000s security was a new space, and so you had innovation at all levels. But I think that, economics being what they are today, we tend to operationalize. Now we don't have individuals at the lowest levels with the right skill sets across all critical infrastructure sectors to be able to truly asses the threats and respond to them.

> …We don't do a good job of fixing the known issues, patching and assessing configurations. I think a big part of that is attributable to the lack of skilled technical workers across the different sectors. I think that continues to be a major issue that we need to address.

(Source: https://searchsecurity.techtarget.com/feature/Critical-infrastructure-protection-hindered-by-difficulties-experts-say)

> The need for Critical Infrastructure professionals with cybersecurity skills puts greater pressure on a program area that is already in very high demand. Inside Higher Ed, a leading digital media company serving higher education, recently defined the pressing need for cybersecurity professionals in an April 26, 2017 article, "Long-term View Needed for Cybersecurity Education":

The projected global demand for cybersecurity talent will climb to six million by 2019, but there will be an expected shortfall of 1.5 million professionals, according to Foote Partners, which tracks information technology jobs across all skill levels. This new intersection of business and higher education is not a nice to have—for many in corporate recruiting, it's become a need to have.

A recent Boston Globe article cited the shortage of skilled technology workers—and in particular cybersecurity talent—as the No. 1 issue for many companies. Cyberattacks increased by 48 percent in 2014, according to the accounting and consulting firm PwC, and are expected to increase as more personal computing devices become connected to the internet. And yet, the talent isn't there to support the demands of this rapidly growing industry.

(Source: https://www.insidehighered.com/digital-learning/views/2017/04/26/cybersecurity-faces-shortage-15-million-workers)

The dramatic growth in the construction industry will also increase the demand for Critical Infrastructure professionals. The construction industry is thriving as the economy continues to grow and the effect of recent reduction in the corporate tax rate to 21% is beginning to be felt across the sector.

"All signs and numbers point to a huge year for the construction industry. Even in December, with much of the nation frozen, the construction industry added 30,000 jobs, according to the Bureau of Labor Statistics.

For all of 2017, construction added 210,000 jobs, a 35 percent increase over 2016.

Construction spending is also soaring, rising more than expected in November to a record $1.257 trillion, according to the Commerce Department. That was up 2.4 percent annually. Spending increased across all sectors of real estate, commercial and residential, with particular strength in private construction projects. The only weakness was in government construction spending.

"This optimism is likely based on current economic conditions, an increasingly business-friendly regulatory environment and expectations the Trump administration will boost infrastructure investments," said Stephen Sandherr, the association's CEO.

Contractors are most optimistic about construction in the office market, which has seen little action since the recession. Transportation, retail, warehouse and lodging were also strong in the survey."

(Source: https://www.cnbc.com/2018/01/05/by-all-measures-a-construction-boom-is-shaping-up-for-2018.html)

The severe shortage of Critical Infrastructure professionals to support new construction, renovations, and retrofitting is occurring at the same time the protection challenges are becoming more complex, interconnected, and extreme. In their 2018 book, Critical Infrastructures Resilience: Policy and Engineering Principles, Auroop Ratan Ganguly, Udit Bhatia, Stephen E. Flynn summarized the issue.

Extreme events and stresses, including those that may be unprecedented but are no longer surprising, have disproportionate effects on critical infrastructures and hence on communities, cities, and megaregions.

Critical infrastructures include buildings and bridges, dams, levees, and sea walls, as well as power plants and chemical factories, besides lifeline networks such as multimodal transportation, power grids, communication, and water or wastewater. The growing interconnectedness of natural-built-human systems causes cascading infrastructure failures and necessitates simultaneous recovery.

(Source: https://www.amazon.com/Critical-Infrastructures-Resilience-Engineering-Principles/dp/1498758630)

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.**

Critical Infrastructure is interdisciplinary by its very nature. The term covers all assets, both physical and virtual, that are essential for the functioning of a society as well as its government and economy. Those assets are divided into sixteen sectors: Chemical, Commercial Facilities, Communications, Critical Manufacturing, Dams, Defense Industrial Base, Emergency Services, Energy, Financial Services, Food and Agriculture, Government Facilities, Healthcare and Public Health, Information Technology, Nuclear Reactors, Materials, and Waste, Transportation Systems, and Water and Wastewater Systems.

Interdisciplinary degrees that lead to hybrid jobs are growing much faster than single occupational field. 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 jobseekers 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, shows 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 7.7%.

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HYBRID JOBS ARE GROWING FAST
NEARLY TWICE AS FAST AS JOBS OVERALL
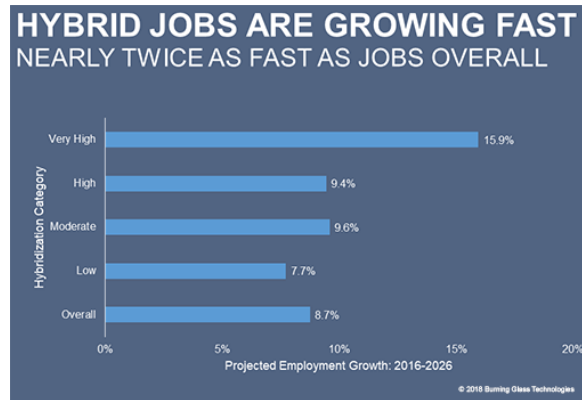
In a 12-month period, we found that more than a quarter million job postings sought this kind of hybrid talent…

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. Thus business, design and programming are skills and disciplines that aren't typically taught together – or sought out as a package by students.

…The takeaway for educators: hybrid jobs 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/)

The protection of Critical Infrastructure is one area that is now permeating all other sectors of the economy. One industry that also spans all of the others of the economy is construction, making it an industry that will be required to address the protection of Critical Infrastructure in all of its projects in the future.

"Security is no longer restricted to just technology companies or financial institutions… organizations in charge of critical infrastructure such as the electric grid grapple with skilled adversaries who take advantage of holes in the network defenses to cause damage."

(Source: http://burning-glass.com/average-cybersecurity-salary-over-93000/)

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

There are a few Bachelor's degree programs in the United States that are focused on Critical Infrastructure. However, none of those programs are in Maryland. As a result, there is no current or projected supply of prospective graduates with a B.S. in Critical Infrastructure.

If approved, the B.S. in Critical Infrastructure will send its graduates into leadership positions with the ability to address one of the biggest threats to every industry: attacks on Critical Infrastructure. Students in the proposed degree will receive courses in Critical Infrastructure protection (as it relates directly to the 16 Critical Infrastructure Protection sectors) as well as

cybersecurity – an existing strength of the university and a key component of all Critical Infrastructure Protection plans.

If approved, Capitol Technology University's degree will position its graduates to earn more money in every Critical Infrastructure sector and fill the requirement for its leaders in each sector to possess advanced training and a graduate degree in Critical Infrastructure.

(Source: http://burning-glass.com/earn-more-money-become-manager/)

D. Reasonableness of Program Duplication

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

   There are no Bachelor's degrees in Critical Infrastructure in Maryland. As discussed earlier, the proposed B.S. in Critical Infrastructure would be the first. This situation presents an opportunity for the state of Maryland to have the first degree of its kind in the state and region as well as one of the first few in the nation. It also presents the opportunity to offer a program that provides future Critical Infrastructure professionals with the cutting-edge skills that address the future needs of government, private industry, existing organizations in each of the 16 Critical Infrastructure sectors. Capitol Technology University's proposed B.S. in Critical Infrastructure will be delivered online. **If approved, Capitol Technology University's B.S. in Critical Infrastructure will position its graduates to fill the need for specialists in Maryland and other States in the U.S.**

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

   The B.S. in Critical Infrastructure program is strongly aligned with the university's strategic priorities and is supported by adequate resources. The new B.S. in Critical Infrastructure degree will strengthen and expand upon existing technology, management, and applied engineering degree programs at the university. In addition, the Critical Infrastructure courses will be an option for all students as the field integrates well with the market needs of the university's other technical programs. The degree will represent study in a rapidly changing and highly complex discipline. Research shows a significant shortage of Critical Infrastructure professionals needed in this emerging discipline. This program helps fill the gap. There is a thorough discussion of the need 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 is not aware of any similar high-demand programs at the Maryland HBIs.

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 is not aware of any impact on the uniqueness and institutional identities and missions of Maryland HBIs.

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 proposed program was established through a rigorous review of unmet needs by the university's New Programs Group. The group includes selected representation from the faculty, administrators, and Executive Council. The program will be overseen by a diverse group of faculty with backgrounds in civil engineering, cybersecurity, construction science and management, intelligence and security studies, mechanical engineering, environmental engineering, architectural engineering, strategic studies, computer science, building construction technology, and business. Please see Section I for a detailed list of the faculty's backgrounds.

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

    Educational Objectives:

    a. Prepare students to critically analyze problems in a variety of disciplines and to identify relevant and useful information to support the attainment of desired outcomes.
    b. Prepare students to think critically by drawing appropriate conclusions from examining the output of methodological applications in the Critical Infrastructure environment.
    c. Prepare students to conceptualize, apply and integrate effective strategies and to use information effectively in the decision-making process.
    d. Prepare students to create robust and sustainable infrastructure that is resilient against multiple threats and hazards.
    e. Prepare students to build operational, systems, and programmatic capabilities for detection, protection, prevention, mitigation and response in the 16 sectors of Critical Infrastructure.
    f. Prepare students to evaluate cyber in the context of data quality and security in order to determine the potential impact on Critical Infrastructure information resources.

    Learning Outcomes:

    Upon graduation:

    a. Graduates will demonstrate an understanding of the legal and ethical principles applicable to Critical Infrastructure and demonstrate the ability to apply these principles in the decision-making process.
    b. Graduates will demonstrate a mastery of traditional and technological techniques of communicating ideas effectively and persuasively.
    c. Graduates will demonstrate and apply in-depth knowledge as it relates to the Critical Infrastructure.

d. Graduates will demonstrate an understanding and evaluate possible economic, social, legal, ethical, and environmental impacts of their Critical Infrastructure solutions.

e. Graduates will enter global organizations with knowledge of Critical Infrastructure concepts, Critical Infrastructure plans, project management processes, and team leadership skills.

f. Graduates will develop and implement Critical Infrastructure strategic management and action plans for an organization.

g. Graduates will demonstrate an understanding of Critical Infrastructure concepts, project management process and team leadership skills

h. Graduates will demonstrate knowledge of security operations and administration, infrastructure and operational security, the selection and deployment access controls, security analysis and monitoring, and principles of risk, response and recovery.

3. Explain how the institution will:

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

Capitol Technology University's Assistant Vice President for Learning, Assessment, and Education leads the assessment of 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. [C]learly 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. [O]rganized 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

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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. [C]onsideration 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. [I]f applicable, adequate and appropriate institutional review and approval of assessment services designed, delivered, or assessed by third-party providers; and

5. [P]eriodic 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)

The University will also evaluate student achievement of the learning outcomes using the Quality Assurance Agency for Higher Education (QAA) Framework for Higher Education Qualifications and its related assessment tools.

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.) degree in Critical Infrastructure is a unique interdisciplinary program designed to meet the demand for highly skilled professionals to upgrade, secure and manage the nation's Critical Infrastructure. The program addresses one of the greatest technical challenges of the 21st century – how to create a robust and sustainable infrastructure that is resilient against multiple threats and hazards as well as build operational, systems, and programmatic capabilities for detection, protection, prevention, mitigation and response. The degree provides a firm foundation in Critical Infrastructure policy, risk management, operations, and mission planning. Students will understand each Critical Infrastructure sector and will apply the latest techniques, including cybersecurity technology, to devise plans and policy for protection and rapid response.

Description of program requirements:

Entrance requirements: To be fully accepted into the program, students must have completed an undergraduate degree with a cumulative GPA of no less than 3.0 on a 4.0 scale. In addition, students must also meet the program-specific prerequisites for their intended program.

Entrance Requirements

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

Degree Requirements:

The following is a list of courses for the B.S. in Critical Infrastructure degree. Students expecting to complete this degree must meet all prerequisites for the courses listed below.

Bachelor of Science in Critical Infrastructure
Courses
Total Credits: 121

CRITICAL INFRASTRUCTURE COURSES – 9 CREDITS

CRITICAL INFRASTRUCTURE CORE COURSES

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. Primary focus will be on incorporating Critical Infrastructure protection into 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.

CRI-211 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. Primary focus will be on incorporating Critical Infrastructure protection in to 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.*

CRI-212 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. Primary focus will be on incorporating Critical Infrastructure protection into 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.*

CONSTRUCTION AND FACILITIES MANAGEMENT CORE COURSES – 39 CREDITS

FM-120 - Introduction to Facilities Management (3 Credits)
This course examines the scope of the professional facilities manager's responsibilities. The Facility Manager's role in relation to an organization's overall plan. An overview is provided of the fundamental concepts in facilities management and a general understanding of the responsibilities of the profession as to why it is valuable to facility managers. The type of facilities associated with critical infrastructures will be covered. An overview of concepts needed to organize, monitor, communicate and develop a good facilities management program will be introduced. Prerequisite: None.

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. Pre-requisite: CM-120

CM-220 - Construction Methods and Materials (3 Credits)

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

CM-230 - Estimating I (3 Credits)
Introduction to the classification of work from plans and specifications. Covers discussion of the estimating function and review and applications of material quantity survey techniques used in estimating costs of construction projects. Includes types of approximate and precise methods of estimating and their uses, and computer applications. Pre-requisite: CM-125

CM-260 – Statics and Strengths of Materials (3 Credits)
This algebra-based course is the study of forces acting upon structural elements. Analytic and graphic methods are used to illustrate resultants and reactions, equilibrium, centroids and moments of inertia applied to static structures. Analysis includes stress, strain, axial loading, bending, and deflection of beams. Prerequisite: MA-112 and PH-201

FM-260 – Space Planning (3 Credits)
The process of design, problem solving, and building management as it relates to the use of interior space will be introduced. Projects involving issues pertaining to space planning, regulatory codes, building systems, material use and construction methods will be applied. Prerequisite: FM-120.

FM-301 – Facilities Project Management (3 Credits)
Methods, concepts and procedures of project management as it relates to facilities. Scheduling, budgeting/estimating, contract administration, purchasing, relocations, move management, and identifying a team to manage the facilities will be introduced. Prerequisite: FM-120, CM-125, and CM-250.

FM-330 – Building Operations (3 Credits)
An examination of how facilities, building operations, and maintenance organizations are managed. An understanding of scheduling, equipment evaluation, training and long range planning of facilities. An in-depth look at the interdependent mechanical systems in a facility working together and how all the elements of a facility work together to function for the best value to the organization. Prerequisite: FM-301.

FM-350 – Facilities Assessment and Forecasting (3 Credits)
This course emphasizes the strategic role required of the facilities manager in providing information for corporate managers and executives for facility forecasting. Topics include corporate real estate, attorney and developer interface, operating budgets and capital expenditures, and building performance assessment. Prerequisite: CM-125.

CM-350 - Construction Planning and Scheduling (3 Credits)
A course using construction scheduling software with plans and specifications will be used in planning a construction project from start to finish. Prerequisite: CM-330

CM-375 - Mechanical and Electrical Construction (3 Credits)
An introduction to the basics of mechanical, electrical, plumbing and fire protection systems (MEP) in construction. This includes installation of systems and the necessary resources. Prerequisite: CM-220

CM-380 – Environmental Systems (3 Credits)
Comprehensive overview of environmental impact of common construction processes; and, environmental/occupational hazards and liability associated with those processes. Prerequisites: CH-120, CM-120, CM-250, and PH-201

FM-380 – Facilities Energy and Sustainability (3 Credits)
An overview of how facilities, building operations, and maintenance organizations are managed to understand energy creation, delivery and consumption. Topics include sources, forms, and methods used to assess and manage energy use in buildings. Current building energy management software is evaluated. Students will apply concepts needed to successfully organize, monitor, communicate and develop a good sustainability program. Prerequisite: CM-125.

CYBERSECURITY CORE COURSES – 15 CREDITS

CS-120 Introduction to Programming Using Python (3 Credits)
The course will cover basic concepts and elements of computer programming using Python. Topics include variables, constants, operators, expressions, statements, branching, loops, and functions. Additionally, Python specific data structures, built-in functions, library modules and working with external files will be applied in developing working code. *Prerequisite: none*

CT-152 Introduction to UNIX (3 Credits)
This course focuses on the 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.

IAE-201 Introduction to IA Concepts (3 Credits)
This course covers topics related to 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. Corequisites: MA-110 or MA-112 or MA-114 or MA-261.

IAE-250 Comprehensive Computer and 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 lecture, current event discussions, and laboratory exercise review and will prepare learners for the CompTIA Security+ certification. (*FORMERLY IAE-301) Prerequisite: IAE-201.

IAE-325 - Secure Data Communications & Cryptography
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 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. NOTE: Students enrolled in this course incur an additional lab fee of $100.

GENERAL EDUCATION – 40 CREDITS
(MATH/SCIENCE, HUMANITIES/SOCIAL SCIENCE/MANAGEMENT)

GEN ED: MATHEMATICS AND SCIENCE COURSES - 16 CREDITS

MA-112 Intermediate Algebra (3 Credits)
Designed for students needing mathematical skills and concepts for MA-114 and MA-261. Students are introduced to equations and inequalities, 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 acceptance based on placement test scores.

MA-114 Algebra and Trigonometry (4 Credits)
Designed for students needing mathematical skills and concepts for MA-261. Topics covered in algebra include algebra: basic operations on real and complex numbers, fractions, exponents and radicals, determinates, solution of linear, fractional, quadratic and system equations. Topics covered in trigonometry include: definition and identities, angular measurements, solving triangles, vectors, graphs and logarithms. Prerequisite: MA-112 or acceptance based on placement test score.

MA-128 Introduction to Statistics (3 Credits)
Topics covered in probability include: definitions, theorems, permutations and combinations. Binomial, hypergeometric, Poisson and normal distributions. Topics covered in sampling include: distribution and central limit theorem, estimation and hypothesis testing. Prerequisite: MA-114.

PH-201 General Physics I (3 Credits)
Non-calculus based physics. The course focuses on Mechanics: units, conversion factors: vector diagrams, translational equilibrium, friction, torque and rotational equilibrium: uniformly accelerated motion, projectiles: Newton's Law, work energy and power: kinetic 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, physics of heat transfer; applications. Prerequisite: MA-114.

CH-120 Chemistry
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. Prerequisties: MA-114

GEN ED: ENGLISH, HUMANITIES AND SOCIAL SCIENCE COURSES - 24 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.

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

BUS 174 - Intro to Business & Management (3 credits)
This course presents a survey of the general business and management environment. Topics include an introduction to the various forms of business, organizational structure, and their legal implications. Modern management and supervision concepts, history and development of theory

and practice, the roles of managers, and the relationship between manager and employee are examined. This is a seminar course with emphasis on class discussion and collaborative learning.

BUS-200 Business Communications and Negotiation (3 credits)
This course includes preparation for various kinds of both written and oral business communication. The course will develop and sharpen the critical thinking and writing skills, including report/proposal preparation and presentation, needed in the workplace. Strategies for effective communication and negotiation will also be explored. Prerequisite: EN-101.

BUS-282 Economics for Management (3 credits)
This course is an introduction to economic concepts and analysis. It deals with the relationship between government, business, and the overall economy. The key areas focused on include gross domestic product, the public sector, unemployment, and aggregate supply and demand. The global economy is covered with discussion of issues such as international trade and protectionism. Prerequisite: EN-101

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

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

Humanities Electives (3 Credits)

GENERAL ELECTIVE COURSES: 18 CREDITS

General Elective #1 (3 Credits)
General Elective #2 (3 Credits)
General Elective #3 (3 Credits)
General Elective #4 (3 Credits)
General Elective #5 (3 Credits)
General Elective #6 (3 Credits)

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

6. As an undergraduate program, students will be expected to enroll in all applicable general education courses, as well..

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

   The program will be accredited regionally by Middle States Commission on Higher Education (MSCHE). The program will also receive specialized accreditation by International Accreditation Council for Business Education (IACBE) for its management content. The cybersecurity courses are recognized by NSA/DHS under our cyber degree recognition. Capitol Technology University is currently accredited by all three.

8. **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.

9. **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 Critical Infrastructure 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 on 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 in the on-ground classroom and online environment to facilitate a high-level learning 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, application process, welcome aboard process, orientation, student town halls, and individual counseling.

10. **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 Critical Infrastructure 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 have articulation partners currently. However, it is expected that articulation 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 transfer as seamless as possible and to maximize transfer credits as allowable. There are dedicated transfer student personnel to guide this 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, adjunct) and the course(s) each faculty member will teach.**

   All faculty listed below have been engaged with the university for at least several years. Dr. Butler and Dr. Pittman are fulltime faculty members. Twelve of the fourteen faculty hold terminal degrees. Mr. Cayot and Mr. Craig work in the fields directly associated with cybersecurity and are considered subject matter experts. The university leadership is confident in the quality of the faculty and their abilities to provide a learning environment supportive of the goals of the university for student success. Additional doctorally-qualified faculty will be added as needed.

Instructors who will be engaged with the B.S. in Critical Infrastructure are:

INSTRUCTOR	BACKGROUND	COURSES ALIGNED TO BE TAUGHT
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 Cybersecurity and Computer courses
Dr. Richard Baker Full-tiime	Ph.D. Information Systems M.S. Computer Science B.S. Mathematics	All Critical Infrastructure and Computer Science courses
Dr. Malcolm Beckett Adjunct	D.B.A. Quality Systems Management in Homeland Security and Defense M.S. Information Systems Management	All Critical Infrastructure and Cybersecurity courses

Mr. Gary Burke Full time	M.B.A. B.S. Building Science OHST	All FM and CM courses
Dr. Jami Carroll Adjunct	D.Sc. Cyber Security M.S. Cyber Security M.B.A.	All Cybersecurity courses
Lt. Col. Soren Ashmall, USMC (Ret.) Full time	M.A. Broadcast Journalism B.A. Theatre MOS 3450 Planning, Programming, & Budget Systems Officer MOS 8055 Information Management Officer MOS 0202 Intelligence Officer MOS 2602 Signals Intelligence Officer/Ground Electronic Warfare Officer Licensed Real Estate Agent/REALTOR Facilities Security Officer, National Industrial Security Program (NISP)	All Liberal Arts EN-101 EN-102
Dr. Hasna Banu Adjunct	Ph.D. Theoretical Physics M.S. Mathematics B.S. Mathematics	All MA courses
Dr. George Ford Adjunct	Ed.D. Educational Leadership M.E. Environmental Engineering M.B.A. B.S. Mechanical Engineering Professional Engineer (P.E.)	All Critical Infrastructure, FM and CM Courses
Mr. Mark Opeka Adjunct	Ph.D. Materials Engineering M.S. Materials Engineering B.S. Mechanical Engineering	CH-120, CM-220, CM-260
Dr. Alexander Perry Adjunct	D.Sc. Cyber Security M.S. Computational Mathematics	All Cybersecurity courses
Prof. Nathan Weideman Adjunct	M.S. Astronautical Engineering B.S. Professional Aeronautics	PH-201
Dr. Jason Pittman Full-time	Ph.D. Information Assurance M.S. Network Security B.S. English Literature and Micro-Biology	All Cybersecurity courses
Dr. Gale Pomper Adjunct	D.Sc. Cyber Security M.S. Network Security	All Cybersecurity courses
Dr. Ronald Mau Adjunct	Ph.D. Business M.B.A. M.S. Civil Engineering B.S. Civil Engineering	All Critical Infrastructure, FM and CM Courses
Dr. Craig Capano Adjunct	Ph.D. Civil Engineering with Concentration in Construction Engineering and Management and a focus on Business M.C.S.M. (Master of Construction Science and Management) B.S. Construction Management A.S. Architectural Engineering	All Critical Infrastructure, FM and CM Courses

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

a) Pedagogy that meets the needs of the students

The primary pedadogy 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 upon 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 all members receive the training. Additionally, the sessions are recorded for those faculty who are unable to attend the live training session due to other professional commitments and who are teaching classes.

b) The learning management system

The Department of Online Learning (formerly the university's Department of Distance Learning) and the instructional technology division support the online program needs of faculty and students. Those university organizations and the IT Help Desk provide constant and on-going support to the faculty. The Canvas portion of the program is the online Learning Management System. When a new faculty member is assigned to teach an online course, the Department of Distance Learning provides formal training for that 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 online delivery of teaching and learning to increase learner motivation is the 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 the 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. The 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 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, to ensure all members receive the training. Additionally, the 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 graduate level: M.S. in Computer Science, M.S. in Cyber and Information Security, M.S. in Business and Information Sciences, M.S. in Information Systems Management, M.S. in Internet Engineering, M.B.A., D.Sc. in Cybersecurity, Ph.D. in Business Analytics and Decision Sciences, and Ph.D. in Technology. Therefore, the library is fully prepared to support a B.S. in Critical Infrastructure.

Services provided to on line students include:

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

Capitol Technology University's online library as well as the on-campus library provides faculty and students with reference documents as well as texts appropriate to their learning experiences. Information about those services may be found at: https://www.captechu.edu/current-students/puente-library
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 the Maryland Digital Library Program (MDL). This online electronic service provides access to numerous databases (Access Science, NetLibrary) that will provide access to the materials needed. 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 data science documents. The proximity of the University of Maryland, College Park and other local area research and academic libraries provides the Puente Library with quick access to these materials as well.

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

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 online class platform is web based and requires no additional equipment for the institution. The current Learning Management System, Canvas and Adobe Connect, meets the needs of the degree program. The Business and Technology lab, Computer Science Lab, Cyber Lab, Robotics Lab, and Unmanned Systems Lab together 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 teaching. The capability is provided to all students and faculty in all of 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 Adobe Connect in order 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 Adobe Connect. All syllabi, grades, and assignments must be entered in to 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 time-saving 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 help 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. **Complete Table 1: Resources and Narrative Rationale. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each resource category. If resources have been or will be reallocated to support the proposed program, briefly discuss the sources of those funds.**

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)	$453,523	$1,085,056	$2,072,221	$3,027,650	$4,555,096
a. Number of F/T Students	12	25	50	75	120

b. Annual tuition/Fee rate	$25,619	$26,003	$26,393	$26,789	$27,191
c. Total F/T Revenue (a x b)	$307,428	$650,082	$1,319,667	$2,009,193	$3,262,929
d. Number of P/T Students	15	44	75	100	125
e. Credit Hour Rate	$812	$824	$836	$849	$861
f. Annual Credit Hour	12	12	12	12	12
g. Total P/T Revenue (d x e x f)	$146,095	$434,974	$752,555	$1,018,457	$1,292,168
3. Grants, Contracts and Other External Sources	$0.00	$0.00	$0.00	$0.00	$0.00
4.Other Sources	-$103,765	-$219,540	-$445,906	-$679,251	-$1,103,679
TOTAL (Add 1 – 4)	**$349,758**	**$865,516**	**$1,626,316**	**$2,348,399**	**$3,451,417**

This proposal builds upon an existing degree programs. The majority of the courses exist within the other master's degree programs currently offered by the university.

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

Capitol Technology University has reallocated funds during Year 1 for support of program and course development, online support, office materials, travel, professional development, and initial marketing. There is no substantial impact on the institution because of the reallocation of these funds. The reallocated funds will be recovered after the first year. The program is expected to be self-sustaining after Year 1.

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. **Complete Table 2: Program Expenditures. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year.**

TABLE 2: EXPENDITURES
Courses are taught by adjunct professors.

Expenditure Category	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b + c below)	$108,750	$276,059	$401,541	$585,581	$694,331
a. Number of FTE	1.3	3.3	4.8	7.0	8.3
b. Total Salary	$89,876	$228,148	$331,852	$483,951	$573,827
c. Total Benefits (20% of salaries)	$18,874	$47,911	$69,689	$101,630	$120,504
2. Admin Staff (b + c below)	$4,659	$4,798	$4,942	$5,090	$5,243
a. Number of FTE	0.07	0.07	0.07	0.07	0.07
b. Total Salary	$3,850	$3,966	$4,084	$4,207	$4,333
c. Total Benefits	$809	$833	$858	$883	$910
3. Support Staff (b + c below)	$57,475	$114,950	$172,425	$229,900	$287,375
a. Number of FTE	1.00	2.00	3.00	4.00	5.00
b. Total Salary	$47,500	$95,000	$142,500	$190,000	$237,500
c. Total Benefits	$9,975	$19,950	$29,925	$39,900	$49,875
4. Technical Support and Equipment	$2,543	$6,503	$11,678	$16,380	$22,793
5. Library	$10,000	$10,000	$10,000	$10,000	$10,000
6. New or Renovated Space	$0	$0	$0	$0	$0
7. Other Expenses	$100,000	$75,000	$50,000	$50,000	$50,000

TOTAL (ADD 1-7)	$283,426	$487,310	$650,586	$896,951	$1,069,741

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 implementation of the action plans.

   <u>Academic Year Assessment Events:</u>

   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 University Academic Dean for review and development of implementation plans.
   - Faculty submit performance plans consistent with the mission and goals of the university and department. The document is reviewed and approved with the University Academic Dean.
   - Department Chairs and University Academic Dean review the Graduating Student Survey data.
   - Department Chairs and University Academic Dean review student internship evaluations.
   - Department Chairs and University Academic Dean review grade distribution reports from the spring and summer semesters.
   - Department Chairs and University Academic Dean 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 curriculum. Based on an analysis and evaluation of the results, the University Academic Dean, faculty and the advisory boards will develop the most effective strategy to move the changes forward.

     - NOTE: A complete curriculum review for degrees in the Department of Intelligence and Security Studies occurs every 2 years. In most cases, the changes only require that the University Academic Dean inform the Chief Academic Officer 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 Chief Academic Officer and the Executive Council.

   - University Academic Dean and Vice President for Academic Affairs 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 University Academic Dean meets 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 University Academic Dean review grade distribution reports from the Fall Semester.
- Department Chairs and University Academic Dean review the Graduating Student Survey data.
- Department Chairs and University Academic Dean review student course evaluations from the Fall Semester and the Spring Semester (in May before the Summer Semester begins).
- Department Chairs and University Academic Dean 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 Annual Faculty Summit in May, the faculty review and discuss student learning challenges from the past academic year and provide recommendations to the Academic Dean 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 University Academic Dean meets 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 during 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 University Academic Dean. 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 University Academic Dean to inform the Chief Academic Officer 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 Chief Academic Officer and the Executive Council.

2. **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 Critical Infrastructure will be measured using the instruments identified in Section G and Section M as well as the assigned rubrics and assessment measures (e.g., capstone courses, competency exams/projects) 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 as well as IACBE. The program will be reviewed for accreditation by MSCHE and IACBE. 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 (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 to 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 Academics/Chief Academic Officer to review the 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 University Academic Dean review the student evaluations for every course offered at the university. The Department Chairs and University Academic Dean 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 University Academic Dean. 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. The university has a vice president and team in charge of outcomes and assessment supporting the formal assessment measures.

Cost Effectiveness:

Based on the year-long inputs, evaluations, and reviews described in Section M from faculty, students, industry representatives, and Department Chairs, the University Academic Dean prepares 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 Chief Operating Officer/Senior 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. Special attention is provided to recruit females into the STEM and multidisciplinary programs such as the B.S. Technology and Business Management, B.S. Management of Cyber and Information Technology, M.S. Computer Science, M.S. Cyber and Information Security, M.S. Information Systems Management, Ph.D. Business Analytics and Decision Sciences, and Ph.D. Technology. The same attention will be given to the B.S. in Critical Infrastructure.

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 Critical Infrastructure program.

   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 systems of governance and academic oversight. Please refer to Section G and Section M of this proposal.

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 Dean, 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, goal, 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 Dean monitors any course conversion from in-class to online to ensure the online course is academically equivalent to traditionally offered course and that the technology is appropriate to support the expected rigor and breadth of the programs courses.

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 Intelligence and Security Studies, where this degree will be sponsored, is staffed by qualified teaching chair, and other appropriately credentialed faculty.

   Evaluation of courses/programs are done using the same process as all other programs (please see Section M of this document). All Capitol Technology University faculty teach

in the traditional classroom environment and online. (Please see 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 Adobe Connect 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 track record of supporting degree completion.

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

   Currently employed faculty act as an internal advisory board for program changes including course and program development. All faculty are selected on domain experience and program-related teaching experience.

   When new faculty or outside consults are necessary for the design of courses offered, our 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 experience and program-related teaching experience

   The university online platforms offer several avenues to support instructors engaged in online learning. The Director of our 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 University Academic Dean and chair and through formal meetings

   The assessment for distance learning classes/students is the same as for all 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 post class to the Vice President of Academic Affairs,

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University Academic Dean, and department chairs. On an annual basis, the information is reported to accreditation authorities such as MSCHE and IACBE.

ORIGINAL CHECK HAS A COLORED BACKGROUND PRINTED ON CHEMICAL REACTIVE PAPER - SEE BACK FOR DETAILS

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CAPITOL
Technology University

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CAPITOL TECHNOLOGY UNIVERSITY

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Title Changes:

BS in Construction Management and Critical Infrastructure to BS in Construction Management	$50
BS in Facilities Management and Critical Infrastructure to BS in Facilities Management	$50
AAS Critical Infrastructure to AAS Professional Trades Administration	$50

New Degree Proposal:

BS in Critical Infrastructure	$850

Total	$1000