CAPITOL TECHNOLOGY UNIVERSITY

1927

December 12, 2017

Bradford L. Sims, PhD
President

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 Mechatronics Engineering**. The degree curriculum will be taught using a significant number of existing faculty at our university and is supplemented by new courses supporting the **Bachelor of Science (B.S.) in Mechatronics Engineering**

The mission of Capitol Technology University is to provide practical education in engineering, computer science, information technology, and business that prepares individuals for professional careers and affords the opportunity to thrive in a dynamic world. A central focus of the university's mission is to advance practical working knowledge in areas of interest to students and prospective employers within the context of Capitol's degree programs. The university believes that a **Bachelor of Science (B.S.) in Mechatronics Engineering** is consistent with this mission.

Mechatronics Engineering is a specific need identified by industry and government communities. According to business executives, mechatronics engineering is a skill set of increasing value to employers. It is desirable across many fields, across a variety of job categories and levels of employment. A critical gap between the supply and demand of skilled engineering professional is already reaching crisis proportions. Increasing demand, in turn, translate into a growing need for universities and other academic institutions to develop a program that educate mechatronics engineering professionals at all levels and for all industries.

To respond to industry need, we respectfully submit for approval of a Bachelor of Science (B.S.) in Mechatronics Engineering. The required proposal is attached as is the letter from me as university president confirming the adequacy of the university's library to serve the needs of the students in this degree.

Respectfully,

Bradford L. Sims, PhD

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President

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

Dear Dr. Fielder,

This letter is in response to the need for confirmation of the adequacy of the library of Capitol Technology University to support the proposed Bachelor of Science (B.S.) in Mechatronics Engineering. As president of the university, I confirm that the library resources, including support staff, are more than adequate to support the Bachelor of Science (B.S.) in Mechatronics Engineering. In addition, the university is dedicated to, and has budgeted for, continuous improvement of library resources.

Respectfully,

Bradford L. Sims, PhD

PROPOSAL FOR:

__X__NEW INSTRUCTIONAL PROGRAM

_____ SUBSTANTIAL EXPANSION/MAJOR MODIFICATION

_____ COOPERATIVE DEGREE PROGRAM

__X__WITHIN EXISTING RESOURCES or____REQUIRING NEW RESOURCES

CAPITOL TECHNOLOGY UNIVERSITY

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Institution Submitting Proposal

Fall 2018
Projected Implementation Date

Bachelor of Science
Award to be Offered

Mechatronics Engineering
Title of Proposed Program

0901
Suggested HEGIS Code

14.4201
Suggested CIP Code

Electrical Engineering
Department of Proposed Program

Dr. Nayef Abu-Ageel
University Academic Dean

Dr. Helen Barker
VP Academic Affairs, CAO

hgbarker@captechu.edu
Contact E-Mail Address

240-965-2510
Contact Phone Number

12-12-17
Signature and Date

President/Chief Executive Approval

12-12-2017
Date

Date Endorsed/Approved by Governing Board

Proposed Bachelor of Science in Mechatronics Engineering
Department of Electrical Engineering
Capitol Technology University
Laurel, Maryland

A. Centrality to institutional mission statement and planning priorities:

1. **Program description and relationship to university mission and how it relates to the institution's approved mission.**

Mechatronics Engineering Program Description:

This is a Bachelor of Science degree in Mechatronics Engineering. The focus is on Mechatronics Engineering -- the fusion of engineering and computer science disciplines – vice the technology and robotics within Mechatronics Engineering. This is a multidisciplinary degree where the curriculum provides significantly greater depth in mathematics, multiple engineering disciplines, and computer science than the other degree submitted by Capitol Technology University (i.e., the Bachelor of Science in Robotics and Mechatronics Engineering Technology). This degree does not have robotics courses. Instead, this degree requires extensive depth in the knowledge space where electrical systems, mechanical systems, control systems and computers intersect, overlap, and interact. This degree has been designed to meet the most stringent accrediting requirements of the Accreditation Board for Engineering and Technology (ABET) as well as the Middle States Commission on Higher Education (MSCHE). As a result, the university has submitted two distinct degree requests.

The Bachelor of Science (B.S.) degree in Mechatronics Engineering provides the student with the necessary knowledge and training to become a professional in the diverse field of Mechatronics Engineering. Mechatronics Engineering is a multidisciplinary segment of the engineering field. Rather than embrace traditional divisions of engineering as distinct entities, the Mechatronics Engineering degree combines electrical engineering, computer engineering, mechanical engineering, control engineering, telecommunications engineering, robotics and cybersecurity. The result is the unification of principles from the various disciplines to create a more economic, reliable, and simplified system. Mechatronics Engineering engineers are the link between technicians and engineers, and work from conception of a project to the completion of the project.

Relationship to Institutional Approved Mission:

The B.S. in Mechatronics Engineering is consistent with the University mission to educate individuals for professional opportunities in engineering, computer science, information technology, and business. We provide relevant learning experiences that lead to success in evolving global community. Fundamental to the degree programs in the Department of Electrical Engineering are opportunities to produce skilled systems-oriented engineers. The B.S. in Mechatronics Engineering 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 2018-2019 and forecasted budgets going forward.

The degree will be offered in the traditional classroom environment as well as in hybrid [simultaneous online (synchronous) and traditional classroom] format. This results in the convenience required by the 21st century learner, and provides 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 an internship, thereby providing the student the necessary practical experience the University believes critical to success in the modern aviation environments. The degree is consistent with the interdisciplinary nature of the University as well as the field of engineering.

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.*

This new instructional program supports all those goals. It does so, in part, because of the cross disciplinary nature of the program. This approach builds upon already successful areas of study such as the Bachelor of Science degrees in Electrical Engineering, Computer Science, Astronautical Engineering, and Cyber Security. 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. Mechatronics Engineering degree allows these students to move their skills and careers to the next level within the evolving innovative global technical community.

Companies are competing to come up with products that excel in terms of their innovation, durability and performance. This requirement has enhanced the need for the field known as Mechatronics Engineering. Mechatronics Engineering is a fast-growing interdisciplinary industry. Leveraging on its increasing relevance, Mechatronics Engineering is extremely active across

many industries, such as aerospace, automotive, chemical processing, health care, manufacturing and mining. The B.S. in Mechatronics Engineering degree answers the growing demand for highly trained personnel in Mechatronics Engineering -- making the degree extremely relevant now and in the future.

The new B.S. in Mechatronics Engineering is fully supported by the university's Vision 2025 and Strategic Plan 2019-2020. Funding to support the degree has been included in forecasted budgets going forward. The expected increase in students as a result of the addition of this degree is expected to have a significant positive affect on the departmental and institutional budgets.

The University has active partnerships (e.g., Leidos, Patton Electronics, Lockheed Martin, Northrup Grumman, and Cyber Security Forum Initiative, IRS, SAS, NASA, Textron) at the private and public level. The Mechatronics Engineering 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. The increase in partnerships and placement of our interns and graduates in our partner institutions will serve to expand enrollment and reputation. While additional enrollment will increase financial resources, additional partnerships and grants in this field of study will help diversify and increase financial resources.

A Mechatronics Engineering Engineer determines how to improve production in manufacturing by developing new machinery or tools. Before implementing changes to the production process, the mechatronics engineer considers factors such as assembly line efficiency and costs, while using specialized software to perform tests on various ways to make improvements. Other names for this job might include Automation Application Engineer, Automation Engineer, Automation Specialist, Business Owner/Engineer, Control Integration Engineer, Control Systems Engineer, Controls Engineer, Design Engineer, Design Engineering Manager, Development Engineer. A bachelor's degree in a field such as Mechatronics Engineering is generally required for this career.

Mechatronics Engineering combines aspects of mechanical, electronic, and computer engineering to increase efficiency in the production and function of manufactured goods. Accordingly, Mechatronics Engineering engineers study aspects of fluid mechanics, control theory, and computer programming. Mechatronics Engineering engineers create and improve automated processes. For example, Mechatronics Engineering engineers may review an assembly line and determine that welding processes on the assembly line are inefficient. Next, engineers may use cost-analysis to highlight an estimated amount that could be gained by improving the system. If superiors approve their project, Mechatronics Engineering engineers may then use computer-aided design software to develop and test potential solutions, such as better machines or welding equipment. Once a new system has been tested and decided upon, engineers may help implement the machinery and controls. The demand for Mechatronics Engineering systems personnel is rapidly growing. The B.S. in Mechatronics Engineering degree answers the growing demand for highly trained personnel in Mechatronics Engineering Systems -- making the degree extremely relevant now and in the future.

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.

KnowledgeWorks, a national educational organization, observes that we are in a new phase in the speed and rate of change in our society. The organization states that "[o]ver the next decade, our lives will become so inextricably linked with our digital companions that we will find ourselves living as partners in code, creating the next generation of human digital co-evolution." KnowledgeWorks captures the very essence and pressing need for Mechatronics Engineering professionals.

> We are rapidly entering a new era in which our economy, our institutions, and our societal structures – indeed, the very bedrock of our lives – are shifting at an accelerating pace. This new era promises to change learning so dramatically that both the ways in which education prepares learners and the reasons why people pursue learning could look drastically different than they do today.
>
> Many factors are contributing to this era shift, among them new social norms, organizational approaches, and economic models. Above all, exponential advances in digital technologies are changing our world at an unprecedented pace.
>
> Our devices are becoming increasingly smaller, more efficient, connected, and affordable. We do not just use them; we wear them as extensions of our bodies and adornments to ourselves. Data is captured in vast amounts, creating ever more detailed images of our realities, behaviors, and patterns. Increasingly sophisticated computational tools and algorithms are ushering in smart machines such as driverless cars; robots that work alongside humans; and digital helpers that can think, learn, anticipate our needs and wants, and even create art. Such developments are disrupting organizational and business models, reconfiguring civic relationships, and changing the role of employment in people's lives. They will also have a profound effect on how, when, and why people learn.
>
> Source: http://www.knowledgeworks.org/future-learning-education-era-partners-code?mkt_tok=eyJpIjoiTWpJMU5UZGtaVGswTVdOaSIsInQiOiJ1Y2hhd0lqbUpPUmdcL0NTRlNaNERidGxJd0J0ejdFcVVTZW9YT0RaZ2dvWDZcLzZpWnNVVE1kNGZiSWFrdGt6SE5xcjlseDlcL3VrTjJnamQ2aTFHeDdabUFNWlN1Nk5laWpVeWxQQ0QxRDJcL2JUV0lDQ0tUVVQ4bjdwRmRhczhoSFYifQ%3D%3D

The use of robotics is no longer just a storyline in a movie or cartoon. The world of Mechatronics Engineering is already here in our daily lives. The beginning of a new type of revolution is already in progress.

> Australian company Fastbrick Robotics has developed a robot, the Hadrian X, that can lay 1,000 standard bricks in one hour – a task that would take two human bricklayers the better part of a day or longer to complete.
>
> In 2015, San Francisco-based startup Simbe Robotics unveiled Tally, a robot the company describes as "the world's first fully autonomous shelf auditing and analytics solution" that roams supermarket aisles alongside human shoppers during regular business hours and ensures that goods are adequately stocked, placed and priced.
>
> Swedish agricultural equipment manufacturer DeLaval International recently announced that its new cow-milking robots will be deployed at a small family-owned dairy farm in

Westphalia, Michigan, at some point later this year. The system allows cows to come and be milked on their own, when they please.

Data from the Robotics Industries Association (RIA), one of the largest robotic automation advocacy organizations in North America, reveals just how prevalent robots are likely to be in the workplace of tomorrow. During the first half of 2016 alone, North American robotics technology vendors sold 14,583 robots worth $817m to companies around the world. The RIA further estimates that more than 265,000 robots are currently deployed at factories across the country, placing the US third worldwide in terms of robotics deployments behind only China and Japan.

Source: https://www.theguardian.com/technology/2017/jan/11/robots-jobs-employees-artificial-intelligence

Capitol Technology University feels very strongly that the state of Maryland should be a leader in the technological change where the previously separate areas of engineering, computer science, and robotics are fused and intertwined in our daily lives and businesses. By training the Mechatronics Engineering professionals at the university-level within the state, Maryland can be at the forefront of the Mechatronics Engineering education process, lead innovation in this emerging area, and supply tomorrow's leaders in this important field.

The ability of Mechatronics Engineering engineers to significantly enhance a business' revenue and profit is detailed in a White Paper case study on the Beyerdynamic, a small business audio equipment manufacturer. Beyerdynamic wanted to increase its factory floor productivity by 50% on a 4-year plan. The increase had to be done in its already at-capacity production space, with the same number of employees initially, and without compromising the brand's high-quality standards. The company turned to a Mechatronics Engineering firm to provide a solution. Beyerdynamic's Manufacturing Engineer Jörg Lang provided the results:

1. An immediate 50-percent in factory floor productivity in a limited space.
2. An immediate 50-percent increase in the quality index.

Sources:
1. https://robotiq.com/resource-center/case-studies/doubled-production-on-limited-floor-space?hsCtaTracking=40362c59-a2a7-45b3-a915-566c9af9da21%7Cf11b45db-03a6-489d-9c63-22f6bfdf0e15
2. https://blog.robotiq.com/hubfs/Beyerdynamic%201-Pager%20(1).pdf?t=1512142010960

The case study is a clear example of how the emerging field of Mechatronics Engineering is the future driver for economic growth within the business sector and can directly increase a company's quality as well as the bottom line.

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

The need to further expand the educational opportunities and choices for minorities and educationally disadvantaged students is critical to the economic strength and viability of Maryland and the nation.

According to a U.S. Census Bureau report cited by the American Speech-Language-Hearing Association (ASHA), "[b]y 2050, it is projected that the minority population will represent approximately 50% of the total U. S. population, meaning ethnically and racially diverse people may no longer be a numerical minority (US Census Bureau)." The issue has been highlighted for over 25 years. However, the tipping point is now within the lifespan of every school age and working age person within the United States.

> The minority labor force is an important source of labor in the 21st century. The majority of jobs in today's technologically oriented society need knowledge and skills that require a college education (Carnevale & Fry, 2000; George, Neale, Horne, & Malcolm, 2001; Heller, 2001; Ntiri, 2001).
>
> Predicted labor shortages in corporate America and in many professions make it essential that the corporate world increase the number of minorities and women with the skills necessary to fulfill their labor demand (Bruner, 2000; Carnevale & Fry, 2000; Ntiri, 2001). As the proportion of white males available decreases in the 21st century, the lack of a skilled labor force can curtail America's economic growth significantly...

Source: https://www.asha.org/practice/multicultural/recruit/litreview.htm

The salaries available to college graduates of STEM programs are highly attractive and will provide a comfortable living upon graduation and in the future. Specifically, the salaries of Mechatronics Engineering Engineers are no exception.

According to BLS, the average annual salary of Mechatronics Engineering Engineers is $99,250. Entry-level Mechatronics Engineering Engineers who starts out at the entry-level average of $71,490 can expect to make $97,300 after 3-5 years of experience in the field. The salary for highly experienced Mechatronics Engineers is typically over $152,970.

Source: http://www.owlguru.com/career/mechatronics-engineers/salary/

Capitol Technology University has a long history of serving the minority population. The university has a 51% minority student population with 7% undisclosed. Thirty-four percent of our minority population is African American. The proposed B.S. in Mechatronics Engineering is consistent in all aspects with the university's history, mission, and demographics.

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

The 2013-2017 Maryland State Plan for Postsecondary Education articulates six goals for postsecondary education:

1. Quality and Effectiveness
2. Access, Affordability, and Completion
3. Diversity
4. Innovation

5. Economic Growth and Vitality
6. Data Use and Distribution

Goal 1

The B.S. in Mechatronics Engineering program, with its rigor, will produce highly qualified Mechatronics Engineering professionals for an emerging field of study and employment. The university has a proven record of quality education. In addition to regional accreditation, the Accreditation Board for Engineering and Technology (ABET) accredits engineering and technology degrees. The B.S. in Mechatronics Engineering program is consistent with the ABET criteria for the delivery of high quality engineering and technology education. Faculty and staff are engaged in faculty development to remain current in their field of teaching as well as to expand knowledge across disciplines. 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. Capitol is a transfer friendly institution and participates in multiple programs for government and military credit transfer. Capitol Technology University participates in ARTSYS and has multiple transfer agreements with local institutions at all degree levels.

Goal 2

The courses for the B.S. in Mechatronics Engineering will be offered in the traditional classroom environment as well as in hybrid (simultaneous online real-time (synchronous) and traditional classroom) format. 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 for the student potential grants, scholarships, and state plans to reduce potential student debt. The net cost vs 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 as to academic readiness and degree requirements. The specific success pathway is developed for each student.

The university tuition increases have not exceeded 3%. The university 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 break.

The university has in place services, tutoring, and other tools to help ensure student graduation and successful job placement. The university has a job placement guarantee, which is supported by mandatory personal and professional growth opportunities.

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

Goal 3

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 supports various clubs that identify with diverse groups including race, gender, military/veterans, and sexual orientation. The university has a 51% minority student population with 7% undisclosed. Thirty-four percent of our minority population is African American. The university has a military/veteran population of 22%. The university has a 17% female population -- which is significant given its status as a technology university.

Achievement gaps: The university provides summer remedial programs offering students with math and English deficiencies to take those courses at no charge the summer prior to entering the university. Free housing is available for these students. This provides the opportunity to enter the freshman year at an improved academic readiness level. There are situations where the community college best serves student needs in these areas. The university partners with local community colleges to allow students to get increased support after which, under a transfer agreement, the student transfers back to the university.

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 such things a team projects and grants across degrees. This has proven effective at supporting multiple aspects of diversity.

Goal 4

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 has the agility to integrate new technologies into the curriculum to better prepare students for the work environment. The university designs curriculum in alliance with accreditation and regulating organizations/agencies.

The university 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 some courses in the degree. This all occurs in parallel with traditional proven learning strategies. These elements of the university learning environment are purposeful and intended to improve the learning environment for both the student and faculty member. In addition, these elements are purposely designed to increase engagement, improve outcomes, and improve retention and graduation rates. The university believes that innovation is the key to successful student and faculty engagement.

Example: The university engages its students in 'fusion' projects, which allows students to contribute skills in interdisciplinary projects such as those in our Astronautical Engineering

and Cyber Labs where students become project managers (to send a CubeSAT on a NASA rocket) and data analysts (analyze rainforest data for NASA). We are recruiting partners for this potential degree for which real projects will provide students integrative learning opportunities.

The university 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.

Goal 5

One of the overarching principles of Capitol Technology University's approach to education is to instill a zeal for life-long learning in our students, which promotes economic growth and vitality of the student. Analytics inherently supports a knowledge based economy. University partnerships both current and future will provide economic growth opportunities for its students, the university, and its partners. The university's B.S. in Mechatronics Engineering provides opportunities for undergraduate students to engage in high level research partnerships. The university is committed to partnering with Maryland institutions to employ our graduates to keep the talent in the state. The university instills in students an entrepreneurial attitude preparing them to bring skills to startup businesses or start a business of their own.

Goal 6

Capitol Technology University is committed to data collection and disclosure beyond the requirements of regulations and accreditation. Data is publicly available on the university website. Assessment for the university is the responsibility of the VP of Academic Affairs. Highly skilled personnel are required in a timely manner to accumulate the data, analyze the data, distribute the results, and recommend potential decisions to achieve the desired outcomes. In addition, data is evaluated by the dean, chairs, faculty, advisory boards, trustees, university executives, etc. to make the best decision possible.

C. Quantifiable & reliable evidence and documentation of market supply and demand in the region and State:

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

   The future of higher education and the STEM fields is the fusion and integration of multiple areas as technology advances at an exponential pace. The once disparate fields of mechanical engineering, electronics, computer engineering, telecommunications engineering, systems engineering, control engineering, computer science, and cybersecurity are at the forefront of the subfields of engineering, electronics, and computer science adapting. In a recent article for the Robotiq.com website, industry expert Samuel Bouchard highlights the fast-paced trend and growing need for Mechatronics Engineering professionals.

While this degree does not focus exclusively on robotics (i.e., mechatronics is focused more on the broader electrical-mechanical arena), it does reflect many of the needs of industrial robotics given the overlap of the two areas. The current shortage of skilled labor and the aging population within the U.S. means that industrial robots will be required to play an even greater role in the country's economic well-being in the future. The requirement for increased mechatronics and robotics knowledge and skills will permeate both the shop floor and the robotics staff. About 90% of manufacturing companies in the U.S. that could use robots still do not use them even though they face challenges in finding skilled workers. Part of the evolution within information technology, is the use of mechatronics to make things more efficiently, perform complex tasks without error, and solve existing challenges. Even though the evolution will continue at a rapid pace across society, industrial robotics -- within the context of mechatronics -- will play an increasing role in increasing the efficiency and viability of multiple sectors of the economy.

Source: https://blog.robotiq.com/bid/52878/Industrial-robotics-7-reasons-why-young-engineers-should-get-into-it

The explosion in the use of Unmanned and Autonomous Systems (UAS) is another area where Mechatronics Engineering engineers will be required. Mechatronics Engineering engineers are needed to create the next generation of airborne, waterborne, and land-based "drones." All types of new Unmanned and Autonomous Systems are rapidly coming on the market; those "drones" are being used in every type of business setting where cost can be minimized and human safety can be maximized. The following chart shows the billions of dollars already being spent in the Unmanned and Autonomous Systems market. All estimates show this area growing at an exponential rate. The need for Mechatronics Engineering engineers in this fast-growing field will mirror the ongoing and future exponential growth in the use of "drones."

DRONES AT WORK: BUSINESS & CIVIL GOVERNMENT

Drones are already generating climate data, monitoring the borders and more—and they're just scratching the surface of their commercial potential.

THE JOB OPPORTUNITIES
Total Addressable Market by Industry/Function
(Millions of Dollars)

• Construction	$11,164
• Agriculture	$5,922
• Insurance Claims	$1,418
• Offshore Oil/Gas and Refining	$1,110
• Police (US)	$885
• Fire (US)	$881
• Coast Guard (US)	$511
• Journalism	$480
• Customs and Border Protection (US)	$380
• Real Estate	$265
• Utilities	$93
• Pipelines	$41
• Mining	$40
• Clean Energy	$25
• Cinematography	$21

Source: Goldman Sachs Research
Source: (http://www.goldmansachs.com/our-thinking/technology-driving-innovation/drones/)

2. **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.**

Engineering professional associations and interest groups are predicting an explosion in the growth of Mechatronics Engineering engineers. Those engineers will be pivotal players in business growth from manufacturing to the combat operations.

> Engineering positions associated with robotics often entail designing and maintaining robotics technology as well as developing new uses for them. Almost all modern factories utilize some form of robotics to perform repetitive tasks that can be done faster by a robot than a human without ever getting fatigued or there being a reduction in efficiency.
>
> The field of robotics has been steadily growing in recent years and the demand for robotic engineers is expected to increase by more than 13% over the next 5 years making it one of the best engineering degrees available for the future.
>
> Robotics-related employment is on the increase as demand grows and technology advances allowing robotics to be used more extensively. It is already essential to most manufacturing environments and is proven to increase production.
>
> Another area where robotics already play a role is in the military, where robots have been used as far back as WW2 for detecting mines. Unmanned aircraft are used extensively to gather intelligence, while remote controlled armed ground robots have been used in Iraq in a limited capacity already. This is just the beginning with Robots expected to actively participate in combat and eventually help reduce the loss of human life while in combat.
>
> It is also expected to expand into industries currently not utilizing robotics (or only in a limited capacity) such as the medical field, particularly surgical procedures where robotics are already being tested and emergency services such as fire and rescue. The future of robotics engineering is an exciting one with plenty of scope for advancement and secure employment over the long term.
>
> Source: https://typesofengineeringdegrees.org/robotics-engineering/

The pace of change in the workplace is staggering in terms of the importance of Mechatronics Engineering, increase in salaries, and technological advancement. The U.S. Edition of The Guardian website states the developments are striking.

> By 2019, 30% or more of the world's leading companies will employ a chief robotics officer, and several governments around the world will have drafted or implemented specific legislation surrounding robots and safety, security and privacy. By 2020, average salaries in the robotics sector will increase by at least 60% – yet more than one-third of the available jobs in robotics will remain vacant due to shortages of skilled workers…

> Meanwhile, developments in motion control, sensor technologies, and artificial intelligence will inevitably give rise to an entirely new class of robots aimed primarily at consumer markets – robots the likes of which we have never seen before. Upright, bipedal robots that live alongside us in our homes; robots that interact with us in increasingly sophisticated ways – in short, robots that were once the sole province of the realms of science fiction.
>
> This, according to [Dr Jing Bing] Zhang [one of the world's leading experts on the commercial applications of robotics technology], represents an unparalleled opportunity for companies positioned to take advantage of this shift…

For Maryland and Capitol Technology University, these rapid advances create a similar unparalleled opportunity to be at the forefront of a seismic in shift the needs of higher education and the businesses that will thrive in the future.

3. Data showing the current and projected supply of prospective graduates.

The Manpower Group, in the results of its 2016-2017 U.S. Talent Shortage Survey, states that engineers have consistently been one of the hardest jobs to fill in the U.S., appearing on its Top 10 Hardest to Fill Job List for 10 of the past 11 years. The engineering field has the fourth largest shortage globally and the ninth largest shortage in the United States with no signs of the trend changing.

Source: http://www.manpowergroup.us/campaigns/talent-shortage/assets/pdf/2016-Talent-Shortage-Whitepaper.pdf

The severe shortage of engineers has created one of the lowest job unemployment rates and made the field a very attractive career. In a recent article in September 2017, the Huffington Post highlighted continuing problem.

> Getting an engineering degree has proven to be a lucrative decision for most people because of the industry's extremely low unemployment rate. In fact, U.S. companies have been struggling with a severe shortage of engineers that can make it seem virtually impossible to remain fully staffed, especially in some parts of the country.
>
> Experts have estimated that there's only one qualified engineer for every 1.9 engineering jobs, so it's not surprising that a worker shortage exists.

In the past, U.S. companies would normally fill this type of shortage with foreign workers using the H-1B Visa Program. However, President Trump signed an executive order this year that makes this approach much more difficult for companies to use. As a result, the shortage in engineers -- including those in the emerging areas of Mechatronics Engineering – is expected to get worse.

Source: https://www.huffingtonpost.com/entry/how-the-engineering-shortage-helped-field-engineer_us_59a80205e4b096fd8876c0bb

The firm Experis Engineering states in its "Focus on Engineering 2017" White Paper that the demand for engineers is not going away. It also points out those in the engineering field are happy with their career and intend to stay.

> Engineers are still overwhelmingly satisfied with their profession (96%) and they intend to remain in the field of engineering for the duration of their career (97%). In addition, 95% of engineers are likely to recommend engineering as a career, which is important because the promotion of the field of engineering is key to building the talent needed for tomorrow's jobs.

Given the disparity between the supply of engineers and the overwhelming demand in the marketplace, the report shows that an opportunity exists for Maryland to simultaneously strengthen its economy, reduce unemployment, educate its residents for well-paying jobs, and spur new technological innovation.

Source: http://www.experisjobs.us/Website-File-Pile/Whitepapers/Experis/engineering-whitepaper.pdf

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 other similar programs in the state or geographical area that offer a B.S. in Mechatronics Engineering. There are 34 programs in the state that offer bachelor's degrees in engineering; those existing degrees are primarily in General Engineering, Systems Engineering, Telecommunications Engineering, Mechanical Engineering, Ocean Engineering, Civil Engineering, and Environmental Engineering. However, those programs follow the traditional engineering education tracks. Capitol Technology University is proposing a bachelor's degree that is distinctly different from the existing programs. Mechatronics Engineering is a multidisciplinary segment of the engineering field. Rather than embrace the traditional divisions of engineering as distinct entities, Mechatronics Engineering combines electrical engineering, computer engineering, mechanical engineering, telecommunications engineering, control engineering, computer science, robotics and cybersecurity into a multidisciplinary field.

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

   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 and delivery to related learning outcomes consistent with Regulation .10 of this chapter:

1. **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:

   Mechatronics Engineering Program Description:

   The Bachelor of Science (B.S.) degree in Mechatronics Engineering provides the student with the necessary knowledge and training to become a professional in the diverse field of Mechatronics Engineering. Mechatronics Engineering is a multidisciplinary segment of the engineering field. Rather than embrace traditional divisions of engineering as distinct entities, the Mechatronics Engineering degree combines electrical engineering, computer engineering, mechanical engineering, control engineering, telecommunications engineering, robotics and cybersecurity. The result is the unification of principles from the various disciplines to create a more economic, reliable, and simplified system. Mechatronics Engineering engineers are the link between technicians and engineers, and work from conception of a project to the completion of the project.

   Description of program requirements:

   Entrance requirements: Have earned a high school diploma or GED. Students must have achieved a minimum of a 2.2 GPA in high school. Submit official transcripts of all prior academic work completed at community colleges, colleges, or universities you've attended. Submit SAT (minimum 800) or ACT (minimum 15) scores. Interview with a Capitol Technology University admission counselor. There are no special criteria for this degree.

   To be eligible to be graduated by the university students must have successfully completed all program course requirements, be in good academic standing (GPA 2.0 or higher), satisfied all financial obligations, any other outstanding obligations to the university.

   Degree Requirements:

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

   TECHNICAL – 66 CREDITS
   MECHATRONICS ENGINEERING ENIGINEERING TECHNOLOGY
   CORE COURSES

   EL-100 Introduction to DC/AC Circuits (3 Credits)

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

EL-150 DC/AC Circuits and Analysis (3 Credits)
Applications of Kirchhoff laws to multiple source and complex series-parallel circuits. Determinants and matrices. Mesh and nodal analysis. Network Theorems: Thevenin, Norton, superposition, maximum power transfer. Review of complex number manipulation. Application to capacitive and inductive circuits, impedance. Complex Mesh analysis. Network theorems applied to complex RLC networks. Frequency response of RL and RC circuits. Plotting frequency response. Bode plots. Laboratory emphasis on the use of standard test equipment to verify theory. MATLAB Part II: input and output statements, importing data from spreadsheets, text files and other formats into MATLAB, conditional statements, loops, arrays, array functions. Prerequisites: EL-100 Corequisite: Math (MA-114 or MA-114 Placement Test equivalent or MA-261 or MA-261 Placement Test equivalent).

EE-155 Intro to Materials Science (3 Credits)
Origin and behavior of materials. Classifications of materials. Physical metallurgy-mechanical and physical properties, crystalline structure, imperfections in solids, phase diagrams, failure mechanisms in materials, hardening and tempering, isothermal diagrams. Involves hands-on experiences through lab sessions in the use of metallurgical and mechanical testing equipment. Lecture and laboratory. Prerequisites: CH 120.

EL-200 Electronic Devices & Circuits (3 Credits)
Principles and characteristics of semiconductor devices. Devices covered include diodes, Zener diodes, bipolar junction transistors, field-effect transistors, and operational amplifiers. Includes bias networks, operating points, maximum output and optimum bias, and DC and AC load lines. Input and output impedances, and voltage and current gains for each amplifier configuration. Prerequisite: EL-150 or EE-159.

EL-204 Digital Electronics (3 Credits)
Number systems, including binary, octal and hexadecimal bases. Binary arithmetic. Boolean algebra, Karnaugh map simplification. Design of combinational circuits. Decoders, multiplexers, flip-flops and other multi-vibrator circuits. Logic families including TTL, CMOS, ECL and others. Memory, shift registers and counters.

EL-262 Microprocessors and Microassembly (3 Credits)
Introduction to microprocessors. Architecture. Fetch and execute cycles. Microprocessor instruction set and assembly language programming. Hardware configuration, pin functions and modes of operation of a typical microprocessor. Basic I/O timing, control and memories. Prerequisite: EL-204.

EE-210 Engineering Mechanics - Statics (3 Credits)

Fundamental concepts and conditions of static equilibrium; their application to systems of forces and couples acting on rigid bodies; and the calculation of centers of gravity, centroids, and moments of inertia. Prerequisites: MA-261. Corequisite: PH-261.

EE-220 Principles of Mechatronics (3 Credits)
This course will introduce you to Mechatronics as a multidisciplinary engineering discipline that includes electronics, electrical, mechanical, computer systems engineering, together with information technology. Theory lectures will introduce the core components of mechatronic systems: electrical and electronic components and circuits, sensors and actuators. In laboratory work, you will work on putting theory into practice in the context of a challenging project that is at the core of a national design and build competition. This course significantly develops the generic skills of teamwork, planning, leadership, and communication. Conventional lectures will be given on the theoretical aspects of these graduate capabilities. You will then apply these skills in the completion of specific learning activities such as design project, report, testing and prototyping. The dry run testing of the prototype Mechatronics mechanisms will provide an opportunity for you to receive feedback. Prerequisites: EL-150 and EL-215.

EL-215 Intro to Engineering Design CAD (3 Credits)
Introduction to computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and manufacturable marketable product. Application to design, manufacturing, and analysis using geometric tolerancing and dimensioning. Two hours lecture and three hours laboratory.

EE-330 Fluid Mechanics (3 Credits)
Continuum, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernoulli equations, viscous flows, boundary layers, flow in channels and around submerged bodies, one-dimensional gas dynamics, turbo-machinery. Applications in hydraulic, pneumatic, and fluidics discussed. Two hours lecture and three hours laboratory. Prerequisites: EE-310 and MA-263.

EE-340 Systems Engineering (3 Credits)
An interdisciplinary course with both technical and management aspects of large, multifaceted engineering projects. Special emphasis placed on design, implementation, and improvement of mechatronic systems. Topics include systems engineering, engineering management, economics, quality control and engineering, project management, production systems planning and operations, and human factors. Prerequisites: EL-215, BUS-301.

EE-310 Engineering Mechanics – Dynamics (3 Credits)
Kinematics of particles in rectilinear and curvilinear motions. Kinetics of particles, Newton's second law, energy and momentum methods. Systems of particles, Kinematics and plane motion of rigid bodies, forces and accelerations, energy and momentum methods. Introduction to mechanical vibrations. Prerequisites: EE-210 and MA-262.

EE-370 Electronics and Instrumentation (3 Credits)
Introduces use and analysis of electronic circuits and input mechanism of various sensors, design of analog signal conditioning systems based on the system requirement, as well as understanding the theory and the art of modern instrumentation and measurements (I&M) systems. Topics include BJT and MOSFET circuit model and analysis; operational amplifier; instrumentation amplifier; survey of sensor input mechanisms; analog signal conditioning and sensor application;

measurement system architecture; errors in measurement; standard used in measurement. Two hours lecture and three hours laboratory. Prerequisite: EL-200.

EE-353 Power Systems Engineering (3 Credits)
Fundamentals of power transmission and electric motors. Single versus three-phase, poly-phase systems, synchronous, asynchronous machines. DC and compound DC motors, induction motors. Equivalent circuit modeling of motors. Start-up conditions. Transformers, transmission of electrical energy, energy distribution and harmonics, Prerequisites: EL-150 and MA-261.

EE-375 Engineering Safety (3 Credits)
Safety and health in the manufacturing, construction, and utilities industries, including pertinent laws, codes, regulations, standards, and product liability considerations. Organizational and administrative principles and practices for safety management and safety engineering, accident investigation, safety education, and safety enforcement.

EE-380 Mechanics and Materials (3 Credits)
Plane stress, plane strain, and stress-strain laws. Application of stress and deformation analysis to members subjected to centric, torsional, flexural, and combined loading. Introduces theories of failure, buckling, and energy methods. Prerequisites: EE-150, EE-210, and MA 262.

EE-385 - Kinematics and Dynamics of Machinery (3 Credits)
The kinematics and dynamics of machinery and its applications to mechatronic systems. Analysis of motion translation/rotation in machinery, energy of machine mechanisms. Involves projects, seminars, and workshops regarding graphical, analytical, and numerical techniques for dynamic analysis and synthesis of machines. Two hours lecture and three hours laboratory.
Prerequisite: EE-310.

EE-430 Mechatronic System Design (3 Credits)
Presents specifics in the mechanical design of mechatronic systems. Includes problem analysis, conceptualization, design/material selection, and performance analysis. Addresses mechanical subsystems, bill of materials, and economic analysis of the system. Two hours lecture and three hours laboratory. Prerequisites: EE-330 and EE-385.

EE-432 Programmable Logic Controllers and Networks (3 Credits)
Introduces programmable logic controllers (PLCs). Emphasizes ladder diagrams and programming of PLC. Introduces network systems such as DeviceNet, ProfiNet, and ProfiBus. Emphasizes the integration of PLCs in automation systems. Two hours lecture and three hours laboratory. Prerequisites: EL-204 and EE-370.

EE-450 Automation Systems Design (3 Credits)
Capstone design project. Design and analysis of a complete mechatronic system using controllers, sensors, and actuators. Advance systems programming with current industrial network programs and GUIs. Implementation of project and process management principles as well as professional documentation and presentation. Two hours lecture and three hours laboratory. Prerequisites: EE-430 and EE-432.

EE-453 Control I (3 Credits)
Introductory concepts. Feedback control systems and derivation of transfer function. System response for undamped and damped systems. Testing for system stability, coefficient test, Routh-

Hurwitz technique. System performance, system types, steady state error and error coefficients calculation. Design of compensator. System bode plots, crossover frequencies, gain and phase margins. The course will stress use of a variety of famous industrial computer-aided control system design software packages. Prerequisite: MA-340.

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

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

GENERAL EDUCATION - 24 CREDITS

BUS-301 Project Management (3 Credits)
This course is a full range introduction to project management. It covers the origins, philosophy, methodology, and involves actual applications and use of tools such as MS Project. The System Development Cycle is used as a framework to discuss project management in a variety of situations. Illustrative cases are used and project leadership and team building are covered as integral aspects of good project management. Prerequisite: EN-101.

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. Prerequisite: 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.

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.

Social Sciences (SS) Elective – one course (3 Credits)

Humanities (HU) Electives – two courses (6 Credits)

MATHEMATICS AND SCIENCE - 30 CREDITS

MA-261 Calculus I (4 Credits)
Topics covered include: lines, circles, ellipses, functions and limits, differentiation, power rule, higher-order derivatives, product, quotient and chain rules, implicit differentiation, applications. Topics in integration include: definite integrals; indeterminate forms; exponential, logarithmic, trigonometric and hyperbolic functions; differentiation and integration, graphing. Prerequisite: MA-114.

MA-262 Calculus II (4 Credits)
Methods of integration: completing the square, substitution, partial fractions, integration by parts, trigonometric integrals, power series, parametric equations. Partial derivatives. Directional derivatives. Introduction to multiple integrals. Prerequisite: MA-261.

MA-263 Calculus III (4 Credits)
Multivariable and vector calculus. Integrals in two and three-dimensional coordinate systems. Cylindrical and spherical coordinates. Vector functions and their derivatives. Gradients, divergence and curl. Stokes theorem, Green's theorem, Gausses theorem. Prerequisite: MA-262.

MA-340 Ordinary Differential Equations (3 Credits)
Methods of solving first order equations with applications to mechanics and rate problems. Solutions of second order equations by undetermined coefficients and variations of parameters. Applications to circuits. Introduction to systems of equations and operational and numerical methods. Prerequisite: MA-262.

CH-120 Chemistry (3 Credits)
Metric system and significant figures; stoichiometry; fundamental concepts of atomic structure and its relationship to the periodic table; electron configuration; bonds and electronegativity; gases; oxidation states and redox; solutions, acids and bases, changes of state, thermodynamics,

chemical kinetics and equilibrium. Prerequisite: MA-114.

PH-261 Engineering Physics I (4 Credits)
Calculus-based physics. Displacement, velocity and acceleration, equations of motion, Newton's laws of motion and their applications, gravitation, work and energy, impulse and momentum, conservation laws, rotational motion, rotational dynamics, equilibrium, elasticity, periodic motion. Prerequisite: MA-261. Corequisite: MA-262.

PH-262 Engineering Physics II (4 Credits)
Calculus-based physics. A continuation of PH-261. Topics include wave motion, vibration and sound, electricity and magnetism, Coulomb's Law, electrical fields, induction. Prerequisite: PH-261.

PH-263 Engineering Physics III (4 Credits)
Calculus based. Introduction to light, lens and diffraction. Photon and their interaction with matter. Wave-particle duality. Basic quantum discoveries leading the Bohr atom and atomic spectra. Interaction of electrons and photons with matter with special emphasis on the design of detectors and electronic devices that use quantum effects. Prerequisite PH-262.

2. Describe the educational objectives and intended student learning outcomes.

Educational Objectives:

a. Students will be able to plan for the employment of the major types, groups, and categories of Mechatronics Engineering Systems.
b. Students will be able demonstrate all aspects of the Mechatronics Engineering design and development process.
c. Students will be able to analyze Mechatronics Engineering systems and optimize those systems.
d. Students will be able to compare, contrast and employ the different types of Mechatronics Engineering Systems.
e. Students will be able to manage, implement, and operate Mechatronics Engineering Systems in the most effective and efficient manner.
f. Students will be to recognize the legal and ethical considerations for specific types of Mechatronics Engineering operations and demonstrate appropriate actions.
g. Students will be able to pursue careers in design, development, analysis, implementation, operation, optimization and management of Mechatronics Engineering Systems and to lead projects as required.
h. Students engage in self-directed continuing professional development, and join a professional society, such as ASME, SAE. SME. ASEE, IEEE, etc.

Learning Outcomes:

Upon graduation:

a. Graduates will be able to analyze the fundamentals of Mechatronics Engineering Systems, including the technological, social, environmental, and political aspects of the system to examine, compare, analyze and recommend conclusions.
b. Graduates will be able to compare and contrast current Mechatronics Engineering Systems issues, identify contributing factors, and formulate strategies to address or further investigate.
c. Graduates will be to evaluate and recommend the incorporation of new technologies, methods, processes, or concepts with current Mechatronics Engineering Systems applications, management practices, or operational policies.
d. Graduates will be able to critically justify and validate Mechatronics Engineering Systems design configurations to support safe, efficient, and effective operations in applicable, including assessing appropriateness of major elemental components, evaluating limitations and constraints, formulating theory of operation, and supporting the perceived need.
e. Graduates will be able to effectively communicate concepts, designs, theories, and supporting material with others in the Mechatronics Engineering field.
f. Graduates will be able to investigate current Mechatronics Engineering Systems problems, complete a thorough review of the issue, formulate hypotheses; collect and appropriately analyze data, interpret the findings, and provide a report to others in the field.
g. Graduates will be able to improve the field of Mechatronics systems and provide solutions to Mechatronics Engineering challenges.

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

General education requirements will be met in an integrated manner along with the degree specific requirements. Beginning in the first semester of the first year, students take both general education requirements as well as degree specific courses. This methodology continues throughout the undergraduate curriculum until all general education requirements have been fulfilled. A student must satisfy all the requirements of the program, both general education and degree specific, to graduate. This process is consistent with other undergraduate degrees at the university.

4. 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). This program is also designed to meet the requirements of Accreditation Board for Engineering and Technology (ABET) and will be reviewed for accreditation by ABET.

5. 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 of non-collegiate organization.

H. Adequacy of articulation:

1. If applicable, discuss how the program supports articulation with programs at partner institutions.

Currently, this program does not have articulation partners. 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 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 college for at least several years. Abu-Ageel, Antunes, Bajracharya, Bajwa, Barker, Mehri, P. Opeka, Pittman, and Sabbah are full-time faculty members. The majority of the faculty hold terminal degrees. 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 qualified faculty will be added as needed.
The faculty listed below do not include those already engaged with the university to teach English, Liberal Arts & Humanities, and Social Sciences.

INSTRUCTOR	BACKGROUND	COURSES ALIGNED TO BE TAUGHT
Dr. Nayef Abu-Ageel Full-time	Ph.D., Electrical and Computer Engineering M.S., Electrical Engineering B.S., Electrical Engineering	ALL ELECTRONICS AND ELECTRICAL ENGINEERING COURSES
Dr. Alex "Sandy" Antunes Full-time	Ph.D., Computational Astrophysics	PH-261, PH-262, PH-263
Dr. Chandra Bajracharya Full-time	Ph.D., Electrical and Computer Engineering M.S., Applied Computing M.S., Electrical Power Engineering B.E., Electrical Engineering	ALL ELECTRONICS AND ELECTRICAL ENGINEERING COURSES
Dr. Garima Bajwa Full-time	Ph.D., Computer Science and Engineering M.S., Electrical and Computer Engineering B.S., Electronics and Communication Engineering	ALL ELECTRONICS AND ELECTRICAL ENGINEERING COURSES
Dr. Richard Baker Professor of Practice (POP)	Ph.D., Information Systems M.S., Computer Science B.S., Mathematics	ALL COMPUTER SCIENCE
Dr. Hasna Banu Adjunct	Ph.D. Theoretical Physics M.S. Mathematics B.S. Mathematics	MA-261, MA-262, MA-263
Dr. Helen Barker Full-time	D.M. Organizational Leadership	BUS-301

	Ph.D. Public Administration and Policy (ABD) M.S. Information Systems Management M.S. Business Administration	
Dr. Malcolm Beckett Adjunct	D.B.A. Quality Systems Management in Homeland Security and Defense M.S. Information Systems Management PMP	BUS-301
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	CH-150
Dr. Soheil Hosseini Full-time	Ph.D., Electrical, Electronics and Communications Engineering	ALL ELECTRONICS AND ELECTRICAL ENGINEERING COURSES
Mr. Andrew Mehri Full-time	M.S. Information Assurance MBA B.S. Engineering Technology	ALL ELECTRONICS, ELECTRICAL ENGINEERING, AND COMPUTER SCIENCE COURSES
Dr. John "Jack" Minogue Adjunct	D.Min., Doctor of Ministry MDiv., Divinity Doctoral Studies, Ethics MA, Theology BA, Philosophy/Minor: Mathematics & Physics	SS-351
Mrs. Pamela Opeka Full-time	M.Ed. Math B.S. Biology & Chemistry	MA 261
Mr. Mark Opeka Adjunct	Ph.D. Materials Engineering M.S. Materials Engineering B.S. Mechanical Engineering	CH-120
Dr. Alexander Perry Adjunct	D.Sc. Cyber Security M.S. Computational Mathematics	MA-261, MA-262, MA-263, MA-340
Dr. Jason Pittman Full-time	Ph.D. Information Assurance M.S. Network Security B.S. English Literature and Microbiology	MA-261, MA-262, MA-263, MA-340
Mr. Jeffrey Pullen	M.B.A. Project Management	BUS-301

Adjunct	M.S. Public Administration M.S. Accounting B.S. Business Management FAC-P/PM, Senior Level FAC-COR, Level III PMP	
Dr. Eric Sabbah Full-time	Ph.D., Computer Science M.S., Computer Science B.S., Mathematics and Computer Science	ALL COMPUTER SCIENCE COURSES

Additional doctorally-qualified faculty will be added in the near future.

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 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 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, which provides material consistent with the needs of a B.S. in Mechatronics Engineering: B.S. Electrical Engineering, B.S. Engineering Technology, B.S. Computer Engineering, M.S. in Computer Science, M.S. in Cyber and Information Security, M.S. in Electrical Engineering, M.S. in Information Systems Management, M.S. in Internet Engineering, M.B.A., D.Sc. in Cybersecurity, and Ph.D. in Business Analytics and Decision Sciences. Therefore, the library is fully prepared to support a B.S. in Mechatronics Engineering.

   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/undergraduate/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.**

The program will require a new lab to support the B.S. in Mechatronics Engineering degree. The university has dedicated the funds to build the new lab that will be constructed during the Summer of 2018 within an existing building on campus. The university has sufficient classrooms to accommodate all hybrid or traditional classroom courses. The online class platform is web based and requires no additional equipment for the institution. The current Learning Management System meets the needs of the degree program. The Computer Science and Robotics Lab, Business and Technology Lab and the Cyber Lab together also meet the potential research needs of the students providing local and virtual support.

L. Adequacy of financial resources with documentation (as outlined in COMAR 13B.02.03.14):

1. **Complete Table 1: Resources. Finance data for the first five years of the program implementation are to be entered. Figures should be presented for five years and then totaled by category for each year.**

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)	$786,570	$2,411,224	$4,728,575	$5,386,445	$5,605,003
a. Number of F/T Students	25	76	140	141	132
b. Annual Tuition/Fee Rate	$25,619	$26,003	$26,393	$26,789	$27,191
c. Total F/T Revenue (a x b)	$640,475	$1,976,250	$3,695,067	$3,777,282	$3,589,222
d. Number of P/T Students	15	44	103	158	195
e. Credit Hour Rate	$812	$824	$836	$849	$861
f. Annual Credit Hour Rate	12	12	12	12	12
g. Total P/T Revenue (d x e x f)	$146,095	$434,974	$1,033,508	$1,609,162	$2,015,782
3. Grants, Contracts & Other External Sources	$0.00	$0.00	$0.00	$0.00	$0.00
4. Other Sources	-$216,178	-$667,402	-$1,248,536	-$1,276,992	-$1,214,047
TOTAL (Add 1 – 4)	**$570,393**	**$1,743,822**	**$3,480,039**	**$4,109,452**	**$4,390,956**

This proposal builds upon an existing engineering degree programs. Over 60% of the courses exist within the other engineering degree programs currently offered by the university.

2. **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.**

a. 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 post Year 1.

b. Tuition and Fee Revenue

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

c. Grants

There are currently no grants etc. at this time.

d. Other Sources of Funds

There are currently no other sources of funds.

3. **Table 2: Expenditure. Finance data for the first five years of the program implementation are to be entered. Figures should be presented for five years and then totaled by category for each year.**

TABLE 2: EXPENDITURES
Courses are taught by adjunct professors.

Expenditure Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b + c below)	$225,867	$677,600	$823,284	$1,013,012	$1,107,876
a. # FTE	2.7	8.0	9.7	12.0	13.1
b. Total Salary	$186,667	$560,000	$680,400	$837,200	$915,600
c. Total Benefits	$39,200	$117,600	$142,884	$175,812	$192,276
2. Admin. Staff (b + c below)	$4,659	$4,798	$4,942	$5,090	$5,243
a. # 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. # 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. Equipment	$3,840	$11,520	$22,745	$27,986	$30,607
5. Library	$0	$0	$0	$0	$0
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)	**$391,840**	**$883,868**	**$1,073,396**	**$1,325,989**	**$1,481,101**

4. **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.**

a. Faculty

Table 2 reflects the faculty hours in total, but this does not imply that these are new hire requirements. The university previously budgeted for a faculty member that will lead the existing mechatronics/robotics area and this hire is to be made in the 2017/2018 budget year. It is not included in this future budget.

b. Administrative Staff

Capitol Technology University will continue with current the administrative staff through the proposed 5-year period.

c. Support Staff

Capitol with continue with current administrative staff through year two. Additional support staff will be added in year 3.

d. Equipment

Software for courses is available free to students or is freeware. Additional licenses for the LMS will be purchased by the university at the rate of $40 per student. No additional equipment is needed. In the 2017-2018 $110,000 is budgeted for equipment to support current courses in this area. It is not included in this future budget.

e. Library

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

6. New or Renovated Space

Please see Section K.

7. Other Expenses

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

M. Adequacy of provisions for evaluation of program (as outlined in COMAR 13B.02.03.15):

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.

Academic Year Assessment Events:

Fall Semester:

- Faculty submit performance plans consistent with the mission and goals of the university and department. The document is reviewed and approved with the 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 Engineering occurs every 2 years. In most cases, the changes only require that the University Academic Dean inform the CAO 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 CAO 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.
- Post-residency, the University Academic Dean meets with the faculty to review the student learning progress and discuss needed changes.
- At the August Faculty Retreat, the faculty reviews any outstanding student learning challenges that have not been addressed. The issues are brought to the University Academic Dean for review and development of implementation plans.

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 (this will move to fall and spring in 2016-2017).
- Departments conduct Industrial Advisory Board meetings to review academic curriculum recommendations.

Based on the foregoing inputs from faculty, students, industry representatives and Department Chairs, the University Academic Dean prepares the proposed academic budget for the upcoming year. Budget increases are tied to intended student learning improvements and key strategic initiatives.
In addition to these summative assessments, the University Academic Dean meets with the Department Chairs weekly 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 CAO 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 CAO and the Executive Council.

Student Learning Outcomes:

Student learning outcomes are measured using the instruments identified above as well as assigned rubrics/measures (e.g. capstone courses, competency exams/projects) dictated by the accreditation requirements of regional accreditor (Middle States Commission on Higher Education) and our degree specific accrediting body (i.e., ABET). This program is designed to meet the requirements of ABET and will be reviewed for accreditation by ABET.

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

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. MCIT, M.S. CIT, M.S. ISM, D.Sc., and Ph.D. in Business Analytics and Decision Sciences. The same attention will be given to the B.S. in Mechatronics Engineering.

O. Relationship to low productivity programs identified by the Commission:

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

P. If proposing a distance education program, please provide evidence of the Principles of Good Practice (as outlined in COMAR 13B.02.03.22C):

a. Curriculum and Instruction

Some courses in this concentration will be offered in an online classroom environment as well as in hybrid (synchronous and traditional classroom).

i. A distance education program shall be established and overseen by qualified faculty.

The Department of Electrical Engineering, where this degree will be sponsored, is staffed by qualified teaching dean and 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 faculty teach in the traditional classroom environment and online. (Please see qualifications in Section I of this document.)

ii. A program's curriculum shall be 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 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.

iii. **A program shall result in learning outcomes appropriate to the rigor and breadth of the program.**

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 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.

iv. **A program shall provide for appropriate real-time or delayed interaction between faculty and students.**

The program courses will be delivered in a format using Adobe Connect and the LMS Canvas. This system supports both synchronous and asynchronous interaction between faculty and students. Some of these class may also be in hybrid (online real-time and traditional classroom) format.

v. **Faculty members in appropriate disciplines in collaboration with other institutional personnel shall participate in the design of courses offered through a distance education program.**

Currently employed faculty acts 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 Resources 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.

b. **Role and Mission**

i. **A distance education program shall be consistent with the institution's mission.**

Distance education is consistent with the institution's mission. Please refer to Section A (please see page 2) of this proposal.

ii. **Review and approval processes shall ensure the appropriateness of the technology being used to meet the program's objectives**

The dean and department chairs are an integral part of the curriculum approval process. The dean, chairs and faculty are participants in any new institutional technology changes. The dean approves technologies brought into the classroom by faculty to ensure compatibility with existing technology as well as with course and institutional objectives.

c. **Faculty Support**

i. **An institution shall provide for training for faculty who teach with the use of technology in a distance education format, including training and learning management system and pedagogy of distance education.**

The Department of Distance Learning and the instructional technology division support the online program needs of faculty and students. These departments and the 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 on-line course, the distance learning department 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 students and faculty.

ii. **Principles of best practice for teaching in a distance education format shall be developed and maintained by the faculty.**

The Distance Learning Department, in conjunction with the dean and an assigned mentor, provide on-going support and instruction on best online practices. Best practices are shared among faculty by the dean and chair as well as through formal events. There are also several texts in the library available to the faculty, which cover distance learning techniques and technology.

iii. **An institution shall provide faculty support services specifically related to teaching through a distance education format.**

As mentioned previously, the university online platforms offer several avenues to support instructors engaged in online learning. The Director of our Distance 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 dean and chair and through formal meetings.

d. **An Institution shall ensure that appropriate learning resources are available to students including appropriate and adequate library services and resources.**

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 (page 28) of this document and the attached letter from the university president, the library adequately supports the students learning needs.

e. **Students and Student Services**

i. **A distance education program shall 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.**

Students are provided support identical to traditional on campus students as the technology is utilized by all our students. Curriculum, course and degree information are available on the university website and via e-mail and mail by request. The expectations as it pertains to the 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 online environment to facilitate a high-level learning experience. Computer requirements are listed on our website and are provided to students in the welcome package. Students are provided a list of departmental services and contacts. Students may request special/additional training to include one-on-one training. In addition, training videos are available in Capitol Technology University's student web portal

ii. **Enrolled students shall have reasonable and adequate access to the range of student services to support their distance education activities.**

Students have access to the same services as traditional on ground students. Some of these services are facilitated via such tools as Skype. For instance, distance students attend job fairs via Skype facilitated by an assigned campus representative. In addition, training videos are available in Capitol Technology University's student web portal.

ii. **Accepted students shall have the background, knowledge and technical skills needed to undertake a distance education program.**

Students are required to have the same skills as tradition on ground students. Training is available for students to familiarize them with the tools of the distance learning system.

iii. **Advertising, recruiting and admissions materials shall clearly and accurately represent the program and services available.**

Advertising, recruiting, and admissions materials do clearly and accurately represent the program and the services available.

f. **Commitment and Support**

i. **Policies for faculty evaluation shall include appropriate considerations of teaching and scholarly activities related to distance education programs.**

All faculty, including online faculty, are strongly encouraged to participate in at least one or two professional development opportunities to improve online teaching skills. Faculty are highly encouraged to share their experiences with fellow faculty as well as through publications and presentations. These factors are considered in the annual goals and objectives of faculty and, therefore, are considered in evaluation of performance for

promotions, etc. Scholarly activities are recognized in formal university publications. Funding in the annual budget is provided for conferences in support of scholarly activities. Faculty meetings and colloquiums provide opportunities to share best practices among faculty. This includes online faculty. In addition, all faculty are offered the opportunity to attend the annual graduation ceremony and attend the annual faculty residency training event at the expense of the university.

ii. An institution shall demonstrate a commitment to ongoing support, both financial and technical, and to continuation of a program for a period sufficient to enable students to complete a degree or certificate.

The university has made the financial commitment to the program (refer to Section L). The university has a proven track record of supporting degree completion.

g. Evaluation and Assessment

i. An institution shall evaluate a distance education program's educational effectiveness, including assessment of student learning outcomes, student retention, student and faculty satisfaction and cost-effectiveness.

The university applies the same evaluation standards and processes to all degree programs at the institution. (Please see Section M, page 32, for an in-depth process description.)

In the Department of Engineering, where this program will be sponsored, evaluations are done at the course level, student level, curriculum level, and faculty level as well as other stakeholder groups.

Assessment is based on the integration of all the above items as appropriate. Changes are developed and implemented by the faculty responsible for the courses upon approval of the dean. At the end of this cycle, an evaluation is repeated and results 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 formal assessment measures.

ii. An institution shall demonstrate an evidence-based approach to best online teaching practices.

Capitol Technology University has established a course/program matrix, which requires faculty to report student outcomes and suggestions for improving student performance. The university complies with the requirements of its accrediting bodies regarding outcomes/evidenced based accreditation [Middle States Commission on Higher Education (MSCHE), ABET, IACBE, and NSA/DHS]. The university is in good standing with all its accrediting bodies.

iii. An institution shall provide for assessment and documentation of student achievement of learning outcomes in a distance education program.

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 VP of Academic Affairs, dean, and department chairs. On an annual basis, the information is reported to accreditation authorities such as Middle States Commission on Higher Education (MSCHE), IACBE, ABET, and NSA/DHS. The same requirement will occur with ABET for this program.

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