



**Statement of Need for
Bachelor of Applied Science:
Mechatronics Engineering Technology and Automation**

July 15th, 2019

By

Clover Park Technical College

4500 Steilacoom Blvd. SW

Lakewood, WA 98499

cptc.edu

**COVER SHEET
STATEMENT OF NEED**

Program Information

Institution Name: Clover Park Technical College

Degree Name: BAS-Mechatronics Engineering Technology and Automation CIP Code: 15.0403

Name(s) of existing technical associate degree(s) that will serve as the foundation for this program:

Degree: Mechatronics AAT CIP Code: 15.0403 Year Began: 2014

Degree: Mechatronics AAS-T CIP Code: 15.0403 Year Began: 2014

Proposed Start Implementation Date (i.e. Fall 2014): Fall 2020

Projected Enrollment (FTE) in Year One: 16 at Full Enrollment by Year: 2025

Funding Source: State FTE: ☒ Self-Support: ☐ Other: ☒

Mode of Delivery

Single Campus Delivery: Hybrid

Off-site: _____

Distance Learning: _____

Statement of Need: *Please see criteria and standard sheet. Page Limit: 20 pages*

Contact Information (Academic Department Representative)

Name: Mabel Edmonds

Title: Vice President of Instruction

Address: 4500 Steilacoom Blvd, Lakewood WA 98499

Telephone: 253-589-5510

Fax: 253-589-5851

Email: Mabel.edmonds@cptc.edu

Mabel Edmonds
Chief Academic Officer

9/17/19
Date

Mechatronics has expanded as more consumer and industrial products started including advanced electronics. Cars now include electronic systems that are intrinsic to the mechanical function in the vehicle. This melding of electronic and mechanical systems will become even more pronounced as autonomous and all-electric vehicles proliferate. Mechanical engineers are well aware they are expected to have more than a cursory familiarity with electronics.¹

Introduction

Mechatronics is a new and increasingly high-demand field with few training providers in our area. We propose implementing a BAS: Mechatronics Engineering Technology and Automation (BAS-META) degree to better prepare our mechatronics associate degree graduates for today's job market. Mechatronics associates graduates enjoy an excellent employment record in entry-level advanced manufacturing careers. The new degree would build upon our current AAS-T in mechatronics by adding additional engineering math and physics, as well as hands-on work with cutting edge industrial technology and practices such as IIOT, Digital Twins, Sustainable Manufacturing, and Data Analytics. Upon completion of this degree, graduates will demonstrate achievement of the following outcomes:

1. Devise solutions to broadly-defined engineering problems in complex mechatronics systems through the application of knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology
2. Design systems, components, or processes meeting specified needs for broadly-defined engineering problems for mechatronics systems
3. Compose written, oral, and graphical communication in broadly-defined technical and non-technical environments
4. Evaluate appropriate technical literature for application in mechatronic systems;
5. Evaluate the results of standard tests, measurements, and experiments for the improvement of processes, efficiency, and sustainability in mechatronic systems
6. Build effective technical teams both as a member, as well as a leader.

We believe that this degree will be unique to the state and therefore have no risk of saturating the market. Our proposal differs from other engineering technology degrees in the state in both approach and scope, as well as the content of the offerings.

Our capacity to meet Criteria 1-6 is explained, in order, below.

¹ **Is All Engineering Mechatronics Now?**, Design News, <https://www.designnews.com/automation-motion-control/all-engineering-mechatronics-now/71192217457489> (visited July 12, 2019).

Criteria 1

CRITERIA	STANDARD
1. Relationship to institutional role, mission, and program priorities.	Describe how the proposed program reflects and supports the role and mission of the institution and reflects program priorities.

Institutional Role

The technical college's role is to serve the community as an open admission educational resource that is responsive to both student and business needs. The BAS: Mechatronics Engineering Technology and Automation (BAS-META) program will uniquely serve our community in this role. As the first Mechatronics Engineering Technology program in the state, the BAS-META will fulfill the needs of place-bound, working practitioner adults needing a four-year degree to progress in their field, as well as regional graduates of other mechatronics associate programs. Our Advisory Committee, composed of representatives from local business, is enthusiastic about this proposed degree. They represent major local employers and reflect the "business needs" side of our role.

Similarly, our AAS-T students have been asking for a baccalaureate option to continue their studies. Currently, they only have our more general and management focused Operations Management program to continue to a bachelor's level degree. If they want more technical engineering content they have had no options in mechatronics, and few distant options for other engineering technology disciplines that are offered well outside the local area and Pierce County. The nearest engineering technology programs are in Bellingham(BTC) and Ellensburg (WVC and CWU) which are roughly 3 hour drives one way from our community. University of Washington (Tacoma), while closer, has only computer and electrical professional engineering programs, as opposed to the more hands-on engineering technology approach. A Clover Park Technical College BAS-META would be responsive to our students' needs and thus fulfill our institutional role.

Mission

The Bachelor of Applied Science: Mechatronics Engineering Technology and Automation (BAS-META) supports Clover Park Technical College's mission, "Educating tomorrow's workforce" by producing graduates with the skills and hands-on experience to maintain, optimize, deploy and design mechatronic systems to keep pace with the rapid automation in our local manufacturing industry.

The BAS-META degree has the potential to serve the workforce of virtually all local and regional industries. Mechatronic systems are everywhere, and growing increasingly complex. The rapid adoption of automation solutions across a broad swath of industries from manufacturing to processing to distribution to foodservice, will act as an accelerator for the demand of mechatronics engineering positions. As these systems all have a complex interplay between what were separate engineering disciplines, the clear advantage of a multidisciplinary system approach is apparent. In fact, it is difficult to find a deployment of a purely mechanical or a

purely electrical system. Mechatronics graduates possess a unique strength in the creation and use of such systems as they understand the interfaces between all these disciplines. It is imperative for the economic growth of our community and region that there is a qualified workforce to meet these forthcoming technological changes. BAS-META graduates will be prepared to fulfill these needs while driving innovation in our industry forward.

The demand for this skillset is an essential part of the workforce of the future. The competitive advantage that China has held in manufacturing is slightly diminishing as labor costs and shipping costs increase, while the cost of automation decreases.

“Today’s American factories are becoming more reliant on robotics, automated optical inspection equipment, and other automation technologies. With greater efficiency, these companies are able to be more cost-competitive with its overseas counterparts now that China’s labor rates are on the rise. Increasing throughput for an OEM allows for them to compete with higher product sales, which in turn leads to larger bottom-line margins.”²

For local manufacturers, both large and small, access to talented graduates who understand how and when to implement complex automation solutions is a precursor to being able to capitalize on these changing trends. From an economic development perspective, having such a workforce is a key factor attracting new manufacturers to locate production in our state.

As mechatronics graduates can perform across a broad array of tasks, the benefit to small manufacturers is particularly large. Being able to bring the full spectrum of automation skills in-house has been prohibitively expensive, as it used to require multiple hires of differentiated employees. Anyone of these positions may not have been fully utilized based upon the scale of work at the company. Mechatronics allows for greater efficiency and agility in these smaller firms. Larger companies will also benefit as better coordination and integration, facilitated by the skills overlap, will reduce costly re-design times and improve efficiency.

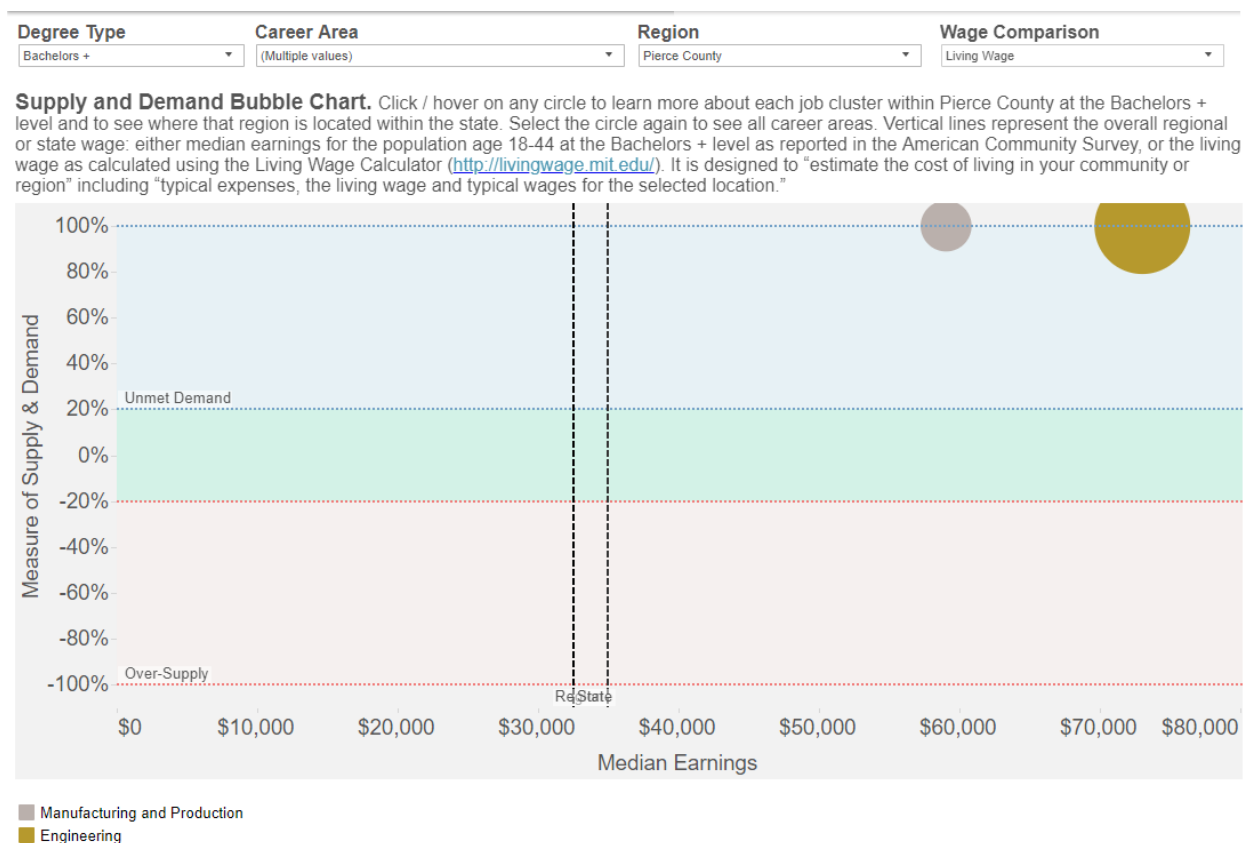
Finally, the unstated mission of a technical college situated in an area with a large population of economically disadvantaged individuals is to raise students from poverty into living wages. In 2015, according to a NACE study, mechatronics overtook all other engineering disciplines as having the highest salaries for graduates.³

The following bubble graph from SBCTC’s workforce supply and demand data gives a stark impression of the local availability of graduates in the related sectors of industry. Since mechatronics bridges both engineering and manufacturing/production, we included data that covers both industries. The number of local graduates qualified for either career cluster is zero. Manufacturing and production have an annual local demand of 97.3 positions, and engineering has a demand of 344.3 positions. The annual earnings are 169% and 209% of the regional median salary, respectively. The BAS-META program has the potential to serve a gap

² Top 7 Reasons to Follow the On-Shoring Trend. (2018) Riverstar Inc. Retrieved from <https://riverstarinc.com/on-shoring-trends/>

³ Top Paid Engineering Grads: Mechatronics. (2016) NACE. Retrieved from <https://www.nacweb.org/job-market/compensation/top-paid-engineering-grads-mechatronics/>

in employable skills in our area, while simultaneously lifting our students to rewarding careers earning well above the median income.



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Program Priorities

The Mechatronics program has three priorities: To prepare students to enter the workforce as highly adaptive employees; Give students, not only the skills but the ability to become self-learners, capable of staying ahead of the changing technologies in the workplace; and maintain an over-the-horizon curriculum that looks to not just equal industry standards, but anticipate the future trends. The proposed program completely supports all three priorities.

Graduates awarded the BAS-META degree will be well prepared to enter tomorrow's workforce. Our current Mechatronics AAT and AAS-T graduates currently enjoy an excellent employment rate with above living wage compensation. This is in a large part because we use a hands-on systems-based approach to reinforce the theory of mechatronics. Our students understand the theory because they have created a working demonstration in the real world. Our industry partners will attest to the efficacy of this approach in preparation for the workforce.

⁴ Washington State Board for Community and Technical Colleges Workforce Supply & Demand bubble chart for King-Pierce Counties Living Wage comparison: <https://cube.nchems.org/views/SBCTCSupplyandDemandVisualization/SBCTCSupplyandOutcomesVisualization?isGuestRedirectFromVizportal=y&:embed=y> retrieved July 12, 2019

BAS-META graduates, though still well qualified for technician positions, would have expanded options for engineering level positions, as well as technical sales and field service. This should move them up the pay scale initially and position them for future promotion without the need for additional training. The BAS-META program will achieve this preparation by providing complex technical experience into emerging and higher-level skills, adding significant project management experience, and also by equipping graduates with advanced communication, quantitative, and reasoning skills. Advanced subjects such as Data Analytics, Digital Twin Simulations, Robotic Integration, and the Industrial Internet of Things (IIoT) will give graduates a future-minded skillset that will allow companies to hire not just for the skill that they need currently, but the for the knowledge to expand their technological capabilities.

BAS-META supports our program quality priority with a high-quality, hands-on program vetted by the advisory committee. The program will employ a highly-skilled faculty, a brand new state-of-the-art facility, and the increased student supports already in place for BAS students in the College's existing applied bachelor's programs. The BAS-META will take advantage of components of the College's existing accredited BAS programs, thereby ensuring excellence from the start. We view this proposal as building on our existing high quality.

Criteria 2

CRITERIA	STANDARD
2. Support of the statewide strategic plans.	Describe how the program will support SBCTC Mission goals outlined in the Mission Study and WSAC policies and goals for higher education as articulated in the Strategic Master Plan for Higher Education.

The BAS-META supports the State Board of Community and Technical Colleges (SBCTC) 2008 Mission Study (MS) published in May 2010. It also supports the Washington Student Achievement Council (WSAC) 2017-19 Strategic Action Plan (December 1, 2016) and the Strategic Master Plan Update 2012. WSAC acquired many of the duties of the Higher Education Coordinating Board when the State abolished the latter and created the former. WSAC also inherited the 2008 Strategic Master Plan for Higher Education in Washington. It published a Strategic Master Plan Update and several Strategic Action Plans as well as Road Maps.

The SBCTC 2008 Mission Study's overarching goal was "to find more and better ways to reduce barriers and expand opportunities so more Washingtonians can reach higher levels of education."⁵ It lays out a ten-point action plan addressing underserved populations, skills gaps, increasing baccalaureate degrees, pathways, modern learning infrastructure and modalities, and increased efficiency.

⁵ Mission Study Washington, May 2010, Community and Technical College System Mission Study Task Force, <https://www.sbctc.edu/resources/documents/about/agency/initiatives-projects/sbctc-mission-study.pdf>, retrieved July 12, 2019

The WSAC Strategic Action Plans have as their goal achieving 100% high school graduation or equivalent and 70% of residents achieving a postsecondary credential by 2023.⁶ An applied baccalaureate, by its nature, will not move the needle in either of these goals. Applicants will already have a high school and postsecondary credential. The BAS-META will contribute to the majority plan's strategies to increase attainment. These strategies include supporting our education continuum; college and career readiness; supporting access, affordability, and quality; expanding innovative, targeted student supports to increase completion; adult re-engagement; and addressing workforce shortages.

The WSAC Strategic Master Plan Update 2012 had as its theme "Raising educational attainment during challenging economic times."⁷ Its seven steps to more successful higher education outcomes in Washington State include: increase capacity of higher education to serve more students, maintain commitment to access for low-income students, build on efforts to increase transitions and completion, provide a simple funding initiative to increase the number of graduates (and) quality of education, define and develop K-12 to postsecondary program pathways, promote accelerated learning programs for high school students and adult learners, and maintain commitment to the original 2008 degree goals.

The BAS-META supports SBCTC and WSAC goals in many ways. It will promote diversity, access, opportunity, lifelong learning, affordability, increased capacity, bridge the skills gap in STEM, and address workforce shortages. The BAS-META will also address and provide a skillset for many of the changes and developments happening in the industry that has no representation at all.

Increasing access, opportunity, and diversity

Clover Park Technical College is located in Lakewood, Washington. Lakewood is poorer and more diverse than Washington State overall. Lakewood's median household income is lower than the State's (\$47,636 vs. \$70,979). It is more varied (49.2% vs 31.2% persons of color).⁸ By locating an open enrollment applied baccalaureate in this community, we will increase access and opportunity to place-bound adults, economically disadvantaged students, and to students of color. Upon graduation, these underserved populations will enjoy an opportunity to compete for many more jobs than are available at the associate's level and for substantially higher pay. A 2012 Georgetown University Center for Education study found that new high school graduates were about three times more likely to be unemployed or underemployed than were new bachelor's degree graduates.⁹

	Washington	Pierce County	Lakewood
Median Household Income	\$70,979	\$69,278	\$47,636
White Residents	68.8%	66.7%	50.8%
Home Ownership	62.8%	63.2%	45.0%

⁶ 2017-19 Strategic Action Plan, December 2016, Washington Student Achievement Council, <https://www.wsac.wa.gov/sites/default/files/2016.12.01.SAP.pdf>, retrieved July 12, 2019

⁷ Strategic Master Plan Update 2012, November 2011, Higher Education Coordinating Board, <https://www.wsac.wa.gov/sites/default/files/SMP2012Update.pdf>, retrieved July 12, 2019

⁸ Data USA: Lakewood, WA, DataUSA, <https://datausa.io/profile/geo/lakewood-wa/>, retrieved July 12, 2019

⁹ The Barriers to a College Degree, February 20, 2013, Population Reference Bureau, <https://www.prb.org/us-college-attainment/>, retrieved July 12, 2018

Role models and moving the needle in educational attainment

A less obvious but important influence in increasing educational attainment is the effect of increasing diversity among graduates in the community. By locating the BAS-META in Lakewood, we will be helping to create very influential role models and ambassadors of diversity and success. Furthermore, as the associates-level mechatronics program is a majority-minority program, the BAS-META will have a very diverse enrollment from our feeder program.

The attainment of the degree is important, but so is the higher salary and access to more specialized positions in larger companies. We cannot overemphasize the importance of local role models of success. This is true with regards to increasing the attractiveness of STEM in general and with women in particular. Role models work to motivate high school students to continue on to college and motivate adults to return to college. These all contribute to educational attainment. Nothing can be as influential as meeting a successful person from our town that looks as we do. The BAS-META program will be a strong, though indirect, force in moving the needle on educational attainment.

Lifelong Learning

The BAS degree is friendly to life-long learners by its course scheduling and its focus on state-of-the-art knowledge and skills. The degree is designed to accommodate current associate degree holders. We will at first offer hybrid courses with the intention of exploring early morning and/or early evening courses. While day classes may be more difficult for working adults to attend, we currently see significant traffic in our associate-level offerings by already employed adults upskilling or changing career focus. Some are recently unemployed and available for day classes. Others are adjusting their work schedule to accommodate daytime attendance. The nature of upper-level baccalaureate courses will permit a broader range of direction and personalization than our associate degree offerings. This should encourage lifelong learning and improve access to place-bound adults.

Economic Growth and Innovation

The BAS-META creates graduates to fill “unmet enrollment in high-demand STEM fields.” For our community, it improves STEM accessibility for place-bound adults.

The mechatronics field is developing and changing at a very rapid rate. As many traditional businesses become more automated, new businesses are emerging in fields like IIOT (Industrial internet of things). These changing traditional businesses, as well as new emerging ones, are currently suffering a significant shortage of people with the skillset to service, design, and optimize mechatronic systems. The CPTC mechatronics program frequently receives visitors from local and regional business who end up becoming strong supporters of the program for the advanced technical skillset found within the program’s curriculum. The BAS-META will provide the next tier of skillsets sought after by our local and regional partners.

Develop Performance-Based Improvement Strategies

The BAS-META will benefit from a strong advisory committee, already in place for the mechatronics associate degrees. Members of the advisory committee provide feedback to the faculty, who adjust and emphasize curriculum accordingly. The development and implementation of a BAS are based upon this feedback.

The mechatronics program firmly relies on lean process principles when it comes to program improvement and development. Standardization, continuous improvement, and visualization allows the faculty to constantly be working on a new iteration of the program where all decisions are based upon facts. Alumni feedback allow the faculty to close the feedback loop. Diagram 1 below shows an example of a tool used within the mechatronics program for development.

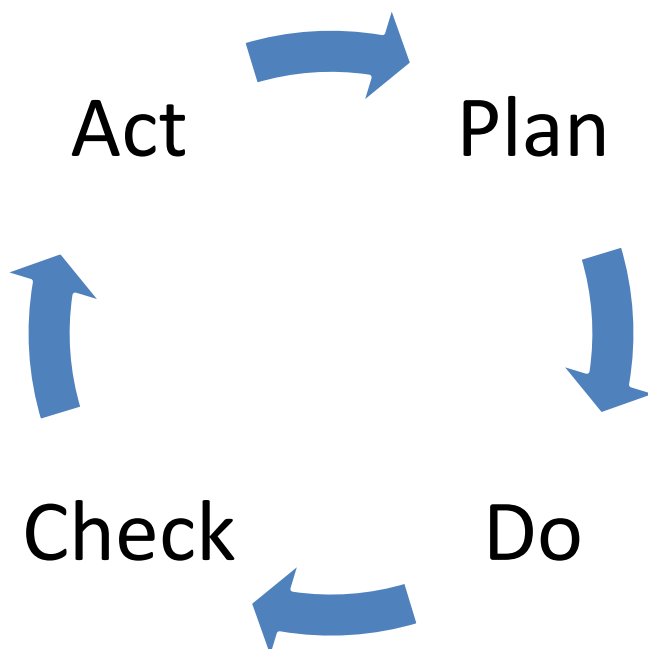


Diagram 1. The Assessment Cycle for Program and Course Improvement

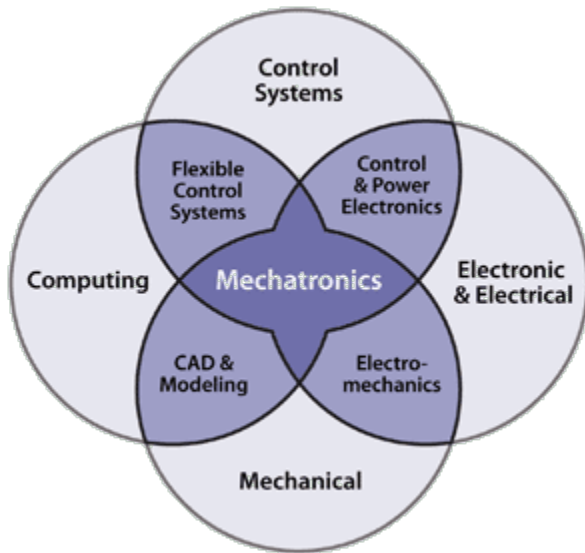
Criteria 3

CRITERIA	STANDARD
3. Employer/community demand for graduates with baccalaureate level of education proposed in the program.	<ul style="list-style-type: none"> •Employer demand must exceed regional supply of graduates with relevant degrees. •Demand must be based on data sources including but not limited to local employer survey, traditional labor market data, industry data, trade associated data, and other transactional data. Please provide evidence of the gap between the numbers of program graduates the number of job opening locally and regionally. Refer to attached supply/demand gap rubric for additional guidance.

Included Occupational Job Titles

Mechatronics, as both an emerging and an interdisciplinary field, is difficult to pin down all the occupational titles for which graduates would qualify. The BLS occupation codes only provide established job titles, and in a dynamic industry, this leaves us with a fragmented picture of what current job title trends are. Many traditional job titles in industry seem to be losing favor,

such as electro-mechanical technicians (SOC 17-3024). While the work performed remains, companies title this position differently. There is no sign of significant settling on nomenclature for these emerging job titles, with significant regional and sector variance between the job titles for the mechatronic skillset.



Typical Mechatronics Related Jobs:

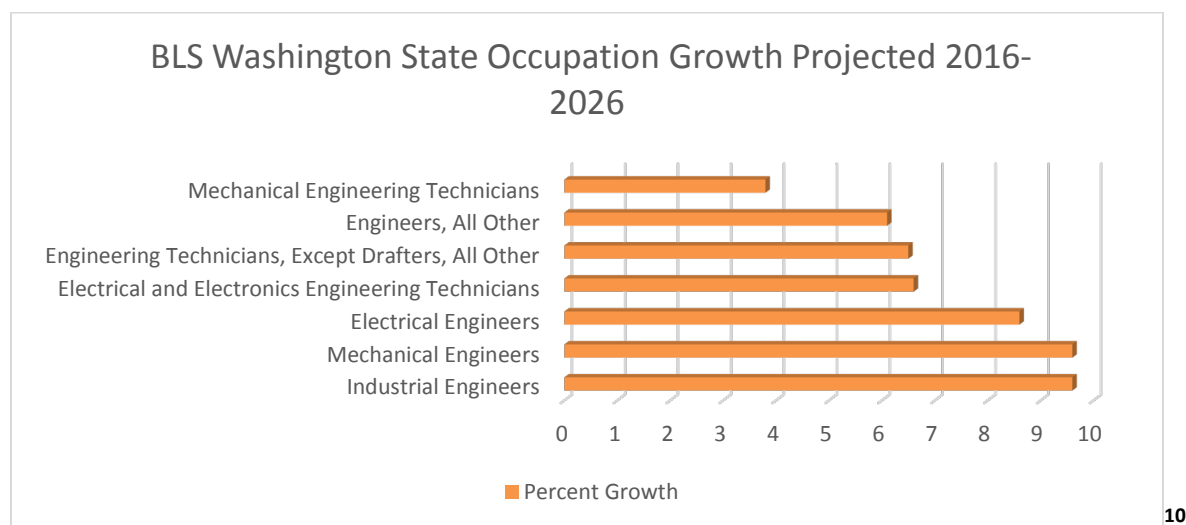
- Application Engineer/Technician
- Systems Engineer/Technician
- Manufacturing Engineer/Technician
- Production Engineer/Technician
- Automation Engineer/Technician
- Control Systems Engineer/Technician
- Development Engineer/Technician
- Mechatronics Engineer/Technician
- Prototyping Engineer/Technician
- Hardware Development Engineer/Technician
- Quality Engineer/Technician
- Reliability Engineer/Technician

The above list provides some of the top current position titles available to mechatronics graduates. Unfortunately, this has little overlap with the available SOC catalog. The closest related titles we can look at are below:

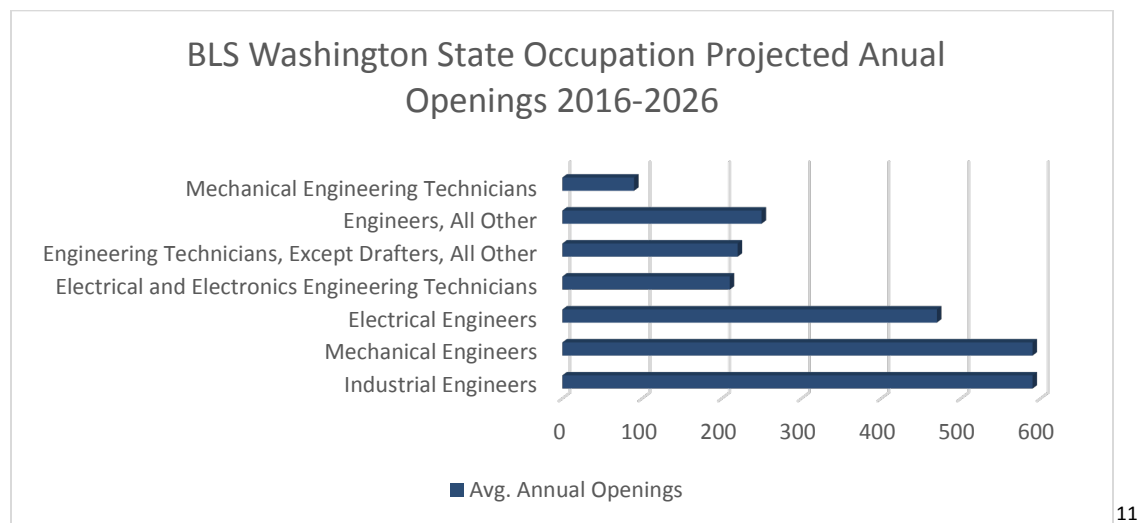
SOC	Occupation Name
17-2112	Industrial Engineers
17-2141	Mechanical Engineers
17-2071	Electrical Engineers
17-3023	Electrical and Electronics Engineering Technicians
17-3029	Engineering Technicians, Except Drafters, All Other
17-2199	Engineers, All Other
17-3027	Mechanical Engineering Technicians

All these titles are continuing to grow in demand; however, we lack the granularity of data on these to fully understand the multivariant mechanics at play in their growth rates and absolute numbers. By elimination, the bulk of mechatronics positions would fall under these categories, however, the scope of jobs *requiring* a multi-disciplinary mechatronics approach is unclear. What is clear is that there are sizeable gaps in supply and demand in these areas, and our graduates would be able to compete for these positions, regardless of whether or not a mechatronics skillset is required.

Employer Demand and Growth Statewide



The growth in the traditional SOC job categories is pronounced when we look at the statewide picture. The number of job openings per year is also very high:

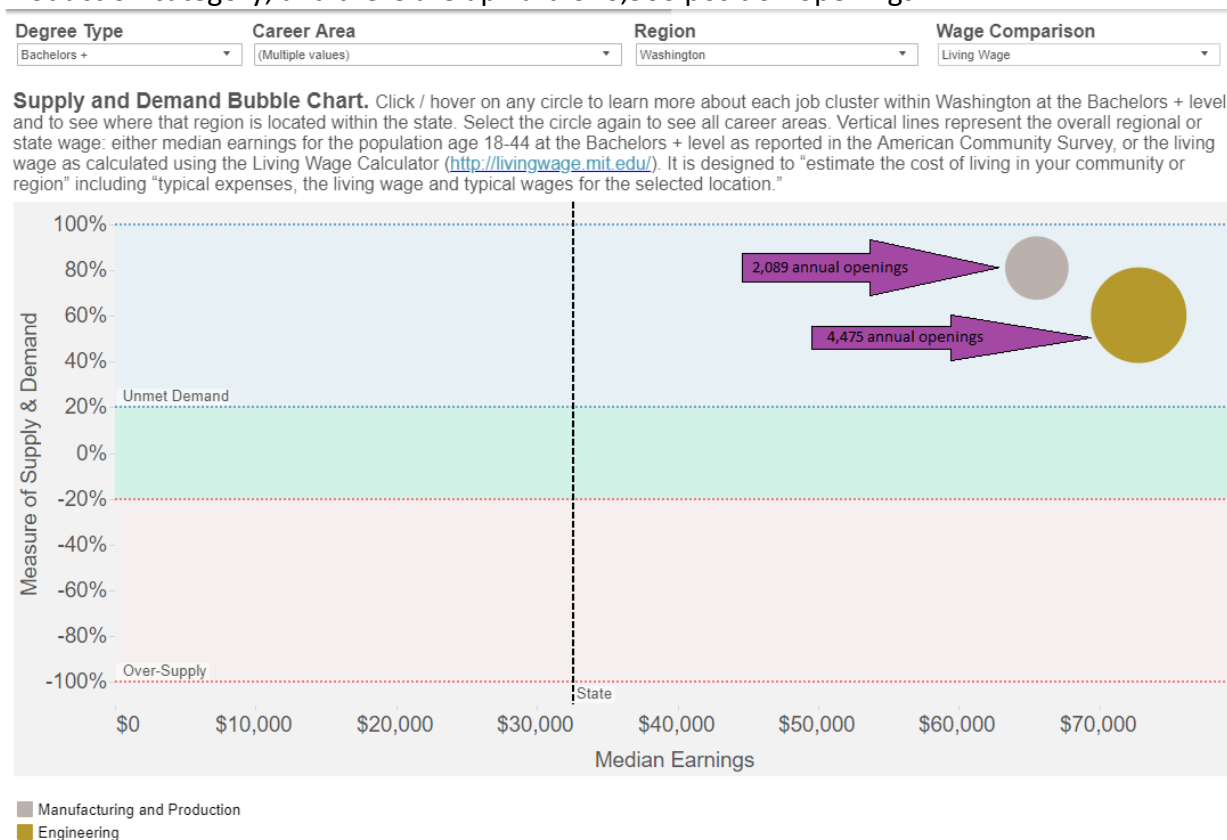


There is clear evidence here of significant continued growth in the demand for engineers statewide. Summing these job opportunities up we get average openings for all titles of 2,420. SBCTC's data finds annual average open engineering positions requiring a minimum of a

¹⁰ BLS job projections for Washington state by Projections Central - State Occupational Projections: <https://projectionscentral.com/Projections/LongTerm> retrieved July 13, 2019

¹¹ *ibid.*

bachelor's degree or higher levels of education at 4,745.¹² Add in the Manufacturing and Production category, and there are upward of 6,500 position openings:



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Though these data sources lack the granularity to determine the precise demand for a specific mechatronics skillset, they do speak to the growing demand for the broader category of engineering.

Statewide Supply

As there is no supply in the state for graduates of a bachelor's level mechatronics degree, no matter what the actual demand, there is a shortage of supply. Once again, the lack of data resolution requires us to look at the broader scope of engineering and manufacturing:

Washington State Supply and Demand				
Career Cluster	Education Level	Job Announcements	Graduates	Gap
Engineering	Sub-baccalaureate	1,580	1,086	494
	Baccalaureate +	4,745	1,883	2,862
	Sub-baccalaureate	12,763	3,312	9,451

¹² Washington State Board for Community and Technical Colleges Workforce Supply & Demand bubble chart for statewide engineering data:

<https://cube.nchems.org/views/SBCTCSupplyandDemandVisualization/SBCTCSupplyandOutcomesVisualization?isGuestRedirectFromVizportal=y&:embed=y> retrieved July 14, 2019

¹³ State Board for Community & Technical Colleges Workforce Supply & Demand. Retrieved from

<https://cube.nchems.org/views/SBCTCSupplyandDemandVisualization/SBCTCSupplyandOutcomesVisualization?isGuestRedirectFromVizportal=y&:embed=y> (accessed July 14, 2018).

Manufacturing and Production	Baccalaureate +	2,089	399	1,690
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The clear shortfall of workforce supply in these career clusters is evident across the board. Tallying up the gap for both manufacturing & production, and engineering at the baccalaureate and beyond level, there are 4,552 job postings each year that do not have a corresponding in-state graduate to fill them. These numbers are lower but still in line with findings from the National Center for Educational Statistics, which reports 2,312 bachelor's degrees conferred by postsecondary institutions in Washington State in Engineering during the 2016-2017 academic year.¹⁵ This completion rate is still not meeting half the reported statewide demand. The data represents a clear employment opportunity for graduates of the BAS-META program.

Regional and Local Supply and Demand

Looking more closely at regional level data we can see the trend continue for significant gaps in supply across all dimensions:

King and Pierce Supply and Demand				
Career Cluster	Education Level	Job Announcements	Graduates	Gap
Engineering	Sub-baccalaureate	877	435	442
	Baccalaureate +	2,524	978	1,546
Manufacturing and Production	Sub-baccalaureate	6,185	1,161	5,024
	Baccalaureate +	941	152	789

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If the data is examined for just Pierce County, as seen in the bubble chart in the introduction, there are no local baccalaureate-level graduates. As such, the local unmet demand is at 100%.

Survey of Regional Manufacturers

In an industry survey undertaken as part of this proposal (full report in appendix), The supply and demand issues remain starkly apparent. 76.2% of respondents have had difficulty filling bachelors level mechatronics positions, and 81% anticipate future difficulties. Just in this small sample of small to medium-sized manufacturers, the respondents indicated that they anticipate the need in the next three years for between 56 and 120 mechatronic positions that will prefer bachelor's degree candidates. 55.6% of respondents have had mechatronic positions open for three months or more, with another 11.1% having openings last for 2-3 months. Finally, the respondents report acceptance of a BAS-META at or above the levels of other alternative degrees offered in the state:

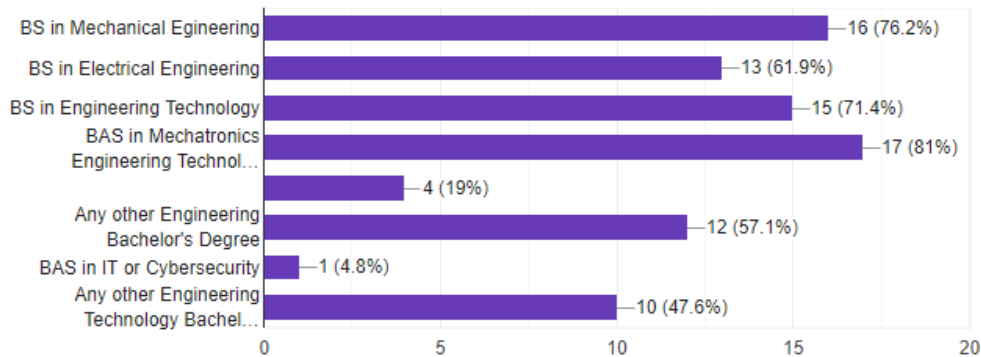
¹⁴ *ibid.*

¹⁵ Table 319.30. Bachelor's degrees conferred by postsecondary institutions, by field of study and state or jurisdiction: 2016-17, National Center for Educational Statistics, 2018, https://nces.ed.gov/programs/digest/d18/tables/dt18_319.30.asp , retrieved July 14, 2019.

¹⁶ State Board for Community & Technical Colleges Workforce Supply & Demand. Retrieved from <https://cube.nchems.org/views/SBCTCSupplyandDemandVisualization/SBCTCSupplyandOutcomesVisualization?:isGuestRedirectFromVizportal=y&:embed=y> (accessed July 14, 2019).

What type of bachelor's degree would your company accept for mechatronics related positions? (check all that apply)

21 responses



Regional Employer Demand Greatly Exceeds Supply

Any way that we divide or project the numbers, the regional demand greatly exceeds supply. With current unemployment at a generational low and the economy growing at a generationally high rate, all of the above data, which is at least two years old, may understate the scope of this workforce shortfall. Though the BAS-META program will not make much of a dent in these numbers on its own, the scope of the unmet demand is such that we can clearly state that there is no danger of our graduates saturating the market. Clearly, the regional demand greatly exceeds supply.

Criteria 4

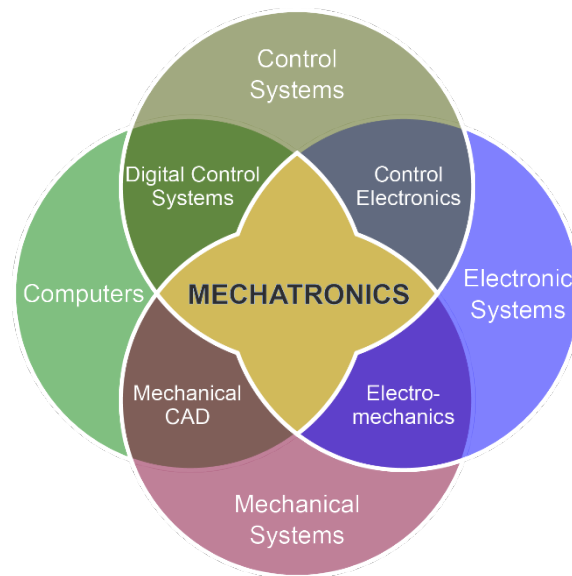
CRITERIA	STANDARD
4. Applied baccalaureate program builds from existing professional and technical degree program offered by the institution.	Describe the existing professional and technical degree program that will be used as the foundation for applied baccalaureate program. Include how long the program has been in existence and the enrollment history of the program over the past five years.

Foundational Program: Mechatronics

Clover Park Technical College has been offering Associate-level degrees in Mechatronics since 2015. Mechatronics is a multidisciplinary field combining mechanical, electrical, telecommunications, control, and computer engineering and focusing on the design and production of automated equipment. Trained mechatronics professionals design and drive the future of industry, as mechatronics systems form the backbone of every computer-controlled machine and sophisticated consumer product. The interdisciplinary nature of CPTC's Mechatronics program prepares students for roles as mechatronics technicians or engineers in a wide range of career fields. Graduates gain experiences that cross different disciplines and prepare for a rapidly changing economy with the help of CPTC's dedicated faculty and the latest

industrial equipment. Students acquire work-ready practical skills as they move towards a specialization such as robotics, agricultural automation, PLC programming, control systems, smart infrastructure, or industrial automation.

While the program offers several standalone certificates for both entry-level and returning student study, its most popular offering is the AAT / AAS-T degree.

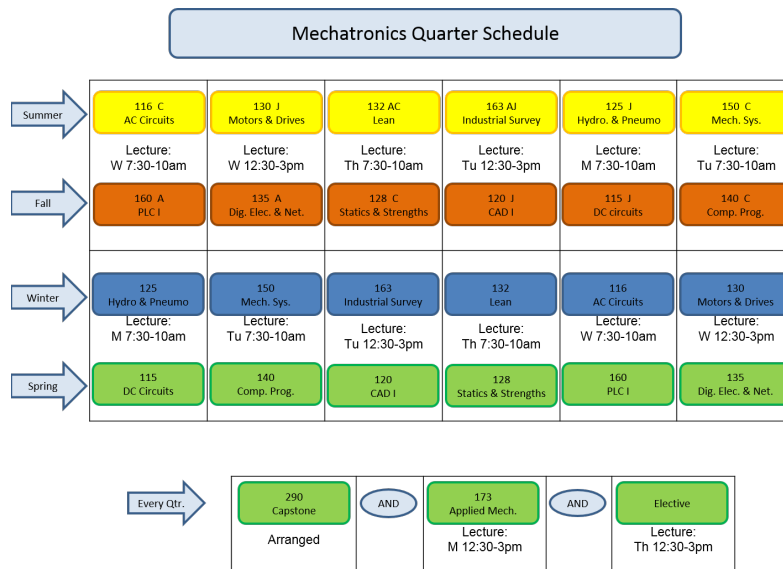


Picture 1. Mechatronics definition

AAT/AAS-T Degrees

The AAT / AAS-T curriculum provides robust college-level general education as well as all the foundational pieces that symbiotically make up this exciting field. The program begins with courses that establish a solid base of technical skills and an understanding of the various disciplines that make up mechatronics as well as lean manufacturing and quality standards. Courses are taught with an eye toward linking disciplines together for larger mechatronic systems. Subsequent courses then build expertise in the foundational skills while increasingly integrating all skills into the design, construction, optimization, maintenance, and repair of full mechatronics systems. Every course offered in the mechatronics program has at least one third party certification possibility associated with the course.

The culminating experience for the AAT/AAS-T student is a capstone project or internship ideally done at a local company where the student can showcase their skills on a resumé building real live project.



Picture 2. Mechatronics course offering

Co-op certs

The “Co-Operative Certificates” are specifically designed for people already employed in industry. The co-op certs were designed and offered based upon needs by industry to upskill professionals while still maintaining their employment. The co-op certs allow employees to gain defined skills that help meet their professional talent needs. Employers may offer workers in a co-op certificate program release time (2 days per week) to attend class and engage in studies. Frequently, employers also help fund tuition and other expenses of participating workers.

Enrollment History

The enrollments for mechatronics have steadily been increasing since the founding of the program in 2014. The original structure for the program was to have enrollment every spring and fall. In 2018 the program was restructured to accept enrollments every quarter at a cap of 12 entering students per quarter. Every quarter enrollment, together with a change in how courses were offered, led to an increase in capacity and better pathways for students to completion.

The enrollment for the last 18 months has been at capacity with a few courses being overenrolled and a slight attrition among students towards the final courses of the program. During the summer of 2019 the Mechatronics program will be moving into a brand-new building allowing for yet another increase in capacity.

Year	Headcount per seat available
2019	63/64
2018	64/64
2017	46/48
2016	20/48
2015	10/48

Table 3. Mechatronics enrollment history per seat

Program History

New to the United States, Mechatronics has been a well-established discipline in the industrialized world since the early 2000s. To mitigate the gap between the United States and its counterparts in Europe and Asia, the Department of Labor setup grants to establish Mechatronics programs across the United States. Clover Park Technical College was awarded the DOL grant in 2014 and the program has been continuously developing since then. The program is currently housed in Building 25 on the Lakewood campus of CPTC but will be moving into the new CAM-T building (Center for Advanced Manufacturing and Technology) during the summer of 2019.

Criteria 5

CRITERIA	STANDARD
5. Student demand for the program within the region.	Evidence of student interest and demand from multiple sources, such as but not limited to: students graduating with technical associate degrees in the region, survey of students within region, demand in excess of opportunity to enroll in related traditional bachelor's programs, and changes in industry standards. Include enrollment projections for each year over the next five years.

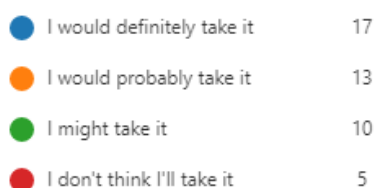
Graduates in the Region

In addition to our AAS-T students that desire a bachelor's program, the BAS-META will attract transfers from our sister colleges in the area. Bates Technical College, Green River College, Renton Technical College, and Centralia College, and all offer associate-level degrees in related areas but offer no corresponding bachelor's degree options. We will seek articulation agreements with all of these nearby colleges for our baccalaureate degree.

Student Demand

As part of the preparation for this proposal, we conducted a survey of our current students to gauge their interest in continuing their studies with the proposed BAS-META degree. The responses pretty much speak for themselves:

14. Clover Park is exploring the creation of a BAS in Mechatronics Engineering Technology and Automation. This Degree would take 6 quarters (1.5 years) to complete after completion of a mechatronics AAS-T degree. Given the subjects below, how would you describe your interest in continuing into this Bachelor's degree program?



Projected Enrollment

The survey of current students of the associates level mechatronics program at Clover Park indicates a high level of probable enrollment in this further degree if offered. 65% of students surveyed indicated that they would definitely or probably enroll in such a degree program, which equates to 10 highly interested students every other quarter. From this data, we can conservatively project with a 40% enrollment conversion factor, that our internal pipeline would provide a steady annual enrollment of 8 students. We project that pent-up demand may cause the initial enrollment to be even higher, with the inclusion of former students coming back to enter the degree. Later in the five-year projections, we anticipate seeing enrollments grow from both external sister school transfers (projected as four every other quarter) as well as higher participation rates (stepping to 8 every other quarter) internally as students begin to enroll in our AAS-T specifically to continue to the BAS-META. Below are our rough five-year enrollment projections:

Entry Quarter	BAS-META 1 st quarter enrollment	BAS-META 3 rd quarter enrollment	BAS-META 5 th quarter enrollment	BAS-META total enrollment
Fall 2020	8	0	0	8
Spring 2021	8	8	0	16
Fall 2021	6	8	8	22
Spring 2022	8	6	8	22
Fall 2022	10	8	6	24
Spring 2023	12	10	8	30
Fall 2024	12	12	10	34
Spring 2025	12	12	12	36
Fall 2025	12	12	12	36

Criteria 6.

CRITERIA	STANDARD
6. Efforts to maximize state resources to serve place-bound students.	<p>Describe how the program will serve place-bound working adults.</p> <p>Identify similar program offered by public or independent institutions in the region.</p> <p>Describe options that have been explored for collaboration with other public baccalaureate institutions, businesses, and /or community organizations considered in the development of the proposal and include a brief description of initial conversations.</p> <p>Describe collaboration with similar CTC BAS programs and related CTC Centers of Excellence.</p> <p>Describe unique aspects of the proposed program that differentiate it from similar programs and/or describe why expansion would be desirable or necessary.</p>

Serves Local, Place-Bound Working Adults

Once operational and running, the Clover Park Technical College BAS-META program will be the only open-admission Mechatronics BAS program in the western half of the United States. The BAS-META program would offer a continued path for all of the associate level mechatronics graduates of our immediate neighboring colleges such as Centralia College, Clark College, Everett Community College, Renton Technical College, Shoreline Community College, Green River Community College, North Seattle College, and South Seattle College.

In addition to our residents who are place-bound by home and family commitments, we serve the Joint Base Lewis-McChord community. It is our intention to develop an academic bridge for associate degree graduates in fields relatable or complementary to mechatronics to increase the accessibility of the program.

Course Schedule

We will be primarily offering hybrid courses with some options for online general education. It is the intention to explore evening courses and Co-op paths for the program as well. Students will be able to choose from a variety of courses to control the focus of the program to their and industry-specific needs.

Collaboration

We will be continuing our collaboration with local and regional business partners to make sure that our future BAS-META graduates leave the program with a developed skillset leading to fulfilling and well-paying employment. It is the ambition of the mechatronics program to not only graduate students who have the skillset industry need, but also the skillset industry wants in order to develop and grow. The mechatronics field is expanding and developing so fast that industry is looking for educational partners to upskill their workforce and relying on graduates to bring new technologies in-house. The mechatronics program has several graduates that have

obtained engineering level jobs due to the need for this type of knowledge. The BAS-META will solidify this skillset and increase the number of available graduates.

While establishing the BAS-META, the intention is to satisfy the demand from associate degree graduates from the mechatronics program at CPTC, but we will also be offering a path for associate-level graduates from other mechatronics programs in the state.

The merger of IT with production and interconnectivity of processes and machines in industry provides substantial collaboration opportunities between the BAS-META and other programs on campus. An obvious collaboration would be between CPTCs CNIS program as well as the computer programming program.

Unique Program

Currently, there are an estimated nine baccalaureate programs for mechatronics in the United States, 11 if satellite campuses are included. The proposed BAS-META program would be the 10th baccalaureate program for mechatronics in the entirety of the United States. The majority of already established programs exist in the eastern United States centered around automotive manufacturing regions. There are additional programs that offer various concentrations in mechatronics, but those programs serve a purpose different from that described in the BAS-META proposal. The automotive industry is considered a strong adopter of automation and technology with well-established connections to European manufacturers and OEM's (Original Equipment Manufacturers). Europe, in comparison, has well over a hundred bachelors level degrees in mechatronics. The proposed BAS-META would be a unique program for our region and the programs future graduates would provide industry with extremely important skills and services, skills and services that currently have to be contracted from companies located in the eastern United States and Europe.

As pointed out in this proposal, mechatronics as a field is growing rapidly. The cost of automation is going down and with it, the barrier of entry for small and medium-size business and manufacturing. The BAS-META program provides a unique opportunity for our region to establish local competence that leads to increased productivity, higher wages, and safer work environments for small as well as large industry.

Conclusion

Mechatronics is an emerging and in-demand field. Job opportunities far exceed the number of college graduates produced by any other related program. The BAS-META would be first of its kind in the state and be among a very few nationwide. Given the industry trends for increasing levels of automation, the demand for these skills can only grow. As workers are displaced by automation, the BAS-META would provide workers an opportunity to upskill for the future workforce. Lakewood, being much more diverse than Washington in general, is an ideal place to anchor a mechatronics baccalaureate program as a lever to increase inclusiveness and provide an opportunity to an underserved population.

Applied Baccalaureate Degree Supply/Demand Gap Rubric for College

The goal of this rubric is to help you build a program that will meet the needs of your community. We have given you options about the information you can use to support the need for your new program. Also, the guidelines for estimating the supply/demand gap are similar to the ones we use for other program applications. We hope this makes the rubric more familiar to you. If not, contact Joyce Hammer at jhammer@sbctc.edu for further information.

The application needs to show the information below for program approval:

- employers demand* the level of technical training proposed within the program, making it cost-effective for students to seek the degree;
- lead to high wage-earning jobs; and
- the proposed program fills a gap in options available for students because it is not offered by a public four-year institution of higher education in the college's geographic area.

College Name: Clover Park Technical College	
Program Name: Computer Networking and Information Systems Security	
Select one: Existing Occupation <input checked="" type="checkbox"/> or Emerging Occupation <input type="checkbox"/>	
If local demand/supply information is available for the specified degree program and target occupation(s),**	
For demand: Provide local/regional demand data for the targeted occupation job title(s) from traditional labor market data, industry data, trade association data, or other transactional data. <i>(Provide absolute numbers, not just percentages)</i>	<i>The facts and figures below are documented within the Statement of Need.</i>
For supply gap: Provide data on the number of programs and the number of annual program graduates for all four-year colleges that supply your region. Is the number of current annual graduates insufficient to meet current and projected demand? (The result of demand minus supply).	<i>The facts and figures below are documented within the Statement of Need.</i>
OR, if demand information is not available or it is a new/emerging/changing occupation, **	
For demand: Provide employer survey results for local demand for the targeted occupation job title(s) to support the demand and education level for the program. <u>Survey requirements are listed below.</u>	Survey respondents indicated that there are up to 90 mechatronics openings at their companies that would prefer a bachelor's degree in the next 3 years.

<p>For supply gap: Provide employer survey results for local supply for the targeted occupation job title(s) to support that there is a gap in the number of qualified applicants available to fill jobs. <u>Survey requirements are listed below.</u></p>	<p>There are no other programs in mechatronics locally to provide graduates qualified for these positions. Respondents indicate that the BAS-META will be accepted at rates above other related programs not offered locally but in the western half of the state.</p>
<p align="center">OR, if based on a statutory or accreditation requirement, **</p>	
<p>Select one: Statutory Requirement <input type="checkbox"/> or Accreditation Requirement <input type="checkbox"/></p>	
<p>For demand: Provide labor market information on the current education requirements for the job, including evidence of recent openings for requiring or preferring bachelor's degrees or above. Cite the statute or certifying body, your proposed program is based upon that has specified a bachelor's or above in the field is needed.</p>	
<p>For supply gap: Provide employer survey results for local supply for the targeted occupation job title(s) to support that there is a gap or that employers anticipate a gap in the number of qualified applicants that will be available to fill jobs with the new requirements. <u>Survey requirements are listed below.</u></p>	
<p>* Demand is defined by state law as <i>“an occupation with a <u>substantial</u> number of current or projected employment opportunities.”</i> **Applications may include information related to more than one option (i.e., labor market data to support the local demand for the occupation and a local employer survey to support that there is a gap in the number of qualified applicants available to fill jobs).</p>	

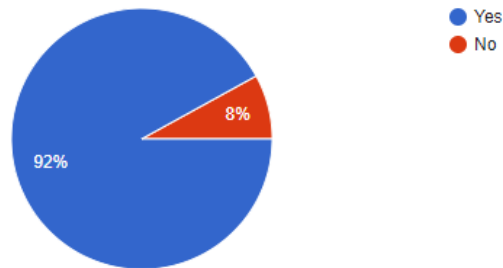
Appendix I: Industry Survey of Workforce Supply and Demand

First Impressions

Do you currently have openings, or anticipate future openings, for mechatronics related positions at your company?



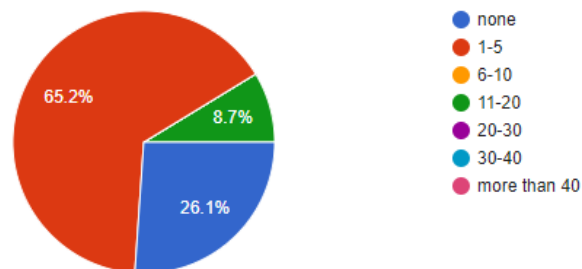
25 responses



General Current Demand

How many mechatronics related positions are currently open at your company?

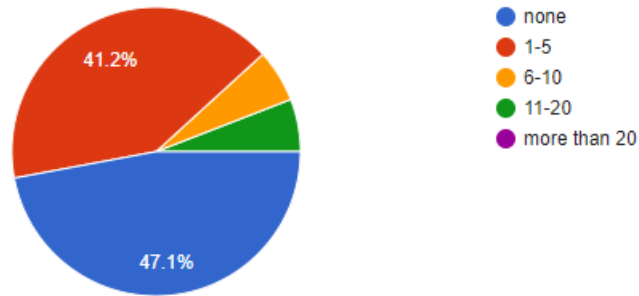
23 responses



Current Demand for Bachelor's Degree

How many open mechatronics related positions does your company have that either prefer or require candidates to hold a 4 year bachelor's degree?

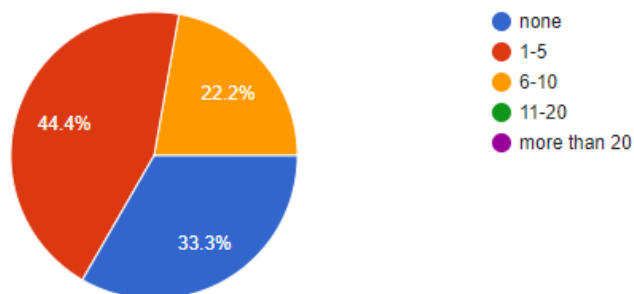
17 responses



Current Bachelor's Degree Demand - Part 2

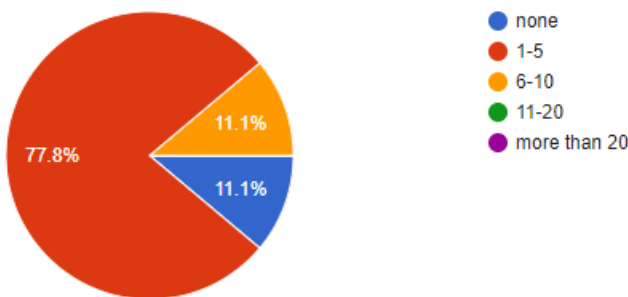
How many of your open mechatronics related positions require a bachelor's degree?

9 responses



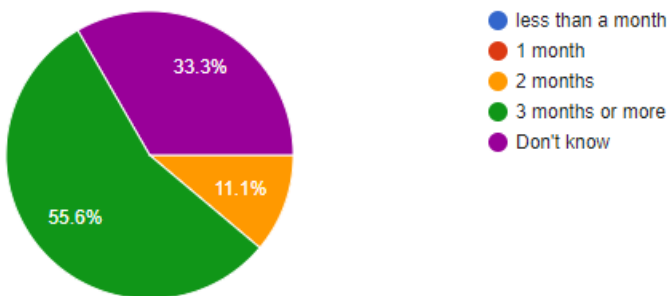
How many of your open mechatronics positions prefer a bachelor's degree?

9 responses



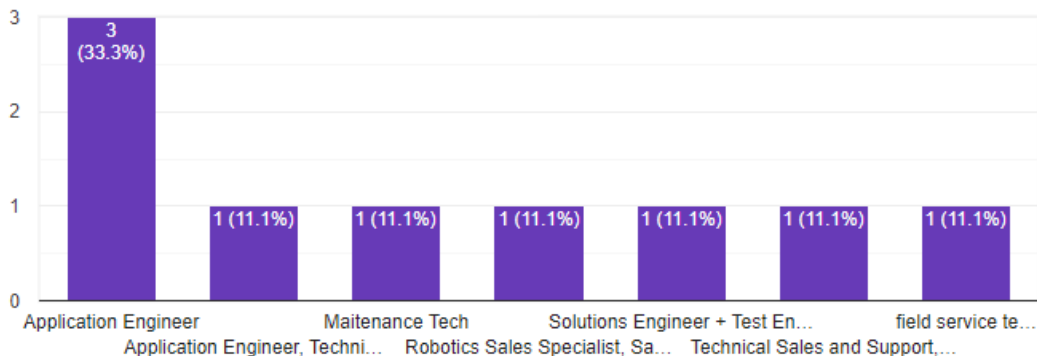
What is the average length of time these positions have been open?

9 responses




What are the top mechatronics related job titles you are currently recruiting for?

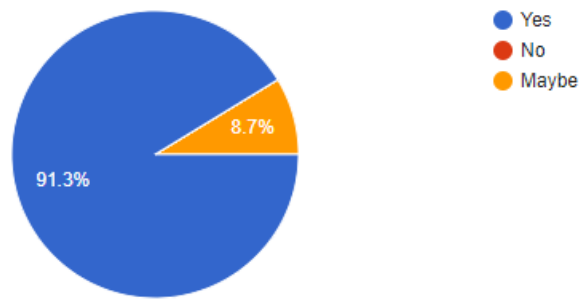
9 responses



General Future Demand

Do you anticipate a future demand for mechatronics related positions at your company? 

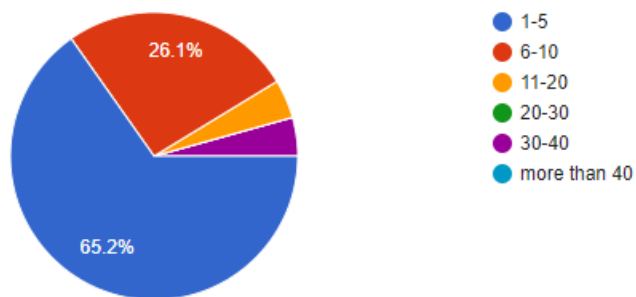
23 responses



Future Demand for Mechatronics

How many mechatronics related positions do you anticipate opening in the next 3 years at your company?

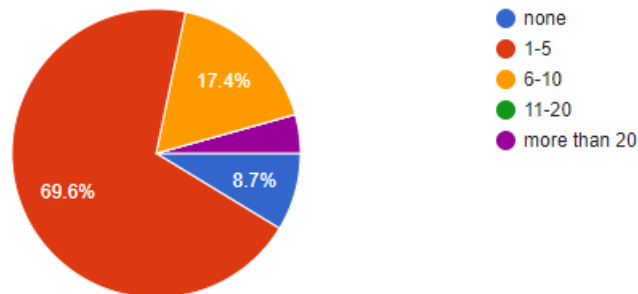
23 responses



Future Demand for Bachelor's Degree

How many mechatronics related positions does your company anticipate opening in the next 3 years that either prefer or require candidates to hold a 4 year bachelor's degree?

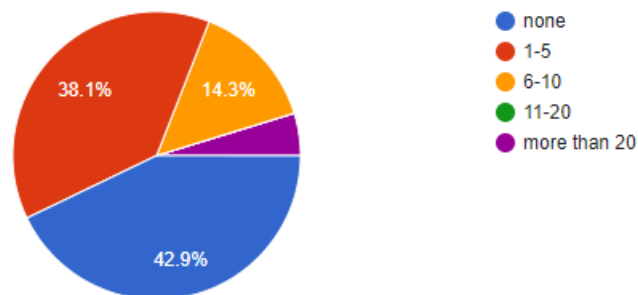
23 responses



Future Bachelor's Degree Demand - Part 2

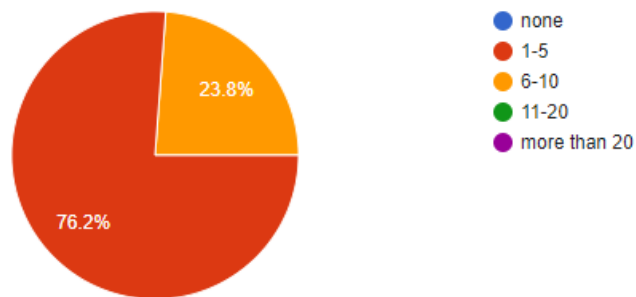
How many of your anticipated mechatronics related position openings in the next 3 years will require a bachelor's degree?

21 responses



How many of your anticipated mechatronics related position openings in the next 3 years will prefer a bachelor's degree?

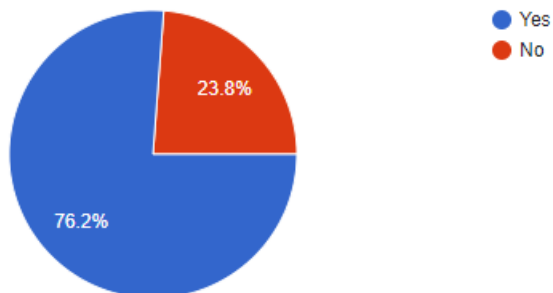
21 responses



Bachelor's Degree Supply

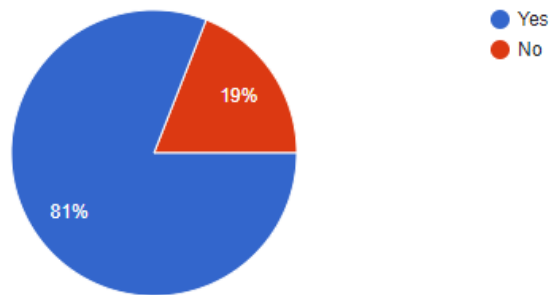
Have you had difficulty finding bachelor's level candidates to fill mechatronics related positions?

21 responses



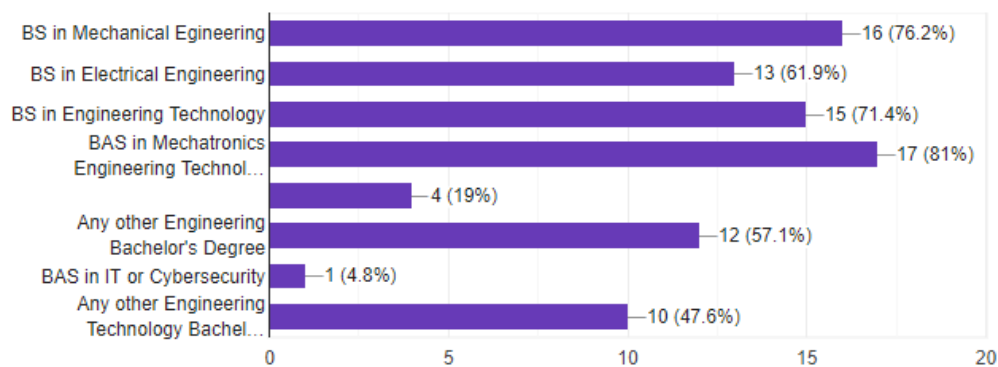
Do you anticipate having future difficulty finding bachelor's level candidates to fill mechatronics related positions?

21 responses



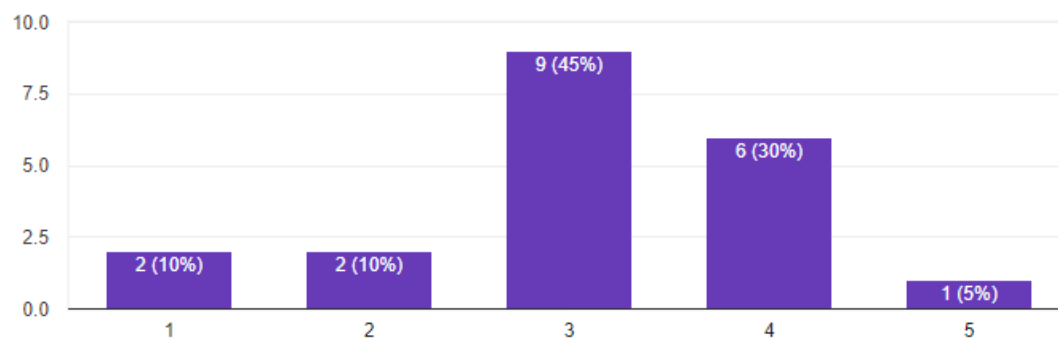
What type of bachelor's degree would your company accept for mechatronics related positions? (check all that apply)

21 responses



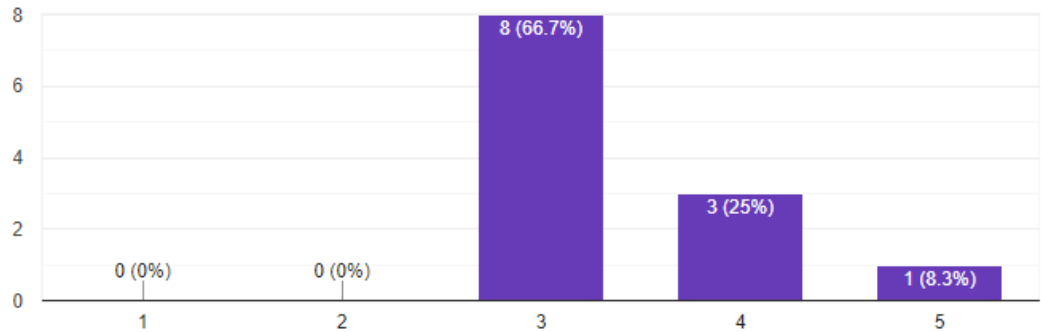
How important is ABET accreditation in evaluating whether or not to accept a degree?

20 responses



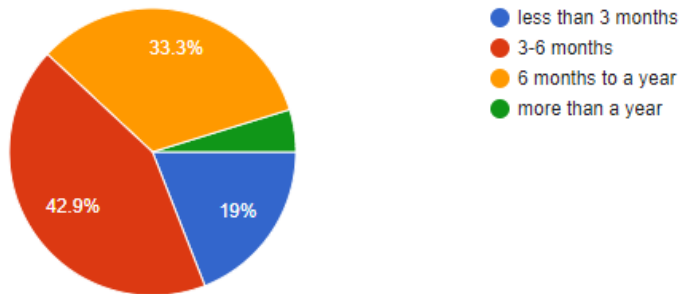
How well prepared for work in mechatronics have you found recent graduates of existing bachelor's degree programs? (please skip if you do not know)

12 responses



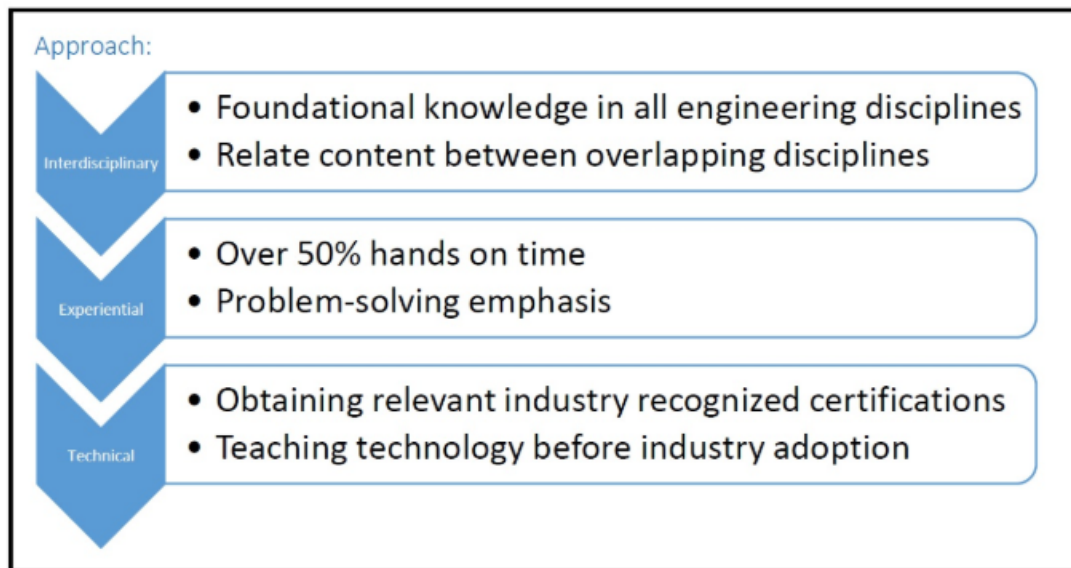
On average how long of do you anticipate the on-boarding/training period for new mechatronics hires to last?

21 responses

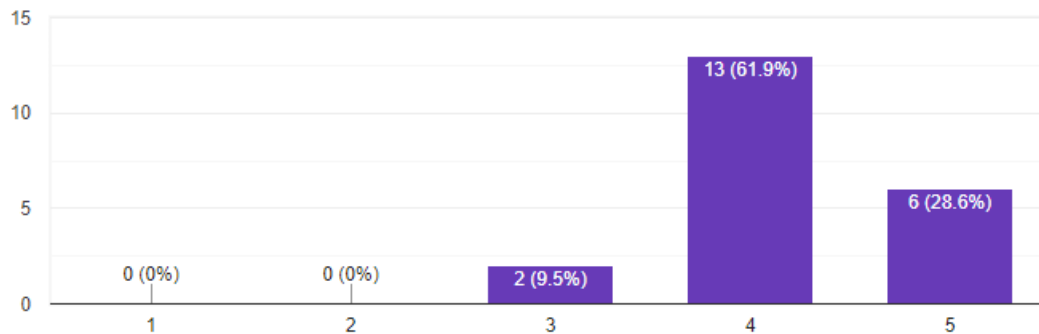


Program Development Feedback

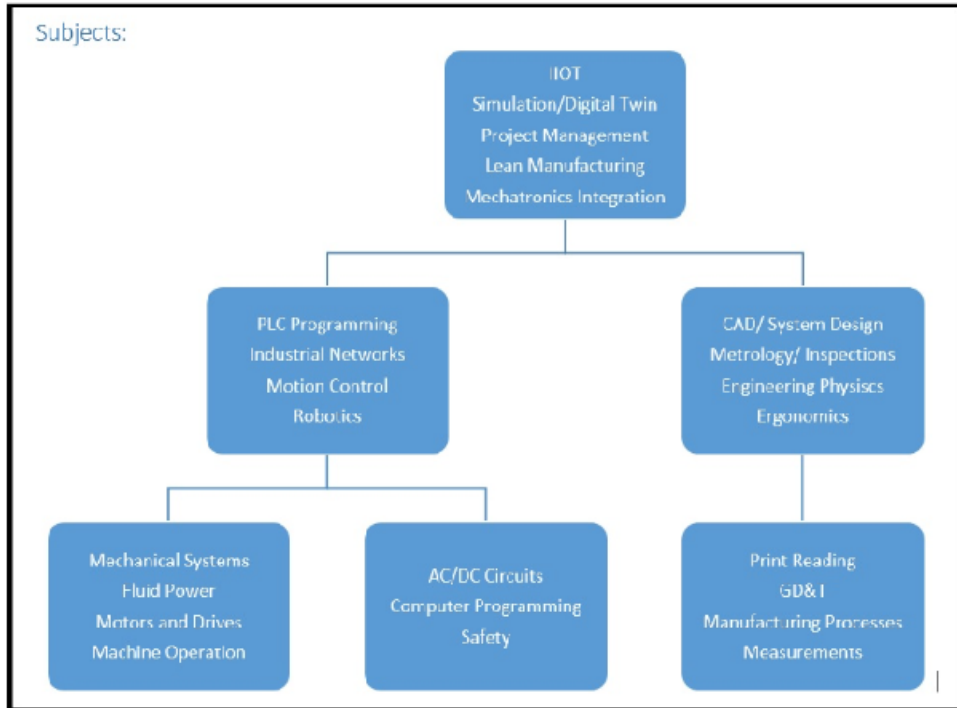
Does the following proposed program approach for a bachelor's degree align with your company's workforce needs?



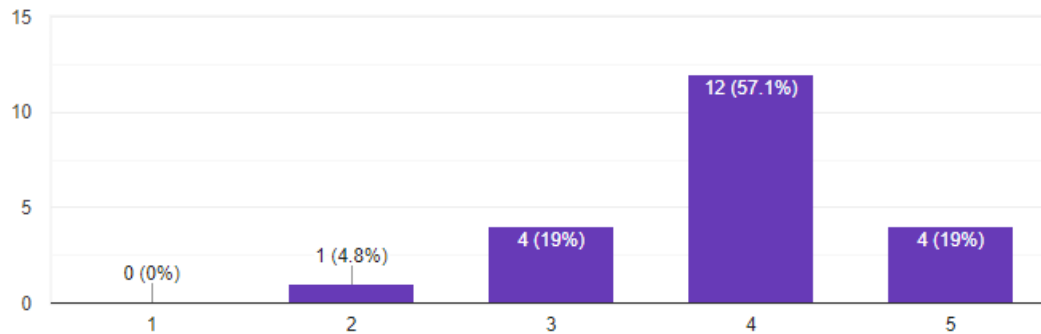
21 responses



Does the following proposed subject matter for a bachelor's degree align with your company's needs?



21 responses



Will the proposed program, as outlined in the above approach and subjects, assist you in finding qualified candidates for your mechatronics positions?

21 responses

