

BOARD OF HIGHER EDUCATION

REQUEST FOR BOARD ACTION

NO.: BHE 22-23

EXECUTIVE COMMITTEE DATE: January 24, 2022

BOARD DATE: February 1, 2022

**APPROVAL OF LETTER OF INTENT OF BERKSHIRE COMMUNITY COLLEGE TO
AWARD THE ASSOCIATE IN SCIENCE IN MECHATRONICS AND
AUTHORIZATION FOR FAST TRACK REVIEW**

MOVED: The Board of Higher Education (BHE) has evaluated the Letter of Intent of **Berkshire Community College** to award the **Associate in Science in Mechatronics** and has determined that the proposal aligns with BHE criteria. Accordingly, the BHE authorizes the Commissioner to review the program and to make a final determination on degree granting authority pursuant to the Fast-Track review protocol.

VOTED: Motion approved and advanced to the full BHE by the Executive Committee on 1/24/2022; and adopted by the BHE on 2/1/2022.

Authority: Massachusetts General Laws Chapter 15A, Section 9(b); AAC 18-40

Contact: Winifred M. Hagan, Ed.D., Senior Associate Commissioner for Strategic Planning and Public Program Approval

BOARD OF HIGHER EDUCATION
February 1, 2022
Berkshire Community College
Letter of Intent
Associate in Science in Mechatronics

DEGREE TITLE ABSTRACT ON INTENT AND MISSION OF PROGRAM

The proposed Associate in Science in Mechatronics (ASM) program at Berkshire Community College (BCC) is intended to educate students, produce highly skilled technical professionals, and provide solid career prospects in electromechanical systems for graduates. The proposed LOI is planned to help address workforce shortages in manufacturing and support the college, as well as county and state equity agendas, through recruitment efforts and applied pedagogical strategies geared toward a diverse body of candidates, typically not well represented in manufacturing industries.

The mechatronics program is intended to center on the foundational changes occurring in technical professions. Recognizing that technical and electronic skillsets are no longer separate in the industrial environment, and innovation and a solid theoretical base are necessary for rapidly changing technologies in the workplace, BCC intended to educate students to understand the physical principles and concepts behind technology, that will prepare them for a successful technical career.

BCC efforts are intended to align closely with Perkins and STEM Starter grant initiatives. The pedagogical approach of learning by doing rather than learning by lecture is expected to increase what students know and can do in concrete evidentiary ways. With specific industrial needs and company skill-requirements at the center, BCC’s educational strategy is to teach students the hands-on technical skills that deliver basic physical principles of mechatronics, and thus increase student capacity to learn and troubleshoot a range of systems, including digitally automated equipment. It is expected that students will become lifelong learners of electronic and mechanical technologies, and software systems through the proposed program. Further, it is intended that students will learn to be curious about and adaptive to the fast-changing and interconnected industrial world of automation.

The proposed Associate in Science in Mechatronics was approved by the Berkshire Community College Board of Trustees on December 1, 2020. The LOI was circulated on September 22, 2021. No comments were received.

A. ALIGNMENT WITH MASSACHUSETTS GOALS FOR HIGHER EDUCATION

Address Gaps in Opportunity and Achievement in Alignment with Campus-Wide Goals

It is expected that the proposed AS Mechatronics program will be geared towards students interested in hands-on technical career pathways. The program will build marketable skills in high need areas such as automation and manufacturing. Unlike an engineering degree, the Mechatronics program will not require mastery of differential calculus-based mathematics. Thus, Berkshire Community College (BCC) expects the proposed Mechatronics program to open an alternative pathway to rewarding technical careers for a broader range of students. It is expected that graduates of the Mechatronics program will pursue hands-on practical careers needed in regional manufacturing industries such as plastics and paper manufacturing. The program aligns with BCC's mission to prepare students for successful entry into the local workforce. This program is designed to meet the needs of local manufacturing industries, mainly small to medium-sized businesses.

The Mechatronics program will require students to learn precalculus and algebra. All students will receive evidence-based, tailored math support such as tutoring, practice sessions, or a personal math coach. Recruitment, retention, and completion strategies are planned to target recent high school graduates as well as persons looking for career change or career advancement. The proposed Mechatronics program was designed to align with BCC's values of diversity and inclusion in the development of curriculum, instructional practices, support strategies, and services per recommendations by BCC's Diversity, Equity, and Inclusion (DEI) Council. Multicultural philosophies and frameworks (described further below) significantly influenced the development of the proposal. At an institutional level, BCC is elevating data literacy through working with Achieving the Dream. It is expected that this will better inform an understanding of students in the program, and their progress through the course sequence. Additionally, a college-wide high-impact-practice program that was recently launched, is expected to support student success. In alignment with BHE's equity priority, BCC adopted an asset-based approach to student success. The proposed mechatronics program recognizes student cultural wealth and will benefit from established STEM efforts such as the STEM Starter Academy initiatives, to recruit students across intersectional identities. Designed to '*sustain a culturally engaging environment*' mechatronics is positioned to serve a diverse student population.

Program or Department Supports to Ensure Student Retention and Completion

BCC reports a wide range of student support services, including STEM Starter Academy (SSA) case management, mentoring, scholarships, research, internships, coaching, and tutoring. BCC's tutoring center assists students in all subject matters and instructors use evidence-based, high impact practices such as differentiated collaboration in groups and applied learning experiences, close and directed engagement with professors, individualized approaches to learning and skill demonstrations, learning communities, field trips and experiential learning. BCC also offers TRIO (Talent, Resources, Initiative, Opportunity), a student support services program for first-generation, low-income, and disabled students. Additionally, BCC is establishing a campus Science Commons offering a wide range of technical equipment to perform hands-on projects related to the program, keeping students engaged and focused on their goals of learning new

technical skills. All students receive regular and detailed academic and career advising throughout their time at BCC.

Alliances and Partnerships with PK-12, Other IHE's, Community Employers

It is planned that a program advisory council including representatives from local industries (Cavallero Plastics, General Dynamics, Crane Currency, Sonoco Plastics, Dive Technologies, and The Berkshire Innovation Center) has been established to support this program. Committee members provided valued input to the design of the program prompting BCC to incorporate training in programmable logic controllers' technology as well as other locally needed, manufacturing skills. BCC anticipates that this committee will grow over the course of the next two years.

It is planned that new articulation agreements will be developed with Berkshire County's two technical high schools, McCann and Taconic once the LOI is approved by BHE; many of their graduates already possess some of the skills this program aims to transmit, therefore accelerating their graduation and participation in local industry.

BCC is currently participating in the MassBridge¹ curriculum development project with MIT and other MA community colleges to incorporate novel manufacturing technologies and employer reported skill gaps into the curriculum and develop transfer pathways to 4-year degrees associated with manufacturing. As well BCC reports collaboration with the Berkshire Innovation Center, an entity that includes industry, academia, and government to spur growth in manufacturing with diverse industry members who have knowledge of workforce skill gaps. It is planned that the 3-credit experiential learning course at the end of the program will be at the Center or a member company.

Relationship to MassHire Regional Blueprints

The Berkshire Workforce Board Regional Labor Market Blueprint (2020 update) lists the priority industries & occupations as Machinist, Manufacturing Assembly; Industrial Machinery Mechanics; Molders, Shapers and Casters; Paper Goods Machine Setters, Operators and Tenders; Extruding, Forming, Pressing and Machine Setters, Operators and Tenders. BCC reports that the 2018 regional Berkshires workforce skills planning initiative cited local industry's workforce challenges as *"The cost of creating appropriate and adequate training programs that meet the needs of the ever-changing industry, including lack of access to high tech equipment. Many employers also show concern related to work readiness of the applicants including needing workers who have greater level of fluency in technology, problem solving skills, and general work ethic. This industry is facing high replacement demand as workers are getting older and closer to retirement age"*. BCC finds this quote to summarize the gap that will be addressed by the

¹ *(Department of Defense)*

proposed program, which is expected to graduate students who are skilled, and have a strong work ethic.

A Burning Glass technologies analysis found on average 641 posting on the manufacturing sector for the Berkshires region, and the median salary of an associate's degree holder for the sector to be USD 55k. The median age of the average manufacturing employee in the Berkshires is 48 years, and this very stable and rewarding line of work has a small (11%) constituency of non-white workers. BCC's proposed program aims to increase and expand opportunities for racially diverse students.

Duplication

BCC reports that there are currently no other existing Mechatronics programs offered within Berkshire County. Greenfield (54 miles away, Franklin County) and Hudson Valley Community College (36 miles, Troy NY) offer associate degrees in Manufacturing and Electronics, or Engineering Technology. There are 4-year colleges in the area with STEM degrees (Williams College with Materials Science and Massachusetts College of Liberal Arts with Computer Science) but no other program trains students at the technical level with a hands-on, experiential learning approach. Previously, Berkshire Community College offered separate associate programs for electronics and manufacturing; these programs are no longer offered and this new proposed Mechatronics program represents a more contemporary replacement for a technician-oriented program.

Innovative Approaches to Teaching and Learning

Courses such as Introduction to Electricity/Electronics, Industrial Control Systems, Microprocessors, and Digital Circuits are planned to be project based. These courses comprise the electronics side of the Mechatronics program where it is planned that students will learn specific competencies that a technician in the field would need to master. Courses related to manufacturing are also planned to be competency-based, such that students will be expected to fabricate a range of mechanical parts to satisfy educational goals; this is the mechanical part of Mechatronics.

BCC has partnered with Intelitek, a major supplier of manufacturing and robotics equipment, in order to offer online curriculum and simulation (Moodle-based) to cover theoretical content of courses. This is planned to provide students with scheduling flexibility. It is planned that labs will be hosted on campus with hands-on delivery for experiential learning and the application of theory.

B. ALIGNMENT WITH CAMPUS STRATEGIC PLAN AND MISSION

Priority Rationale and Support of Strategic Plan and Overall Mission of Institution

BCC's Strategic Plan encompasses goals that are directly related to the implementation of the proposed program including, the promotion of a dynamic, diverse environment that prepares students for the 21st century, encourages innovation, incorporates leading technology, and utilizes best practices to promote academic excellence.

The strategy to embark on major infrastructure improvements that use sustainable practices to modernize facilities, integrate advanced technologies, improve access, and create engaged learning spaces is evidenced through BCC's development of a Science Commons to integrate advanced technologies into coursework and improve student access to these resources. It is anticipated that the Science Commons will complement the development of the Mechatronics program. State of the art equipment for a mechatronics laboratory is a significant step forward in realizing this goal. It is planned that students will engage and learn about program automation, or manufacture components using 3d printers or robotic equipment and this will support retention.

The strategy to strengthen relationships with high schools, colleges, community organizations, business, and industry to provide experiential learning, seamless transfer, and career opportunities for students can be seen in the plan that BCC will work with local high schools to recruit students into the program to ensure that there is a pipeline of skilled graduates who are ready to enter into high-demand technical positions. The Mechatronics program is expected to provide an achievable career pathway particularly for traditionally underserved students.

LOI Program Goals and Objectives (Form B)

BCC plans that the proposed mechatronics program will develop a dynamic, technical curriculum that is shaped by, and addresses the needs of local industry. It is also planned to enable students to develop the technical skills that are valued by industrial employers and provide supportive, experiential learning opportunities. BCC will utilize state-of-the-art electronic and manufacturing equipment to enhance graduates' career prospects. BCC anticipates that a diverse student body will further enhance the cultural wealth of the local workforce.

C. ALIGNMENT WITH OPERATIONAL AND FINANCIAL OBJECTIVES OF INSTITUTION

Enrollment Projections (Form C)

It is anticipated that the proposed Mechatronics program will enroll a total of 12 students in year one, increasing to 52 students by year five.

Resources and Financial Statement of Estimated Net Impact on Institution (Form D, Appendices)

BCC does not expect one-time or start-up costs for full-time faculty, adjunct faculty, staff, general administrative purposes, facilities, space, or equipment because the infrastructure and personnel necessary to run the program is currently in place.

It is planned that full-time faculty will share teaching obligations between engineering and mechatronics programs. The technical support staff position will share time between mechatronics and the newly built makerspace. Instructional materials and consumables will generate costs as noted on the budget form. The program relies on field experiences with educational industry partners and therefore field resource start-up costs are expected. Outreach, partnerships, and workshops are expected to form an important component of the program's ecosystem.

STAFF REVIEW AND VALIDATION

Staff thoroughly reviewed the **LOI** proposing full degree granting authority for the **Associate in Science in Mechatronics** submitted by **Berkshire Community College**. Staff validate that the **LOI** includes all data required by the Massachusetts Board of Higher Education. Staff recommendation is for BHE authorization for the Commissioner to review the program pursuant to the Fast-Track review protocol.

Form A1 (LOI) Curriculum: AS in Mechatronics

Required (Core) Courses in the Major (Total # courses required =13)		
<i>Course Number</i>	<i>Course Title</i>	<i>Credit Hours</i>
ENT-122	Computer Aided Drafting/Design I	4
ENT-185	Engineering Computer Applications	4
ENT-129	Introduction to Electricity and Electronics	3
ENT-151	Introduction to Manufacturing	3
ENT-260	Industrial Control Systems	4
ENT-152	Advanced Manufacturing	3
ENT-235	Digital Circuits and Microprocessors	4
ENT-238	Elements of Machines	4
ENT-225	Introduction to Computer Aided Manufacturing I	3
ENT-244	Hydraulics and Pneumatics	3
EXL-225 to	Experiential Learning I	1
EXL-250	Experiential Learning II	1
EXL-275	Experiential Learning III	1
Sub Total Required Credits		38
Elective Courses (Total # courses required =4) (attach list of choices if needed)		
ENG	English Composition Elective (2 sections)	6
COM- or BUS-	Communications or Business Elective	3
-	General Education Elective	3
Sub Total Elective Credits		12
Distribution of General Education Requirements		# of Gen Ed Credits
Attach List of General Education Offerings (Course Numbers, Titles, and Credits)		
Arts and Humanities, including Literature and Foreign Languages		0
Mathematics and the Natural and Physical Sciences		10
MAT-102 / College Algebra		3
MAT-121 / Precalculus		3
PHY-111A / The Ideas of Physics (with lab)		4
Social Sciences		0
Sub Total General Education Credits		20
Curriculum Summary		
Total number of courses required for the degree		20
Total credit hours required for degree		60
Prerequisite, Concentration or Other Requirements:		

Form B: LOI Goals and Objectives

Goal	Measurable Objective	Strategy for Achievement	Timetable
To develop a dynamic, technical curriculum that is shaped by, and addresses the needs of local industry	Semester meetings with surveys and inputs from advisory committee members.	An advisory committee comprised of local industry representatives will assist in evaluating program outcomes.	Advisory Committee work is ongoing. Committee was assembled for program proposal, semester meetings held with surveys and input regarding local industrial needs.
Program graduates will demonstrate technical skills valued by industrial employers.	Program graduates will obtain at least one industry recognized certification.	Courses in Manufacturing and Electronics will include content by certification organizations, and program will encourage and financial support certification tests.	Certification data will be collected as well as the above-mentioned survey to employers and advisory committee at the end of each semester.
To support hand-on technical skills education through the purchase of state of the art electronic and manufacturing equipment	A maker space and electronics laboratory are created based on recommendations of advisory committee	Obtaining public and private funds to purchase equipment required for courses, and working closely with the Berkshire Innovation Center (our local technology Incubator)	By the end of Fall semester 2021. Maker space is under construction and procurement of newer equipment is underway, relationships as well as collaboration with the

			innovation center have been established. Grant applications on a case by case basis
Graduates improve the career prospects and obtain employment in automation or manufacturing positions	Students are employed by local industry	The last semester includes 3 credits of experiential learning, which will allow the students to get involved with local industry and apply knowledge acquired in a real-world setting	Students will be surveyed 6 months after graduation and their employers will be surveyed the subsequent 6 months after (12 after graduation)
Diversifying local workforce by the inclusion of underrepresented minorities in solid middle-class technical career trajectories	Enrolled students and program graduates include a mixture of diverse ethnic, socioeconomic and gender identifying groups.	Students to be recruited by outreach to local high schools as well as the local community workforce board (mass hire) and the local chamber of commerce (One Berkshire)	Yearly review of enrollment demographics and corrective actions taken as needed

Form C: LOI Program Enrollment

	Year 1	Year 2	Year 3	Year 4	Year 5
New Full-Time	6	8	10	12	14
Continuing Full-Time		6	8	10	12
New Part-Time	6	8	10	12	14
Continuing Part-Time		6	8	10	12
Totals	12	28	36	44	52

Form D: LOI Budget

One Time/ Start Up Costs

	Cost Categories	Year 1	Annual Enrollment			
			Year 2	Year 3	Year 4	Year 5
no additional costs (current full-time faculty will teach the courses)	Full Time Faculty <i>(Salary & Fringe)</i>	12	24	24	24	24
none	Part Time/Adjunct Faculty <i>(Salary & Fringe)</i>					
\$15,000 (part time technician shared with makerspace)	Staff					
no additional costs	General Administrative Costs					
\$2,000	Instructional Materials, Library Acquisitions (consumables)					
no additional costs (equipment purchased for and maintained by makerspace)	Facilities/Space/Equipment					
no additional costs	Field & Clinical Resources					
no additional costs	Marketing					
no additional costs	Other (Specify)					

One Time/Start-Up Support	Annual Income					
	Revenue Sources	Year 1	Year 2	Year 3	Year 4	Year 5
	Grants					
	Tuition (= \$26/ credit, the program requires 15 credits/ semester = 30 credits/ year)	\$9,360	\$18,720	\$18,720	\$18,720	\$18,720
	Fees (= \$197/ credit, the program requires 15 credits/ semester = 30 credits/ year)	\$70,920	\$141,840	\$141,840	\$141,840	\$141,840
	Departmental (mechatronics will be part of the engineering department)	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
	Reallocated Funds					
	Other (specify)					
	TOTALS	\$100,280	\$180,560	\$180,560	\$180,560	\$180,560