District Career & Technical Education (CTE) Pathway Proposal: Advanced Robotics

The Career & Technical Education (CTE) Pathway proposal must be submitted to the CTE Coordinator for prior approval and must include the following information:

Name of State approved (CCCS) CTE Program:

Pathway Name: **Manufacturing**
Sub-Pathway Name: **Mechatronics**

Credit Type(s): **PRA. ELE** *Department Code:* **EGR** *CIP Code:* **480000**

I. GOALS

A. Provide a brief overview of the CTE Pathway.

- The Advanced Robotics Pathway is an experiential learning program with specialized training in robotics and automation topics such as automated control systems, manufacturing, electrical principles, and robotic programming. The multidisciplinary curriculum provides you with the diverse skill set required to install, calibrate, modify, troubleshoot, repair, program, and maintain automated systems and industrial robots.

B. How does this CTE Pathway fit into the overall educational program?

- CTE programs significantly increase not only the high school graduation rate but also result in a higher percentage of students going to college and persisting through graduation. Students taking academic and technical courses have lower dropout rates and better achievement gains than other students. Students from throughout the district will have access to this program, and gain marketable skills that are valued and sought after throughout the industry.

C. What benefits would students receive from this CTE pathway?

- This pathway will prepare students for entry-level positions in manufacturing, robotics, and automation. It will provide students the opportunity to be prepared to focus on skills that will increase their postsecondary readiness. Students have the opportunity to earn industry credentials from industry leaders such as PMMI, SACA, Snap-on, and NC3. Students can also continue in the program to earn their AAS degree in Robotics and Automation through Arapahoe Community College.

II. CAREER & TECHNICAL EDUCATION (CTE) PATHWAY COURSES

A. Complete the table below indicating the course sequence students would take within the CTE program. Other courses may be added or changed within the program, based on the need of students or program modifications. New course names will be indicated in red text.

Level:	*State Approved Course Name:*	*State Approved Description:*	*Credit Type*	*Course Number*
1	*CTE Principles of Manufacturing (A & B)*	*In Principles of Manufacturing, students are introduced to knowledge and skills used in the proper application of principles of manufacturing. The study of manufacturing technology allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities. Students will gain an understanding of what employers require to gain and maintain employment in manufacturing careers.* *SCED CODE: 13002* ***Course Fee Proposal: $100.00***	*PRA*	*79140204*
2	*CTE Digital Electronics (A & B)*	*Digital Electronics is intended to provide students with an introduction to the basic components of digital electronic systems and equip them with the ability to use these components to design more complex digital systems. Proficient students will be able to (1) describe basic functions of digital components (including gates, flip flops, counters, and other devices upon which larger systems are designed), (2) use these devices as building blocks to design larger, more complex circuits, (3) implement these circuits using programmable devices, and (4) effectively communicate designs and systems. Students develop additional skill in technical documentation when operating and troubleshooting circuits. Upon completion of the Digital Electronics course, students will be able to design a complex digital system and communicate their designs.* *Course fee: $50.00/term*	*ELE*	*79140202*
3	*CTE Robotics & Automated Systems*	*Robotics & Automated Systems is an applied course for students who wish to explore how robots and automated systems are used in industry. Upon completion of this course, students will have an understanding of the historical and current uses of robots and automated*	*PRA*	*79140302*

		systems; programmable circuits, interfacing both inputs and outputs; ethical standards for engineering and technology professions; and testing and maintenance of robots and automated systems. *Course fee: $50.00/term*		
3	*CTE Electronics- Analog/Robotics*	*An in-depth study of series-parallel circuits, inductive and capacitive reactance, rectification, amplification, voltage regulation, semiconductors, and robotics will be conducted. The electronic theory is reinforced through breadboarding circuits in the lab. Students will program robots to perform a specific task.* *Course Fee Proposal $50/term*	*ELE*	*79140304*
3	*CTE Electronics- Solid State/Semiconductor*	*The course is an introduction to semiconductor fundamentals and applications to electronic devices. The course creates the background in the physics of compound semiconductor-based electronic devices and also prepares students for advanced courses in solid-state and quantum electronics. The course provides an opportunity for students to continue their education by undertaking advanced study and research in a variety of different branches of semiconductor device applications. Topics include the background solid state and semiconductor physics, and basic principles of electronic device operation including diodes, transistors, FETs, SCRs, and UJTs. The hands-on laboratory portion of this course compares different types of devices and their characteristics with an emphasis on real-life circuits and applications. (This course covers all competencies of ELT 134.)* *Course Fee Proposal $50/term*	*ELE*	*79140305*
3	*CTE Robotics and Mechatronics/ Technology* *(A & B)*	*Introduces industrial robotics as well as a survey of the technologies and equipment used in manufacturing automation and process control. Includes axis configurations, work envelopes, programming, troubleshooting, and*	*ELE*	*79140306*

		maintenance. Incorporates a survey of automation topics including history, computer, and hardwired controls, sensors and transducers, motors and actuators, fluid power, etc. *Course Fee Proposal $50/term*		
3	*CTE DC/AC Electricity and Electronics*	*This course introduces the basic principles of electronics including the fundamentals of Direct Current (DC), Alternating Current (AC), and robotics. Topics include basic circuits, voltage, current and resistance measurement, Ohm's Law, series and parallel circuits, magnetism, motors and generators, electromagnetic induction, and robotics. The electronic theory is reinforced through breadboarding circuits in the lab. Students fabricate printed circuit boards projects. Utilization of electronic test equipment is emphasized.* *Course fee: $50.00/term*	*ELE*	*79140303*
4	*CTE Electromechanical Control Systems (A&B)*	*Electromechanical Control Systems is designed to provide students with the knowledge and skills to effectively perform basic industrial maintenance procedures in an advanced manufacturing facility. Students in this course develop proficiency in a vast array of electromechanical domains, including fundamental safety practices in electromechanical technology, electrical systems, AC and DC motors, calibrating instruments, drive systems, hydraulic systems, pumps, digital electronics, programmable logic controllers (PLC), and troubleshooting procedures. Upon completion of this course, proficient students will be prepared to pursue postsecondary electromechanical technology programs and entry-level industrial maintenance technology careers in the advanced manufacturing industry.* *Course Fee Proposal $50/term* *Course fee: $50.00/term*	*ELE*	*79140401*
4	*CTE Robotics and Mechatronics Technology II (A&B)*	*In this class students will research, design, and build projects based on the field of robotics automation. Students will*	*ELE*	*79140402*

		learn about Pneumatics, Hydraulics, Electronics, and Mechanical Design along with basics in Control and Programming by designing and building robotic systems *Course Fee Proposal $50/term*		
4	CTE Eng & Tech WBL	Students build on prior knowledge and skills in the program of study to further develop and apply employability and technical skills that prepare them for success in future career and postsecondary education, as deemed developmentally appropriate.	ELE	79149999S1
4	CTE Eng & Tech Capstone	This course allows for individualized, advanced, and/or cumulative work in a program of study. This work is individualized to the student within a specific program of study to allow for specialized study. It may include problem-/project-based learning or preparation for industry certification. The specific content and course design are determined by the instructor, in collaboration with the individual student	ELE	79148888S1 / 79148888S2
	ACC OSH 1300	*1 ACC credit (embedded 0 HS credit) Provide a 10-Hour OSHA certification course for the general industry, and participants will review the current OSHA standards contained in 29 CFR 1910. Participants that complete the course will receive a certificate of completion from the United States Department of Labor, Occupational Safety and Health Administration. The course is taught by instructors certified by the Occupational Safety and Health Administration. Note: This course was previously listed as OSH 117.*	*ELE*	*69141000*
	ACC EIC 1001 Electrical Print Reading	*4 ACC Credits / 1 HS Credit Teaches the skills needed to interpret electrical drawings properly. This 15-hour seminar is critical for anyone involved in the design, construction, or maintenance of electrical systems. Note: This course was previously listed as EIC 102.*	*ELE*	*69141001*

	ACC ELT 1206 Fundamentals of DC/AC	*4 ACC Credits / 1 HS Credit Introduces the basic skills needed for many careers in electronics and related fields. Covers the operations and applications of basic DC and AC circuits consisting of resistors, capacitors, inductors, transformers, and diodes. Emphasizes the use of common test instruments in troubleshooting. Note: This course was previously listed as ELT 106. Course fees: Actual cost of ACC fees*	*ELE*	*69141002*
2	*ACC ELT 2254 Industrial Wiring*	*3 ACC Credits / .5 HS Credit Focuses on the required and recommended practice for industrial wiring. The National Electrical Code is applied to industrial power and control wiring. Covers specification and installation of wiring, conduit, enclosures, and termination components in lecture and applied during lab. Note: This course was previously listed as ELT 254.*	*ELE*	*69141003*
	ACC ELT 2254 Motors & Controls	*3 ACC Credits / .5 HS Credit Enables the student to study, construct, test, and evaluate basic industrial control systems, including AC/DC motors, stepper motors, power sources, generators, tachometers, line diagrams, and logic functions. Covers safety standards and preventive maintenance. 68 contact hours. Note: This course was previously listed as ELT 252.*	*ELE*	*69141004*
	ACC ELT 2455 Fluid Power	*3 ACC Credits / .5 HS Credit Enables the student to study, construct, test, and evaluate circuit diagrams, the transmission of force and energy, pumps and motors, actuators, cylinders, valves, and control devices. Incorporates the construction of hydraulic and pneumatic circuits using industrial equipment in the laboratory. 68 contact hours. Note: This course was previously listed as ELT 255.*	*ELE*	*69141005*
	ACC ELT 2367 Introduction to Industrial Robotics	*1 ACC Credit / .5 HS Credit Introduces basic robotics. Enables the student to program a robot in a*	*ELE*	*69141006*

		higher-level language to perform various tasks. Covers building and interfacing of sensor circuits. Note: This course was previously listed as ELT 267.		
	ACC CAD 2455 Solidworks/Mechanical	*3 ACC Credits / .5 HS Credit Introduces parametric feature-based solid modeling 3D concepts to build confidence in 3D thinking and progress to three-dimensional parameters. This course provides instruction on how to construct, modify, and manage complex parts in 3D space as well as to produce 2D drawings from the 3D models. Note: This course was previously listed as CAD 255.*		*69141007*
	ACC ELT 2348 Automation Control Circuits	*3 ACC Credits / .5 HS Credit Introduces the fundamentals of automatic controls including process control methodologies used to regulate a system or multiple systems for the purpose of establishing and maintaining a predictable manufacturing process. Note: This course was previously listed as ELT 248.*		*69141008*
	ACC ELT 2358 Programmable Logic Controllers	*3 ACC Credits / .5 HS Credit Covers the fundamentals of programmable logic controllers (PLCs) as they are applied in robotics and automation. Includes history, terminology, typical applications, hardware, and software. Incorporates lab and project activities that address operating, monitoring, programming, troubleshooting, and repairing PLC-controlled lab trainers as well as actual industrial equipment. Note: This course was previously listed as ELT 258.*		*69141009*
	ACC IMA 1500 Industrial Rotating Equipment	*3 Credits / .5 HS Credit Explains the theory, operation, and maintenance of rotating equipment found in industrial environments such as gears, bearings, pumps, and compressors. Mechanical power transmission systems including direct coupling, belt drives, and chain drive*		*69141010*

		are studied. Alignment techniques are practiced and related to the impact on machine vibration and equipment failures. The principles involved in the operation of centrifugal and positive displacement pumps and compressors will be discussed along with the function of connected components. Note: This course was previously listed as IMA 120.		
	ACC ELT 2368 Robotic Technologies	*3 ACC Credits / .5 HS Credit Introduces industrial robotics as well as a survey of the technologies and equipment used in manufacturing automation and process control. Includes axis configurations, work envelopes, programming, troubleshooting, and maintenance. Incorporates a survey of automation topics including history, computer and hardwired controls, sensors and transducers, motors and actuators, fluid power, etc. and provides a preview of the other ELT classes that cover those subjects. Note: This course was previously listed as ELT 268.*		*69141011*
	ACC ELT 2359 Advanced Programmable Logic Controllers	*3 ACC Credits / .5 HS Credit Serves as the second in a two-course sequence and covers advanced topics and applications for programmable logic controllers (PLCs) as they are applied in robotics and automation. Includes advanced programming, diagnostics, Human Machine Interfaces (HMIs), introduction to automation networking, and system integration. Incorporates lab and project activities that address designing, operating, monitoring, programming, analyzing, troubleshooting, and repairing PLC-controlled lab trainers as well as actual industrial equipment. Note: This course was previously listed as ELT 259.*		*69141012*
	ACC ELT 2080 Internship	*3 ACC Credits / .5 HS Credit Provides students with the opportunity to supplement coursework with practical work experience related to*		*69141013*

		their educational program. Students work under the immediate supervision of experienced personnel at the business location and with the direct guidance of the instructor. Note: This course was previously listed as ELT 280.		

Signature Page

Does the Career and Technical Education (CTE) Coordinator approve the adoption of this program? *** Your signature below indicates your approval of the program.*
Signature Aimee Barker

Does the Chief Assessment Officer (or designee) approve the adoption of this program? *** Your signature below indicates your approval of the program.*
Signature Mathias Reynolds

Does the Assistant Superintendent approve the adoption of this program? *** Your signature below indicates your approval of the program.*
Signature Danny Winsor

Does the Board of Education approve the adoption of this program?	Yes	No
Date of BOE Meeting _____ Signature_____		

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Course entered in NCAA database if applicable.	
Update Graduation Competencies course document if applicable for Math and English courses.	
VIP Code:	
CIP Code:	
Add to HEAR list, if applicable.	
Course Mapping SCED code:	
Date entered into Infinite Campus	
Credit amount:	

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Document Details

Title	CTE Pathway Proposal IGA-E-2 - Legacy Advanced Robotics.pdf
File Name	CTE Pathway Proposal IGA-E-2 - Legacy Advanced Robotics.pdf
Document ID	95fac4a323dc4cdd8b08c6ecb273623b
Fingerprint	05c4cf007c551052929d1bb700f8e9d5
Status	Completed

Document History

Document Created	Document Created by Tammy Melanson (tlmelanson@dcsdk12.org) Fingerprint: 973991f9a4033a33a1ae6a165b91642d	Dec 01 2022 08:21AM America/Denver
Document Sent	Document Sent to Aimee Barker (AJBARKER@dcsdk12.org)	Dec 01 2022 08:21AM America/Denver
Document Viewed	Document Viewed by Aimee Barker (AJBARKER@dcsdk12.org) IP: 38.19.173.218	Dec 01 2022 08:46PM America/Denver
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