Florida Department of Education
Curriculum Framework

The standards and/or benchmarks for this program were updated for the 2026-27 academic year.

Program Title: **Applied Robotics**
Program Type: **Non-Career Preparatory**
Career Cluster: **Engineering & Technology Education**

Secondary – Non-Career Preparatory	
Program Number	9410100
CIP Number	0615030330
Grade Level	9-12
Program Length	4 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FL-TSA, SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study of the principles and applications of robotics engineering and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of entrepreneurship, safety, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of science and mathematics knowledge, technological tools, machines, instruments, materials, processes and systems related to robotics.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four credits.

It is recommended (but not required) that students complete or be concurrently enrolled in advanced science (physics) and mathematics courses (e.g., trigonometry, calculus).

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9410110	Foundations of Robotics	ENG 7G ENG TEC 7G ROBOTICS 7G TEC ED 1 @2 ENG&TEC ED1@2	1 credit	3	CT
9410120	Robotic Design Essentials		1 credit	3	CT
9410130	Robotic Systems		1 credit	3	CT
9410140*	Robotic Applications Capstone		1 credit	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

** Note: Course 9410140 is intended to serve as a capstone course.*

Florida's Career Readiness Skills for CTE Programs

Employability Skills	
01.0	Apply academic skills to workplace scenarios.
	01.01 Use reading skills.
	01.02 Use writing skills.
	01.03 Use mathematical strategies and procedures.
	01.04 Use scientific principles and procedures.
02.0	Design a solution to an industry problem.
	02.01 Use critical thinking.
	02.02 Use creativity.
	02.03 Make sound decisions.
	02.04 Solve problems.
	02.05 Reason.
	02.06 Plan and organize.
03.0	Manage resources within an industry project
	03.01 Manage time.
	03.02 Manage money or resources.
	03.03 Manage materials.
	03.04 Manage personnel.
04.0	Oversee the subcomponents, operations and output of a technical or organizational system.
	04.01 Manage systems.
	04.02 Monitor systems.
	04.03 Improve systems.
05.0	Use information for decision making.
	05.01 Locate information.
	05.02 Organize information.
	05.03 Use information.

	05.04 Analyze information.
	05.05 Communicate information.
06.0	Apply relevant technology to workplace scenarios to aid productivity.
	06.01 Use technology.
07.0	Interpret and express interpersonal communication.
	07.01 Communicate verbally.
	07.02 Listen actively.
	07.03 Comprehend written material.
	07.04 Convey information in writing.
	07.05 Communicate nonverbally.
	07.06 Interpret nonverbal communication.
08.0	Interact with others to accomplish workplace goals.
	08.01 Collaborate with others in a team.
	08.02 Respond to customer needs.
	08.03 Exercise leadership.
	08.04 Negotiate to resolve conflict.
	08.05 Respect others.
09.0	Manage personal behavior to maximize productivity and professional growth.
	09.01 Demonstrate responsibility and self-discipline.
	09.02 Adapt and show flexibility.
	09.03 Work independently.
	09.04 Demonstrate a willingness to learn.
	09.05 Demonstrate integrity.
	09.06 Demonstrate professionalism.
	09.07 Take initiative.
	09.08 Display positive attitude.
	09.09 Take responsibility for professional growth.

Career Exploration & Planning	
10.0	Explain career opportunities aligned with the regional economy and personal aspirations.
10.01	Describe regional occupations that are high-demand, high-growth, high-wage and/or high-skill.
10.02	Describe careers aligned with his or her interests, skills and values based on career assessment, experiential learning, career informational interviews, research and/or reflection.
11.0	Explain postsecondary pathways aligned with his or her career aspirations.
11.01	Compare and contrast postsecondary pathways, including education, employment, entrepreneurship and enlistment (the “Four Es”).
11.02	Compare and contrast regional postsecondary training provider options, including apprenticeships, technical colleges, state colleges, universities and industry-recognized certification providers.
11.03	Define postsecondary credentialing and stacking options, including industry-recognized certifications, apprenticeship certificates of completion, career certificates, licenses and associate or baccalaureate degrees.
11.04	Compare postsecondary training data for training programs of interest, such as total costs, average student loan debt, and median earnings and job placement rates after program completion.
12.0	Develop a personalized career and academic plan.
12.01	Prioritize an occupation, credential and postsecondary training provider for plan formation.
12.02	Self-assess progress toward meeting graduation requirements and skill-development goals.
12.03	Develop and complete a chronological checklist of steps and deadlines prior to postsecondary training or national service application that includes any required documentation to gather, writing prompts and examinations.
12.04	Identify a variety of financial aid opportunities, including scholarships, grants, savings, work, work-study programs, private loans and federal loans.
12.05	Develop a postsecondary training budget that is inclusive of living and school expenses.
Job Attainment	
13.0	Find, assess and apply to job opportunities.
13.01	Identify online job posts relevant to his or her career aspirations.
13.02	Compare and contrast the job posts’ required qualifications, job duties, compensation, benefits and employers.
13.03	Define what information, documentation and writing prompts are required for the positions.
14.0	Communicate personal competence, character and fit for a job opportunity.
14.01	Develop a resume.
14.02	Write a cover letter.
14.03	Curate a professional portfolio that includes work products.
14.04	Prepare for and experience a mock job interview.

15.0	Cultivate and leverage relationships to professionally advance.
	15.01 Request a signed reference letter, letter of recommendation and/or an online skill/professionalism endorsement.
	15.02 Develop a plan to cultivate a professional digital footprint.
	15.03 Develop a networking plan for a specific industry of interest.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of robotics, its history, applications, and evolution.
02.0 Describe programming concepts and the forms of applied logic.
03.0 Describe the role of sensors in the field of robotics.
04.0 Demonstrate an understanding of the foundations of electronics.
05.0 Describe the operation of DC motors and servos used in robotics.
06.0 Demonstrate an understanding of engineering design principles.
07.0 Explain fundamental physics concepts applicable to the field of robotics.
08.0 Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials.
09.0 Build, program, and configure a robot to perform predefined tasks.
10.0 Solve problems using critical thinking skills, creativity, and innovation.
11.0 Correlate elements of artificial intelligence to their functions in robotics.
12.0 Describe the various classification schemes of sensors applicable to robotics.
13.0 Explain how electronic devices are used in the operation of a robotic assembly.
14.0 Demonstrate an understanding of various technologies used in the design of robotic assemblies.
15.0 Demonstrate an understanding of advanced mathematics and physics associated with the design of a robotic assembly.
16.0 Create a program to control a robotic mechanism.
17.0 Describe the operation and use of various forms of electrical motors in robotic assemblies.
18.0 Demonstrate an understanding of basic 3D modeling concepts.
19.0 Describe the approaches, challenges, and problem-solving methodologies involved with integrating artificial intelligence into robotic systems.
20.0 Describe the role of specialized sensors in the design and operation of robotic systems.
21.0 Describe the use of specialized electronic applications used in robotic systems.
22.0 Demonstrate the applicability of hybrid systems in robotics.
23.0 Demonstrate an understanding of underlying principles of environmental physics related to robotic technology.
24.0 Demonstrate an understanding of the manufacturing process and its impact on robotics.
25.0 Demonstrate an understanding of topographical and environmental considerations in robotic assembly design.
26.0 Create a program to control a robotic system.
27.0 Demonstrate an understanding of technologies for communication with and among robotic systems.
28.0 Demonstrate an understanding of static and dynamic modeling and simulation concepts related to the design of robotic systems.
29.0 Identify, define, and justify a technical design problem for resolution.
30.0 Conduct research and investigation into the stated problem.
31.0 Design a solution to the problem and create a working prototype for testing.
32.0 Create and deliver a formal presentation in a suitable form of the solution to the problem.
33.0 Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications.
34.0 Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results.

Florida Department of Education
Student Performance Standards

Course Title: **Foundations of Robotics**
Course Number: **9410110**
Course Credit: **1**

Course Description:
This course provides students with a foundation in content and skills associated with robotics and automation, including artificial intelligence, electronics, physics, and principles of engineering.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of robotics, its history, applications, and evolution. The student will be able to:
01.01	Explore robotics history through research of the industry.
01.02	Compare and contrast various applications of automation and robotics.
01.03	Describe emerging technologies and their implications on the field of robotics.
02.0	Describe programming concepts and the forms of applied logic. The student will be able to:
02.01	Describe the role of decision logic in robotics.
02.02	Understand Boolean logic, its operations and laws, as used in robotics.
02.03	Translate data specifications into truth tables and extract logical expressions.
02.04	Solve simple Boolean algebra problems.
02.05	Discuss Human Computer Interaction (HCI) and describe its role in robotics.
03.0	Describe the role of sensors in the field of robotics. The student will be able to:
03.01	Define sensor.
03.02	Describe the basic operation common to all sensors.
03.03	Describe the types of sensors and ways in which they can be categorized.
03.04	Differentiate between digital and analog sensors relative to their use in robotics.

CTE Standards and Benchmarks	
04.0	Demonstrate an understanding of the foundations of electronics. The student will be able to:
04.01	Define voltage, current, resistance, inductance, and capacitance.
04.02	Describe the difference between alternating and direct current.
04.03	Identify and describe the operation of common electronic components.
04.04	Compare and contrast series and parallel circuits.
04.05	Define Ohm’s Law and Kirchhoff’s Laws.
04.06	Perform basic soldering techniques and breadboard construction.
04.07	Analyze simple circuits using common electronic test equipment and tools.
04.08	Describe the characteristics of analog and digital signals.
04.09	Translate logical expressions into schematic or symbolic representation.
04.10	Create basic schematic drawings of electronic circuitry.
05.0	Describe the operation of DC motors and servos used in robotics. The student will be able to:
05.01	Describe how DC motors are used in robotics.
05.02	Describe how speed and torque are controlled in DC motors.
05.03	Describe how servos are used in robotics (e.g., robot arms, legs, steering, et al).
05.04	Describe how angle and torque are controlled in a servo motor.
05.05	Describe magnetics and its use and implications in robotics.
06.0	Demonstrate an understanding of engineering design principles. The student will be able to:
06.01	Describe the steps involved in the engineering design process and the activities performed in each step.
06.02	Describe the role of diagnostics and troubleshooting to the engineering design process.
07.0	Explain fundamental physics concepts applicable to the field of robotics. The student will be able to:
07.01	Describe Newton's Laws of Motion (inertia, net force, reaction) and relate their applicability to robotics.

CTE Standards and Benchmarks	
	07.02 Compare and contrast the forms of energy (e.g., thermal, solar, mechanical, kinetic, potential, et al.) employed in robotics.
	07.03 Relate the concept of time and rate to its application in robotics.
	07.04 Relate how material properties (e.g., mass, density, strength, et al) have applicability to robotics.
	07.05 Name the six simple machines (i.e., lever, inclined plane, wheel and axle, screw, wedge, and pulley) and describe their application to robotics.
	07.06 Explain and demonstrate how gear ratios are used for increasing or decreasing power or speed.
08.0	Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials. The student will be able to:
	08.01 Apply safety rules in the use of electronic instruments and demonstrate proper care and maintenance for the equipment during storage and use.
	08.02 Use testers to determine the condition of electronic components.
	08.03 Demonstrate proper soldering applications.
	08.04 Identify and use common electrical and electronics hand tools.
	08.05 Follow laboratory safety rules and procedures including use of personal protection gear.
	08.06 Demonstrate good housekeeping skills within the laboratory.
	08.07 Identify OSHA color-coding safety standards.
	08.08 Explain fire prevention and safety precautions and practices for extinguishing fires.
	08.09 Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment (example: LiPo batteries).
09.0	Build, program, and configure a robot to perform predefined tasks. The student will be able to:
	09.01 Design a robot.
	09.02 Create programs as required using robotic software that will allow the robot to perform a set of tasks.
	09.03 Configure subsystems to operate the robot.
	09.04 Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.
10.0	Solve problems using critical thinking skills, creativity, and innovation. The student will be able to:

CTE Standards and Benchmarks
10.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
10.02 Employ critical thinking and interpersonal skills to resolve conflicts.
10.03 Identify and document workplace performance goals and monitor progress toward those goals.
10.04 Conduct technical research to gather information necessary for decision-making.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Design Essentials**
Course Number: **9410120**
Course Credit: **1**

Course Description:
This course provides students with content and skills essential to the design and operation of robotics, including artificial intelligence, sensors, electronic devices, engineering technologies, motion physics, electrical motors, programming, simulation and modeling, and critical thinking skills.

CTE Standards and Benchmarks	
11.0	Correlate elements of artificial intelligence to their functions in robotics. The student will be able to:
11.01	Describe the types of sensor output required for various algorithms used in robotics.
11.02	Formulate a schema (e.g., logic flow diagram.) for robotic control based on sensor data interpretation.
11.03	Explain how artificial intelligence and motion sequences are impacted by controlling sensor data and interpretation.
11.04	Describe the design implications and options for sensor data and interpretation algorithms employed for autonomous robotic applications.
12.0	Describe the various classification schemes of sensors applicable to robotics. The student will be able to:
12.01	Compare and contrast the characteristics, benefits, constraints, and cost implications of analog and digital sensors.
12.02	Differentiate between passive and active sensors relative to their applicability and suitability for various robotic applications.
12.03	Compare and contrast open and closed loop feedback/control systems.
13.0	Explain how electronic devices are used in the operation of a robotic assembly. The student will be able to:
13.01	Design and build breadboard or printed circuit boards for a robotic assembly.
13.02	Describe the advantages, limitations, and operation of electronic control and feedback systems.
13.03	Describe the operation and design considerations of electronic devices used to control robotic assemblies.
13.04	Describe the kinds of electronic devices used as input/output devices in a robotic assembly and explain the rationale for their use.
14.0	Demonstrate an understanding of various technologies used in the design of robotic assemblies. The student will be able to:

CTE Standards and Benchmarks	
	14.01 Describe the underlying principles associated with pneumatic and hydraulic devices used in the design of a robotic assembly.
	14.02 Describe the underlying principles of electricity and electrical components, to include power sources, consumption, and heat issues.
	14.03 Interpret manufacturer's specification documentation for selected components.
	14.04 Compare and contrast the operation, advantages, and constraints of wired and wireless strategies for communicating with robotic assemblies.
	14.05 Identify the design considerations associated with materials used in robotic assemblies and describe how the intended operational environment plays a role in the design.
	14.06 Discuss the methodologies and tools used in resolving systems integration challenges in robotic systems.
15.0	Demonstrate an understanding of advanced mathematics and physics associated with the design of a robotic assembly. The student will be able to:
	15.01 Employ the concepts of acceleration and velocity as they relate to the kinematic design of robotic assemblies.
	15.02 Describe the term "degrees of freedom" and relate it to the design of joints used in robotic assemblies.
	15.03 Describe angular velocity/momentum and its role in the design of robotic joint motion, balance, and mobility.
	15.04 Explain impulse-momentum theory and illustrate its applicability to the design of robotic assemblies.
	15.05 Explain translational, rotational, and oscillatory motion in terms of their applicability to the design of robotic assemblies.
16.0	Create a program to control a robotic mechanism. The student will be able to:
	16.01 Demonstrate an understanding of coding semantics, syntax, and implementation.
	16.02 Apply programming best practices for commenting and documentation.
	16.03 Describe how logic structures (conditional execution, loops, etc.) control the flow of a program.
	16.04 Write pseudocode using logic structures to solve a problem.
	16.05 Write code for evaluating a condition and performing an appropriate action using If/then statements.
	16.06 Write code for performing actions within a code segment (using do/while statements) for as long as a given condition exists.
	16.07 Write code that loops through a series of actions for a specified increment.
	16.08 Write code that evaluates sensor data to provide feedback control.

CTE Standards and Benchmarks	
17.0	Describe the operation and use of various forms of electrical motors in robotic assemblies. The student will be able to:
17.01	Explain the operation and use of stepper motors to control or limit movement of a robotic assembly.
17.02	Explain the operation and primary use of AC and DC motors in robotic assemblies.
17.03	Explain the operation, use, and advantages of brushless motors used in robotics.
17.04	Explain the types, use, and advantages of linear actuators used in robotics.
10.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
10.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
10.02	Employ critical thinking and interpersonal skills to resolve conflicts.
10.03	Identify and document workplace performance goals and monitor progress toward those goals.
10.04	Conduct technical research to gather information necessary for decision-making.
18.0	Demonstrate an understanding of basic 3D modeling concepts. The student will be able to:
18.01	Compare and contrast 3D modeling software applications that offer a perspective view, an orthographic view, additive manufacturing, or a combination.
18.02	Explain how Cartesian coordinate systems are used to locate objects in three-dimensional space.
18.03	Describe basic geometric shapes available in 3D modeling software (sphere, cube, cylinder, torus, cone, plane, axis point).
18.04	Describe basic shapes available in 2D modeling software (arcs, ellipses, circles, curves, freehand curves, polygons, splines).
18.05	Define the parameters used for determining the size, placement, and orientation of a modeling object.
18.06	Describe the Boolean modeling operations of union, subtraction, and intersection.
18.07	Describe how extrusion or sweeping techniques transform 2D objects into 3D objects.
18.08	Describe the lofting technique for creating 3D objects.
18.09	Describe the revolve or lathe techniques for animating a 2D object and give examples of their application.
18.10	Describe the scale, rotate, and move actions that comprise the transformation technique for animating a 3D object.
18.11	Describe the object parameters modified using the deformation technique and provide examples of its use.

CTE Standards and Benchmarks	
18.12	Describe the copy or clone technique.
18.13	Describe the mirror technique.
18.14	Compare and contrast the wire frame and solid viewing tools.
18.15	Describe basic viewing navigation tools such as zoom, rotate, and panning.
18.16	Define plug-in and describe how it extends the capability of the modeling program.
18.17	Describe the export function and its value when producing visualizations.
09.0	Build, program, and configure a robot to perform predefined tasks. The student will be able to:
09.01	Design a robot.
09.02	Create programs as required using robotic software that will allow the robot to perform a set of tasks.
09.03	Configure subsystems to operate the robot.
09.04	Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Systems**
Course Number: **9410130**
Course Credit: **1**

Course Description:
This course provides students with extended content and skills essential to the design and operation of robotic systems, including artificial intelligence, specialized sensors, electronic applications, engineering technologies, environmental physics, manufacturing, topographical considerations, programming, communications, simulation and modeling, and critical thinking skills.

CTE Standards and Benchmarks	
19.0	Describe the approaches, challenges, and problem-solving methodologies involved with integrating artificial intelligence into robotic systems. The student will be able to:
19.01	Compare and contrast symbolic and sub-symbolic approaches to integrating artificial intelligence into robotic systems.
19.02	Describe an intelligent agent and relate its role to the operation of robotic systems.
19.03	Discuss the classes of intelligent agents and their application in the design of robotic systems.
19.04	Describe the obstacles to integration of artificial intelligence components in robotic systems.
20.0	Describe the role of specialized sensors in the design and operation of robotic systems. The student will be able to:
20.01	Explain how Global Positioning System (GPS) sensors are used in robotic systems.
20.02	Discuss the application of laser range finders to the operation of robotic systems.
20.03	Describe the types and uses of optical sensors in robotic systems.
20.04	Describe the ways in which gyroscopes are used in robotic systems.
20.05	Describe the operation of an accelerometer and the ways in which accelerometers are used in robotic systems.
20.06	Discuss the various types of pressure sensors and how they are used in robotic systems.
20.07	Discuss the various applications of vision and voice activation sensors.
21.0	Describe the use of specialized electronic applications used in robotic systems. The student will be able to:
21.01	Explain the various methods for controlling robotic systems and the form of electronic feedback system needed for the appropriate sensor (example: PWM-Pulse width modulation).

CTE Standards and Benchmarks	
	21.02 Describe the concept of Fail Safe and how such components are integrated into robotic systems.
	21.03 Describe the electronic operation and application of electrically, pneumatically, and hydraulically controlled robot systems.
	21.04 Compare and contrast various sources for powering robotic systems, including solar cells, batteries, and radioisotope thermoelectric generators (RTGs).
22.0	Demonstrate the applicability of hybrid systems in robotics. The student will be able to:
	22.01 Compare and contrast the operation of reactive, behavior-based, and deliberative robot controllers.
	22.02 Discuss real-time systems and their applicability in robotics.
	22.03 Explain the role of Hybrid Control Systems (HCS) in the design and operation of robust robotic systems.
23.0	Demonstrate an understanding of underlying principles of environmental physics related to robotic technology. The student will be able to:
	23.01 Describe thermal dynamics and discuss its practical application to robotics, particularly as it relates to motor and gear selection.
	23.02 Describe the concept of pressure and relate its implications on robotic assemblies, include methods and forms or measurement.
	23.03 Distinguish between tolerance and allowance.
	23.04 Explain dimensional and variation tolerance and their applicability to the design and operation of robotic systems.
	23.05 Describe the concept of fault-tolerance as it is related to a robotic assembly's degrees of freedom.
24.0	Demonstrate an understanding of the manufacturing process and its impact on robotics. The student will be able to:
	24.01 Describe Computer Integrated Manufacturing (CIM) and its implications on and uses of robotic technologies.
	24.02 Explain the impact of rapid prototyping on the manufacturing process to include Additive Manufacturing.
	24.03 Describe the process and methodology for creating a rapid prototype of an interactive robot.
25.0	Demonstrate an understanding of topographical and environmental considerations in robotic assembly design. The student will be able to:
	25.01 Describe various robot design considerations related to the intended operating environment or medium.
	25.02 Explain the correlation between sensor selection and a robot's operating environment, capability, and autonomy.
	25.03 Explain the term obstacle avoidance and relate its importance to the design, mobility, and autonomy of a robot.
26.0	Create a program to control a robotic system. The student will be able to:

CTE Standards and Benchmarks	
	26.01 Compare and contrast the popular programming languages used to program robots and discuss their suitability for particular environments.
	26.02 Validate selection of wired or wireless communications.
	26.03 Distinguish between holonomic and non-holonomic motion planning relative to feedback and control applications.
	26.04 Describe the process of motion planning and the variations in the underlying algorithm or approach.
27.0	Demonstrate an understanding of technologies for communication with and among robotic systems. The student will be able to:
	27.01 Compare and contrast the features, capabilities, obstacles, and suitability of wired and wireless communication technologies for communicating with a variety of robots.
	27.02 Discuss the methodologies by which static and mobile networked robots communicate with each other.
	27.03 Describe the various forms of sensor-based feedback typically obtainable from a robotic assembly and explain their application and associated challenges (e.g., EMI, bandwidth, etc.) in specific robotic applications (e.g., surgery, hazardous environment inspection, low oxygen/underwater).
	27.04 Troubleshoot an inoperable wireless robotic communication connection.
10.0	Solve problems using critical thinking skills, creativity and innovation. The student will be able to:
	10.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
	10.02 Employ critical thinking and interpersonal skills to resolve conflicts.
	10.03 Identify and document workplace performance goals and monitor progress toward those goals.
	10.04 Conduct technical research to gather information necessary for decision-making.
28.0	Demonstrate an understanding of static and dynamic modeling and simulation concepts related to the design of robotic systems. The student will be able to:
	28.01 Differentiate between static and dynamic modeling relative to designing robotic systems.
	28.02 Explain the role of simulation to the design of mobile and humanoid robots.
	28.03 Create a static simulation of a stationary robot featuring a single multi-segment manipulator.
	28.04 Create a simulation of a mobile robot that features obstacle avoidance.
09.0	Build, program, and configure a robot to perform predefined tasks. The student will be able to:
	09.01 Design a robot.

CTE Standards and Benchmarks	
09.02	Create programs as required using robotic software that will allow the robot to perform a set of tasks.
09.03	Configure subsystems to operate the robot.
09.04	Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Robotic Applications Capstone**
Course Number: **9410140**
Course Credit: **1**

Course Description:
This course provides students with extended content and skills essential to the design and operation of autonomous robotic systems in the context of a capstone project.

CTE Standards and Benchmarks	
29.0	Identify, define, and justify a technical design problem for resolution. The student will be able to:
29.01	Brainstorm and identify a specific problem for a unique robotic solution.
29.02	Write a concise problem statement using technical writing skills.
29.03	Document research that justifies using the problem statement for the robotics project.
30.0	Conduct research and investigation into the stated problem. The student will be able to:
30.01	Use a list of specifications and constraints identified in a decision matrix to develop a list of alternative solutions to the stated problem.
30.02	Conduct research to investigate and determine the merit of his or her alternative solution based on past solutions to the problem.
30.03	Explain the feasibility of his or her solution based on his or her research.
30.04	Develop research strategies for his or her solution, including the use of surveys, phone interviews, and personal contact with experts related to the field of his or her technical problem
31.0	Design a solution to the problem and create a working prototype for testing. The student will be able to:
31.01	Sketch all parts of their design solution including an isometric view of the assembled product.
31.02	Create a set of working drawings for their design solution.
31.03	Interpret and apply the feedback they receive from experts to improve their design solution.
31.04	Refine their design solution, if necessary, based upon expert feedback.
31.05	Document the project's progress in their engineering notebooks.

CTE Standards and Benchmarks	
	31.06 Create a detailed set of instructions for producing a testable prototype based on the information gained through their research.
	31.07 Identify methods and sources for obtaining materials and supplies.
	31.08 Compile a materials list that includes vendors and cost for all necessary materials and equipment to build their prototype.
	31.09 Write a step-by-step procedure for the assembly of their prototype.
	31.10 Build a working prototype that can be tested.
32.0	Create and deliver a formal presentation in a suitable form of the solution to the problem. The student will be able to:
	32.01 Create deliverables to include design brief, presentation, display (e.g., poster, three panel display), and 3D virtual model.
	32.02 Orally present an effective technical presentation on the design solution.
33.0	Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications. The student will be able to:
	33.01 Create a description of the product specifications for the design solution.
	33.02 Objectively evaluate proposed design solutions using specific criteria.
	33.03 Select the best design solution option using a decision matrix.
	33.04 Graphically represent the results of the design solution evaluation.
34.0	Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results. The student will be able to:
	34.01 Select and describe a valid testing method that will be used to accurately evaluate their design solution's ability to solve their problem.
	34.02 Prepare a description of the testing method that will be used to valid the designed solution.
	34.03 Create a valid justification for the selected testing method.
	34.04 Devise a list of testing criteria that will be used to evaluate the success or failure of their prototype testing
	34.05 Identify, define, and implement needed modifications to their testing method based on expert feedback and their ongoing research.
	34.06 Document their project's progress.
	34.07 Create a detailed set of instructions for testing the prototype that will be valid, repeatable, and reliable.

CTE Standards and Benchmarks
34.08 Evaluate and explain the effectiveness of their design at solving the problem they have defined.
34.09 Document the test results and project progress.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Career and Technical Student Organization (CTSO)

CTSOs are co-curricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. Other CTSOs not listed in this curriculum framework or recognized by the Florida Department of Education are permissible provided they support student mastery over the standards and benchmarks of this curriculum framework.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Work-Based Experience (8601800) is the appropriate course to provide Engineering & Technology Education students with the opportunity, as Student Learners, to gain real world practical, first-hand exposure in broad occupational clusters or industry sectors through a structured, compensated or uncompensated experience. Work-Based Experience (WBE) is also designed to give the Student Learners an opportunity to apply and integrate the knowledge, skills, and abilities acquired during their School-Based Experience to actual work situations independent of school facilities. At least one credit of Engineering & Technology Education program consisting of three credits must be completed before enrolling in WBE. See the Work-Based Experience framework for more information.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.