Florida Department of Education
Curriculum Framework

Program Title: **Advanced Manufacturing Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	9200200
CIP Number	0615040605
Grade Level	9 –12
Standard Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, Florida Technology Student Association (FL-TSA)
SOC Codes (all applicable)	51-1011 – First-line Supervisors of Production and Operating Workers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in Advanced Manufacturing and Production positions.

The content includes but is not limited to providing students with a foundation of knowledge and technically oriented experiences in the study of automation technology, its application in manufacturing, engineering and robotics, and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of enterprise systems, safety, quality, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

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 five credits.

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	SOC Code	Level	Graduation Requirement
9200210	Advanced Manufacturing Technology 1	AUTO PROD 7G ELECTRONIC @7 7G ENG 7G TECH ED 1 @ 2 ENG&TEC ED1@2	1 credit	51-1011	2	
9200220	Advanced Manufacturing Technology 2		1 credit	51-1011	3	
9200230	Advanced Manufacturing Technology 3		1 credit	51-1011	3	
9200240	Advanced Manufacturing Technology 4		1 credit	51-1011	3	
9200250	Advanced Manufacturing Technology Capstone		1 credit	51-1011	3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

National Standards

Industry or National Standards corresponding to the standards and/or benchmarks for the Advanced Manufacturing Technology program can be found using the following link: http://www.msscusa.org

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

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

01.0 Demonstrate an understanding of technology.
02.0 Demonstrate an understanding of Design for Manufacturing (DFM).
03.0 Demonstrate an understanding of workplace safety and workplace organization.
04.0 Demonstrate an understanding of workplace communication skills and teamwork
05.0 Demonstrate an understanding of basic machine tools.
06.0 Demonstrate the ability to read and interpret blueprints and schematics.
07.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
08.0 Demonstrate proficiently in the use of quality assurance methods and quality control concepts.
09.0 Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods.
10.0 Demonstrate an understanding of modern business practices and enterprise systems.
11.0 Demonstrate an understanding of and be able to select production processes.
12.0 Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control.
13.0 Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project.
14.0 Demonstrate an understanding of industrial tools and processes inclusive of: Manual Milling (Optional), CNC machines, and Welding (Optional).
15.0 Demonstrate proficiency in computer control and robotics.
16.0 Demonstrate an understanding of mechanisms.
17.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control.
18.0 Demonstrate a fundamental understanding of Programmable Logic Control.
19.0 Demonstrate an understanding of fluid power.
20.0 Demonstrate the abilities to use and maintain technological products and systems.
21.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.
22.0 Conceive, design, and present a project(s) that encompass all the skills learned in the Advanced Manufacturing Technology program.
23.0 Plan, organize, and carry out a project plan.
24.0 Formulate strategies to properly manage resources.
25.0 Use tools, materials, and processes in an appropriate and safe manner
26.0 Create a project portfolio describing the project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 1**
Course Number: **9200210**
Course Credit: **1**

Course Description:
The Advanced Manufacturing Technology 1 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students gain an understanding of technology and the concept of Design for Manufacturing, study workplace safety and workplace organization, workplace communication skills, and basic machine operation.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of technology.--The student will be able to:
01.01	Define and understand the concept of “Technology”.
01.02	Explain “Technological Literacy” and what it means to be “Technologically Literate”.
01.03	Classify the resources of technology.
01.04	Illustrate the nature and development of technological knowledge and processes.
01.05	Identify and describe technological systems. (ex. open-loop, closed-loop, system, subsystem)
01.06	Compare and contrast current and past technological systems.
01.07	Identify and give examples of criteria and constraints applied to a product or system.
01.08	Identify and give examples of optimization and trade-offs.
01.09	Apply systems thinking logic and creativity with appropriate compromises.
01.10	Define management systems applicable to process planning, organizing, and controlling work.
01.11	Assess and evaluate technological systems embedded within larger technological, social, and environmental systems.
01.12	Explain technological innovation results when ideas, knowledge, or skills are shared within a technology, among technologies, and across other industries.
01.13	Identify and discuss ethical considerations important in the development, selection, and use of technologies.
01.14	Assess how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.

CTE Standards and Benchmarks	
01.15	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
02.0	Demonstrate an understanding of Design for Manufacturing (DFM).--The student will be able to:
02.01	Describe and apply the engineering and design process.
02.02	Identify design principles to include, but not limited to, Design for Manufacturing (DFM) used to evaluate existing designs, to collect data, and to guide the design process.
02.03	Apply the engineering design process to construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
02.04	Analyze competing requirements of a design.
02.05	Evaluate a design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
02.06	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
02.07	Create and populate a graph or table identifying how the fields of science, technology, engineering, and mathematics apply to a manufactured product.
02.08	Utilize a multidisciplinary approach to solving technological problems.
03.0	Demonstrate an understanding of workplace safety and workplace organization.--The student will be able to:
03.01	Wear appropriate Personal Protective Equipment (PPE).
03.02	Follow appropriate safety procedures.
03.03	Follow applicable safety and environmental laws and regulations.
03.04	Maintain a clean and safe work environment.
03.05	Maintain personal protection equipment.
03.06	Report unsafe conditions and practices.
03.07	Locate emergency equipment, exits, and alarms.
03.08	Comply with established safety practices.
03.09	Explain appropriate fire extinguishing procedures.
03.10	Explain when a machine or a process should be stopped to investigate an unsafe condition.
03.11	Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.

CTE Standards and Benchmarks	
	03.12 Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
	03.13 Use and evaluate information resources such as SDS (Safety Data Sheets).
	03.14 Describe safe identification, handling, monitoring, and measurement of hazardous materials.
	03.15 Use appropriate electrical and mechanical safety procedures.
	03.16 Selecting and use personal protective equipment (PPE).
	03.17 Explain Lock Out/Tag Out requirements and procedures.
	03.18 Explain the safety benefits of a 6S work environment.
	03.19 Demonstrate knowledge of ergonomic impact of work techniques.
	03.20 Describe Federal Law as recorded in (29 CFR-1910.1200).
04.0	Demonstrate an understanding of workplace communication skills and teamwork.--The student will be able to:
	04.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.
	04.02 Demonstrate an understanding of appropriate use of productivity tools. (example: software, computers, networks, etc.)
	04.03 Read and understand graphs, charts, diagrams, and common table formats.
	04.04 Read and follow written instructions.
	04.05 Demonstrate knowledge of technical language and technical acronyms.
	04.06 Demonstrate an understanding of; and ability to follow oral instructions.
	04.07 Answer and ask questions coherently and concisely.
	04.08 Read critically to identify oversights and assumptions.
	04.09 Interact with co-workers using communication tools appropriately.
	04.10 Create and deliver a short presentation using a presentation application.
	04.11 Explain the benefits of teamwork.
	04.12 Define member roles of a high-performance team.
	04.13 Compare and contrast various types of teams.

CTE Standards and Benchmarks
04.14 Select and analyze the stages of teambuilding.
04.15 Develop and participate in teambuilding exercises.
04.16 Explain the importance of setting goals both personally and as a team.
04.17 Understand the importance of building consensus.
04.18 Formulate a process for building consensus.
04.19 Understand the value of resolving conflict.
04.20 Develop a plan for resolving conflict within a team.
05.0 Demonstrate an understanding of basic machine tools.--The student will be able to:
Simple Machines
05.01 Define simple machine.
05.02 Understand and construct a wheel and axle.
05.03 Understand and construct a pulley system.
05.04 Understand and construct the three classes of levers.
05.05 Understand and construct an inclined plane.
05.06 Understand and construct a wedge.
05.07 Understand and construct a screw.
Hand Tools
05.08 Use a bench vise to hold material for a bench-work operation.
05.09 Change a blade on a hacksaw.
05.10 Cut a piece of stock to length using a hacksaw.
05.11 Stamp letters in a part using a letter/number stamp set.
05.12 Deburr a part using a file.
05.13 Clean and store a file.

CTE Standards and Benchmarks
05.14 Chamfer a part using a file.
05.15 Square the ends of a part using a file.
05.16 Identify three common metal stock shapes: sheet, flat, round.
Band Saw Operation
05.17 Select stock size and type (sheet, flat, round) given a part drawing and prepare for cutting.
05.18 Use a horizontal band saw to cut stock to a specified length.
05.19 Use a vertical band saw to cut stock to a specified length.
Drill Press Operation
05.20 Create layout lines on stock. (sheet, flat, round)
05.21 Use the prick punch, center punch, and ball-peen hammer to prepare holes for drilling.
05.22 Determine the size of a drill.
05.23 Select and change the spindle speeds of a floor drill press.
05.24 Install a twist drill into a drill chuck.
05.25 Mount a workpiece in a drill press vise.
05.26 Drill holes using cutting fluid.
05.27 Select a drill and drill a hole for reaming.
05.28 Select a reamer and ream a hole.
05.29 Drill a pilot hole to prepare a hole for countersinking.
05.30 Select a countersink and countersink a hole.
05.31 Drill the pilot hole for the counter-boring operation.
05.32 Select a counter-bore and counter-bore a hole.
05.33 Select drill size and drill the holes for the tapping operation.
05.34 Use a countersink to chamfer a hole.

CTE Standards and Benchmarks
05.35 Select a tap and thread a hole using a tap and a tap wrench.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 2**
Course Number: **9200220**
Course Credit: **1**

Course Description:
The Advanced Manufacturing Technology 2 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study how to accurately read and interpret blueprints and schematics; graphic design and computer-aided drawing; quality assurance methods and quality control concepts; use of precision measurement tools and instruments; and understanding modern business practices.

CTE Standards and Benchmarks	
06.0	Demonstrate the ability to read and accurately interpret blueprints and schematics.--The student will be able to:
06.01	Define basic blueprint terminology used in manufacturing.
06.02	Differentiate between dimensions of location and size.
06.03	Interpret Linear, Circular, and Angular dimension features on a print.
06.04	Identify general note symbols and their applications within a manufacturing environment.
06.05	Locate notes on a print using industry standards.
06.06	Interpret commonly used abbreviations and terminology used on prints in the manufacturing environment.
06.07	Determine tolerances associated with dimensions on a drawing.
06.08	Determine if a part dimension is within tolerance using conventional tolerancing.
06.09	Calculate the limits of a dimension given its tolerance.
06.10	Determine a dimension of an object given an undimensioned scaled drawing.
06.11	Identify types of lines within a drawing.
06.12	Interpret and understand information from a blueprint title block.
06.13	Check for revisions.

CTE Standards and Benchmarks	
06.14	Recognize the changes through which the design has progressed from the original design.
06.15	Interpret the meaning of the revision block symbols and notations.
06.16	Identify orthographic views.
06.17	Recognize the three basic orthographic views which may be represented on a drawing; front, top, right side.
06.18	Construct an orthographic view.
06.19	Identify isometric views.
06.20	Interpret the isometric view on a drawing containing both orthographic and isometric views.
06.21	Identify positions of views: top, front, side, auxiliary, and section of an orthographic drawing.
06.22	Draw an actual part using orthographic principles.
06.23	Determine the scale of the view or section.
06.24	Calculate appropriate scale of view or section based on the title block information, physical scaling of view, and standard drawing scale
06.25	Identify the size and type of fasteners used in an assembly drawing.
06.26	Produce a detailed blueprint from sketches.
07.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.--The student will be able to:
07.01	Apply current industrial design software computer aided-drawing practices.
07.02	Apply standard dimensioning and tolerance rules.
07.03	Import and export various file types.
07.04	Use industrial design software to open and change the views of CAD drawings.
07.05	Use standard industrial design software commands in the editing of a drawing.
07.06	Use industrial design software to create a single view drawing.
07.07	Use industrial design software to create a multi-view drawing.
07.08	Use industrial design software to dimension a drawing.
07.09	Use industrial design software to create a full sectional view for an object.

CTE Standards and Benchmarks	
07.10	Use industrial design software to create a bent sectional view for an object.
07.11	Use industrial design software to create an offset sectional view for an object.
07.12	Use industrial design software to draw a thread representation.
07.13	Create a custom 3D coordinate system orientation.
07.14	Create a 3D object using 3D drawing commands.
07.15	Open and change the view of a solid model.
08.0	Demonstrate proficiency in the use of quality assurance methods and quality control concepts.--The student will be able to:
08.01	Demonstrate knowledge of quality systems. (e.g., Statistical Process Control (SPC), Six Sigma, Total Quality Management (TQM), and International Standards Organization (ISO) 9000)
08.02	Select and use quality systems to identify problems and record quality issues.
08.03	Demonstrate knowledge of statistics for making accurate decisions about quality data.
08.04	Demonstrate knowledge of various statistical quality tools. (e.g., histograms, Cpk, X bar and R charts, and range)
08.05	Create control charts (e.g., variables and attributes) using linear relationships and properties of parallel lines.
08.06	Record and analyze quality issues in the production process using tools such as Root Cause Failure Analyses (RCFA).
08.07	Use Pareto analysis to identify priorities for solving multiple sub–standard product problems.
08.08	Demonstrate knowledge of performance indicators that can be readily understood by operators.
08.09	Develop records on quality process which are maintained to appropriate standards.
08.10	Chart outcomes of quality processes according to appropriate methods and standards.
08.11	Demonstrate knowledge of the importance of accurate and precise data for quality process performance.
08.12	Analyze quality process performance data to identify trends.
08.13	Examine previous documentation on similar process issues to identify possible solutions.
08.14	Recommend actions that are clear, concise and supported by data.
08.15	Identify the circumstances for prompt corrective actions related to product quality.
08.16	Implement closed-loop corrective action follow-up activities which include spot checks, quality documentation, and an audit to optimize the outcomes of the corrective steps.

CTE Standards and Benchmarks	
	08.17 Document product quality following corrective action and identify documentation and records transmittal required for customers.
	08.18 Determine disposition of sub-standard product.
	08.19 Identify follow-up activities that indicate that corrective action was taken.
	08.20 Describe and explain the concepts of Lean Manufacturing.
	08.21 Identify value stream mapping, just-in-time procedures, and techniques of continual improvement.
	08.22 Describe the changes necessary in implementing waste-free manufacturing (WFM) in a lean environment.
	08.23 Describe and explain supply chain management.
	08.24 Describe and explain the use of the 6S's, (sort, set in order, shine, standardize, sustain, safety).
09.0	Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods.--The student will be able to:
	09.01 Use measurement tools appropriately.
	09.02 Maintain and store inspection tools appropriately.
	09.03 Determine accuracy and precision when using inspection tools, measuring equipment, and procedures.
	09.04 Use and convert both U.S. measurement and Standard International (S.I.) metric systems.
	09.05 Demonstrate knowledge of inspection equipment, calibration standards, and requirements.
	09.06 Verify calibration of inspection equipment.
	09.07 Demonstrate knowledge of appropriate automated inspection systems.
	09.08 Use appropriate safety monitoring and testing equipment.
	09.09 Implement appropriate testing regimens.
	09.10 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
	09.11 Research measurement tools for non-mechanical systems and products. (e.g., pH, °Brix)
10.0	Demonstrate an understanding of modern business practices and enterprise systems.--The student will be able to:
	10.01 Research economic statistics.

CTE Standards and Benchmarks	
10.02	Research commodity price data.
10.03	Use a spreadsheet application to analyze economic data.
10.04	Select materials and process for a product using cost as a factor.
10.05	Interpret a Bill of Materials.
10.06	Create a Bill of Materials for a product.
10.07	Demonstrate knowledge of the alignment of a company's business objectives with production goals.
10.08	Compare and contrast various business structures. (e.g., sole-proprietor, S-Corporation, Limited-Liability Corporation, C-Corporation, etc.)
10.09	Identify the necessary personal characteristics of a successful entrepreneur.
10.10	Identify the business leadership skills needed to operate a business efficiently and effectively.
10.11	Identify the key elements of a business plan and apply them in the creation of a business plan.
10.12	Identify and explain personal and organizational consequences of unethical or illegal behaviors in the workplace.
10.13	Interpret and explain written organizational policies and procedures.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 3**
Course Number: **9200230**
Course Credit: **1**

Course Description:
The Advanced Manufacturing Technology 3 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study how to select production processes; computer-aided manufacturing and flexible manufacturing planning; produce a product via a master project; manual milling machines, computer-numeric-control machines, and welding systems; and robotic systems used in manufacturing.

CTE Standards and Benchmarks	
11.0	Demonstrate an understanding of and be able to select production processes.--The student will be able to:
11.01	Identify customer needs.
11.02	Determine available and needed resources for the production process.
11.03	Make job assignments and coordinate workflow.
11.04	Communicate production and material requirements to meet product specifications.
11.05	Establish set-up and operation procedures are available and up-to-date.
11.06	Read and interpret a production schedule and manufacturing work order.
11.07	Demonstrate knowledge of production processes, including flow and bottlenecks.
11.08	Document product and process compliance with customer requirements.
11.09	Compare and contrast various production processes. (e.g., push, pull, just-in-time, workcell, batch, etc.)
12.0	Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control.--The student will be able to demonstrate:
12.01	Identify manufacturing process variables that must be controlled for quality and reliability.
12.02	Identify the process for making job assignments and coordinating workflow.
12.03	Identify and explain Enterprise Resource Planning (ERP) and Material Resource Planning (MRP).

CTE Standards and Benchmarks	
	12.04 Understand and predict lead-time required for a production plan.
	12.05 Read and interpret bills of materials and routing sheets.
	12.06 Identify methods of productivity measurement and improvement.
	12.07 Apply principles and practice of various production processes such as just-in-time (JIT) inventory control in performing a physical inventory.
13.0	Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project.--The student will be able to:
	13.01 Work in a team and use a multi-step design process to design a prototype.
	13.02 Create a Design Portfolio documenting research and student development.
	13.03 Create a Technology Sector Research Report.
	13.04 Create an Industry Market Report.
	13.05 Create a Bill of Material (BOM) for your solution.
	13.06 Create and build a prototype using specified design constraints (time, expenses, materials, safety considerations, etc.).
	13.07 Create and deliver a presentation to communicate project results.
14.0	Demonstrate an understanding of industrial tools and processes inclusive of: Manual Milling (Optional), CNC machines, and Welding (Optional).--The student will be able to:
Manual Milling Processes (Optional when manual mill is NOT available to students)	
	14.01 Operate manual controls on a milling machine.
	14.02 Use a milling machine micrometer collar to measure table movement.
	14.03 Face a piece of stock to length.
	14.04 Mill a step using the micrometer collars on the milling machine.
	14.05 Mill a step on a part using layout lines.
	14.06 Mill a slot to a specific depth.
	14.07 Mill a part.
CNC Mill Programming and Operation	

CTE Standards and Benchmarks
14.08 Write and edit a CNC program that uses common industry accepted tasks.
14.09 Enter and edit a CNC mill program using a text editor.
14.10 Simulate and edit a CNC mill program.
14.11 Determine the size and cutting direction of an end mill.
14.12 Mount a tool in a CNC mill.
14.13 Operate a CNC Mill.
14.14 Determine CNC program coordinates based on a dimensioned part drawing.
14.15 Select tooling for a CNC operation.
14.16 Determine the spindle speed for various machining operations.
14.17 Determine the feed rate for a machining operation.
14.18 Locate the PRZ (Program Reference Zero) of a part in a CNC mill using an edge-finder.
14.19 Determine the tool offsets in a CNC mill.
14.20 Create a precision part using PRZ (Program Reference Zero) and tool offset measurements.
14.21 Convert coordinates between absolute and incremental positioning methods.
14.22 Interpret a CNC mill program that uses basic G- and M-Codes.
Welding – (Optional when welding equipment is NOT available to students)
14.23 Identify a specified weld using a welding symbol.
14.24 Draw welding symbols.
14.25 Demonstrate an understanding of the steps necessary to create a project from a welding drawing.
14.26 Prepare metal for welding.
14.27 Demonstrate an understanding of weld quality analysis using various testing procedures. (i.e., dye penetrant, guided bend)
14.28 Design a welded project.
15.0 Demonstrate proficiency in computer control and robotics.--The student will be able to:

CTE Standards and Benchmarks
Programmable Logic Controllers (PLC)
15.01 Demonstrate proficiently an understanding of Binary concepts.
15.02 Wire input and output devices to a PLC.
15.03 Open, download, monitor, run and stop a PLC processor file using PLC programming software.
15.04 View the status of Input and Output Data Tables.
15.05 Create, enter, save, and edit a PLC program using PLC programming software.
15.06 Generate and print out a ladder logic report using PLC software.
15.07 Design a PLC program to jog two motors.
15.08 Design a PLC program to control the start/stop of two motors.
15.09 Design a PLC program to interlock two motors.
15.10 Design a PLC program that uses a safety interlock to control the operation of a machine.
15.11 Design a reciprocating actuator sequence PLC program.
15.12 Design a continuous cycle clamp and drill sequence PLC program.
Basic Robot Operation
15.13 Power up and shut down servo robot.
15.14 Jog a servo robot and adjust the fast and slow jog speed settings.
15.15 Move parts using the manual jog function.
15.16 Home a servo robot.
15.17 Manually operate the gripper using the teach pendant.
15.18 Use a teach pendant to: teach robot position points, test teach points, and edit teach points.
15.19 Use a teach pendant to delete a program file.
15.20 Use a teach pendant to enter a servo robot program that uses standard commands.
15.21 Run a servo robot program using a teach pendant.

CTE Standards and Benchmarks
15.22 Stop a servo robot program using functions on a teach pendant.
15.23 Design a program to perform a basic material handling task.
15.24 Store and retrieve multiple programs in a robot controller.
15.25 Use PC software to enter and edit a robot program offline and online.
15.26 Use PC software to delete a program.
15.27 Use PC software to power up, jog, home, and power down a servo robot
15.28 Use PC software to run a servo robot program.
15.29 Connect digital input and output devices to a robot controller.
15.30 Use PC software to enter program commands that uses a manual operator station, and will unload an automatic machine.
15.31 Design a robot program that performs a basic assembly task using linear motion.
15.32 Enter a robot program that uses the World Coordinate motion commands.
15.33 Design and enter a robot program that uses Tool Coordinate motion commands.
Application Development and Flexible Manufacturing Cells
15.34 Construct a flow chart given a general sequence of operations.
15.35 Connect a solenoid-operated pneumatic valve to the output of a robot and operate.
15.36 Design a robot program that will load and unload an automatic machine.
15.37 Teach points with a double-jointed robot arm using the full range of its work envelope.
15.38 Design a robot program that uses a robot’s double-jointed design.
15.39 Design a robot program given a general description of the application.
15.40 Connect and configure a servo conveyor to a servo robot. (optional when conveyor is available to students)
15.41 Design and run a robot program that uses a non-servo DC motor attached to a robot controller axis.
15.42 Design a robot program that uses a servo conveyor.
15.43 Design a robot program that uses a conveyor. (optional when conveyor is available to students)

CTE Standards and Benchmarks
15.44 Design and enter a robot program that uses conditional commands.
15.45 Design a robot program that sorts parts.
15.46 Design and enter a robot program that uses subroutine commands.
15.47 Design a robot application using a subroutine.
15.48 Program a robot that uses a servo traverse axis.
15.49 Design and enter a robot program that uses a servo gripper.
15.50 Develop a robot-to-solid state I/O interface wiring diagram.
15.51 Interface a robot discrete I/O using a relay.
15.52 Design a robot program to control an FMS (Flexible Manufacturing System) workstation via discrete I/O.
15.53 Design a robot program that will unload two or more automatic machines.
15.54 Design a robot program that encompasses the skills, techniques, and components in a flexible manufacturing system.
Production Control
15.55 Enter a robot program that uses an input command.
15.56 Enter a robot program that uses arithmetic and relational operators.
15.57 Design and enter a robot program that has loop commands.
15.58 Design a robot application using loop commands.
15.59 Design and enter a robot program that uses counter commands.
15.60 Design and enter a robot program that stops a production process if a quality standard is not met.
Quality Control
15.61 Document the current location of a robot in Cartesian coordinates.
15.62 Design and run a robot program that uses points stored in Cartesian coordinates.
15.63 Design and run a robot program to perform go no-go inspections.
15.64 Design and run a robot program that uses a variable name.

CTE Standards and Benchmarks	
15.65	Design and run a robot program that uses a command that will output messages or the contents of variables from the robot controller to the computer screen.
15.66	Design and run a robot program to inspect parts by measuring them in its gripper.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 4**
Course Number: **9200240**
Course Credit: **1**

Course Description:
The Advanced Manufacturing Technology 4 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study mechanisms; AC/DC electrical control; programmable logic control; fluid power; maintenance of technological systems; and exploration of employability and career opportunities.

CTE Standards and Benchmarks
16.0 Demonstrate an understanding of mechanisms.--The student will be able to:
Levers and Linkages
16.01 For the relation (m, w) calculate the weights (range) of objects given mass (domain) of objects.
16.02 Calculate the compression rate of a spring using Hooke's Law.
16.03 Use a spring scale to measure the weight of an object and the force on an object.
16.04 Calculate torque.
16.05 Calculate the moment caused by a force.
16.06 Calculate and measure the mechanical advantage of a first-class, second-class, and third-class lever.
16.07 Calculate the coefficient of friction given application data.
16.08 Measure the force required to overcome friction in different applications.
16.09 Calculate and measure the mechanical advantage of an inclined plane
16.10 Connect and operate a slider crank linkage.
16.11 Connect and operate a double rocker linkage.
16.12 Connect and operate a crank rocker linkage.
16.13 Connect and operate a cam and cam follower.

CTE Standards and Benchmarks
16.14 Measure the velocity and dwell of a cam.
16.15 Connect and operate a turnbuckle.
Power Transmission Systems
16.16 Use a spirit level to determine orientation of a surface.
16.17 Select a fastener size and type for a motor mount and correct for a soft foot condition.
16.18 Level an electric motor.
16.19 Select a key size.
16.20 Measure the actual size of a key and keyseat.
16.21 Assemble a hub to a shaft using a key fastener.
16.22 Use a digital tachometer to measure motor speed.
16.23 Use a prony brake to measure shaft torque.
16.24 Calculate rotary mechanical power.
16.25 Identify shaft size given a sample.
16.26 Install and adjust a pillow block antifriction bearing and shaft.
16.27 Install a flexible jaw coupling.
16.28 Align two shafts using a straight edge and feeler gage.
Pulley Systems and Gear Drives
16.29 Measure the mechanical advantage of a fixed pulley.
16.30 Measure the mechanical advantage of a movable pulley.
16.31 Calculate and measure the mechanical advantage of a pulley combination.
16.32 Connect and operate a gear drive system.
16.33 Calculate and measure the mechanical advantage of a gear drive.
V-belt Drives

CTE Standards and Benchmarks
16.34 Calculate pulley ratio.
16.35 Calculate the shaft speed and torque of a belt drive system.
16.36 Install and align a fractional HP V-belt drive with a finished bore.
16.37 Determine the belt deflection force for a given application.
16.38 Adjust belt tension using an adjustable mounting base.
16.39 Use a belt tension tester to measure belt tension.
Chain Drives
16.40 Calculate sprocket ratio.
16.41 Calculate the shaft speed and torque of a chain drive system.
16.42 Install and align a roller chain drive system with adjustable centers.
16.43 Determine allowable chain sag for a given application.
16.44 Use a rule and a straight edge to measure chain sag.
16.45 Adjust chain sag to a specified amount using adjustable centers.
16.46 Install and remove a chain with a master link.
17.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control.--The student will be able to:
17.01 Demonstrate knowledge of AC/DC theory.
17.02 Check electrical components for UL and CSA approval.
17.03 Understand how to use an AC tester to check for electricity.
17.04 Use appropriate grounding techniques.
17.05 Connect and operate a circuit with a load.
17.06 Use a Digital Multi-Meter (DMM) to properly measure voltage, current, resistance, and continuity.
17.07 Solve circuit problems using appropriate units and notation.
17.08 Solve problems using Ohm’s Law.

CTE Standards and Benchmarks
17.09 Solve problems using Watt's Law.
17.10 Solve problems involving series and parallel impedance in circuits.
17.11 Solve problems involving capacitance in circuits.
17.12 Test a capacitor with a DMM.
17.13 Measure the voltage across a charged capacitor.
17.14 Calculate the time to charge and discharge a capacitor.
17.15 Following specific safety instructions safely discharge a capacitor.
17.16 Solve problems involving inductance in circuits.
17.17 Operate a circuit using a fuse, test and replace a fuse.
17.18 Operate a circuit using a circuit breaker, test and reset a circuit breaker.
17.19 Connect and operate a relay in a circuit.
17.20 Solve problems involving combination circuits.
17.21 Connect and operate a basic rheostat.
17.22 Design, connect, and operate a voltage divider network.
17.23 Solve problems involving a transformer
17.24 Size, connect, and operate a transformer.
17.25 Troubleshoot a transformer.
17.26 Design a control transformer circuit to provide a given output voltage.
18.0 Demonstrate a fundamental understanding of Programmable Logic Control.--The student will be able to:
18.01 Read and interpret the operation of a circuit given a ladder diagram.
18.02 Connect and operate a logic circuit given a ladder diagram.
18.03 Design a ladder diagram using one or more logic elements.
18.04 Design, connect, and operate a control circuit to operate a solenoid valve.

CTE Standards and Benchmarks
18.05 Read and interpret a basic ladder diagram with detached symbology.
18.06 Design, connect, and operate a relay to energize a fluid power solenoid.
18.07 Connect and operate a relay to perform a seal-in function.
18.08 Connect and operate an event sequencing circuit given a ladder diagram.
18.09 Design a logic circuit that uses a limit switch to sequence an event.
18.10 Connect and operate a single-cycle cylinder reciprocation circuit.
18.11 Connect and operate a continuous-cycle cylinder reciprocation circuit.
18.12 Design a continuous-cycle cylinder reciprocation circuit with a safety interlock.
18.13 Connect and operate a control circuit with a timer relay.
18.14 Connect and operate a control circuit to perform an unloaded start of a motor.
18.15 Design a control circuit to perform time-driven sequencing.
18.16 Connect and operate a dual-cylinder control circuit using two limit switches.
18.17 Design a continuous-cycle multiple-cylinder circuit.
18.18 Connect and operate a circuit having both automatic and manual modes of operation.
18.19 Connect and operate a control circuit to simulate a two-pushbutton jog circuit.
19.0 Demonstrate an understanding of fluid power.--The student will be able to:
Pneumatic Circuits and Power Systems
19.01 Identify pneumatic symbols.
19.02 Read a pneumatic pressure gage and flow meter.
19.03 Calculate the extension force of a cylinder given its size and pressure.
19.04 Determine the pressure needed to create a known output force on an extending cylinder.
19.05 Measure the force output of an extending cylinder.
19.06 Calculate the retraction force of a cylinder given its size and pressure.

CTE Standards and Benchmarks
19.07 Convert between gage and absolute pressures.
19.08 Solve problems using Boyle's Law.
19.09 Convert air volumes at pressures to free air volumes.
19.10 Measure pressure drop (Delta P) across pneumatic components.
19.11 Connect equipment and perform basic pneumatic operations.
19.12 Connect a pneumatic circuit given a schematic.
19.13 Draw a pneumatic schematic from the actual circuit connections on a machine.
19.14 Design a multiple actuator pneumatic circuit.
19.15 Connect pneumatic speed control circuits.
19.16 Design speed control circuits.
19.17 Connect and operate pneumatic Directional Control Valve (DCV) applications.
19.18 Design a rapid traverse-slow feed pneumatic circuit.
19.19 Design a pneumatic circuit to sequence two cylinders.
19.20 Design a pneumatic circuit that uses an externally air-piloted DCV.
Vacuum Systems
19.21 Convert between units of mercury and units of air pressure.
19.22 Connect and read a vacuum gage and manometer.
19.23 Convert between units of water column and units of water pressure.
19.24 Connect and operate a vacuum generator.
19.25 Calculate vacuum cup lift force.
19.26 Connect and operate a vacuum cup.
19.27 Design the vacuum cup portion of a handling rack.
Hydraulic Circuits and Power Systems

CTE Standards and Benchmarks
19.28 Read a hydraulic pressure gage, flow meter and the liquid level and temperature in the reservoir.
19.29 Calculate the extension force of a cylinder given its size and pressure.
19.30 Measure the force output of an extending cylinder.
19.31 Calculate the retraction force of a cylinder given its size and pressure.
19.32 Measure the force output of a retracting cylinder.
19.33 Measure the pressure drop (Delta P) across a hydraulic component.
19.34 Convert between absolute pressure and gage hydraulic pressure.
19.35 Calculate the extend speed, retract speed, and cylinder stroke time of a hydraulic cylinder given its size and a flow rate.
19.36 Draw a hydraulic schematic from the actual circuit connections on a pictorial.
19.37 Draw a hydraulic circuit given a schematic.
19.38 Operate a hydraulic power unit.
19.39 Connect equipment and perform basic hydraulic operations.
19.40 Connect and operate hydraulic Directional Control Valve (DCV) applications.
19.41 Design and connect hydraulic speed control circuits.
19.42 Design and connect a multiple actuator hydraulic circuit, an independent speed control circuit, and a two-speed actuator circuit.
20.0 Demonstrate the abilities to use and maintain technological products and systems.--The student will be able to:
Overall Maintenance Process
20.01 Discuss preventive and predictive maintenance methods for manufacturing environments.
20.02 Demonstrate knowledge of principles of Total Productive Maintenance (TPM).
20.03 Recognize potential maintenance issues with basic production systems and determine when to inform maintenance personnel about issues.
20.04 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
20.05 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
20.06 Operate systems so that they function in the way they were designed.

CTE Standards and Benchmarks	
20.07	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
20.08	Develop and follow maintenance schedules.
20.09	Identify the most common causes of failure of equipment in order to diagnosis problem quickly.
20.10	Demonstrate knowledge of what different equipment alarms indicate.
20.11	Understand the procedure for making on-process adjustments during production.
20.12	Examine the concept of troubleshooting within basic manufacturing maintenance areas.
20.13	Identify equipment failures in manufacturing maintenance areas.
20.14	Describe root cause analysis methods.
20.15	Use materials management to know what is recyclable and what is not.
20.16	Use monitoring or diagnostic devices to find out when equipment is operating correctly.
20.17	Use appropriate maintenance tools to maintain machines.
Documentation of Maintenance	
20.18	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
20.19	Demonstrate knowledge of the procedures for logging repairs and work order requests.
20.20	Demonstrate knowledge of statistical method charts to ensure that equipment is producing a quality product.
20.21	Demonstrate knowledge of forms and procedures for correctly documenting processes (e.g., preventative maintenance forms and workorders).
20.22	Read diagrams, schematics, manuals and specifications to understand how to repair equipment.
20.23	Document repairs, replacement parts, problems and corrective actions to maintain log to determine patterns of operation.
20.24	Review maintenance log/checklist to ensure that recommended preventative procedures are followed.
Specific Maintenance Operations	
20.25	Demonstrate knowledge of proper and safe functioning of mechanical power transmission equipment.
20.26	Demonstrate knowledge of lubrication procedures and requirements.
20.27	Demonstrate knowledge of the selection, design, and safe functioning of belt, chain, and roller chain drive equipment.

CTE Standards and Benchmarks	
	20.28 Demonstrate knowledge of fluid transport.
	20.29 Identify standard types of industrial pumps and determine the causes and maintenance procedures for shaft seal failure, shaft misalignment, and pump cavitations.
21.0	Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.--The student will be able to:
	21.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	21.02 Discuss motivation and human behavior.
	21.03 Develop a personal stress management plan.
	21.04 Demonstrate knowledge of ways to improve reading, listening and writing skills.
	21.05 Demonstrate knowledge of techniques for making effective presentations to internal and external customers.
	21.06 Provide effective feedback and make suggestions.
	21.07 Demonstrate appropriate customer service skills and techniques.
	21.08 Explain the characteristics of a high-performance team and how to assess team member personality types.
	21.09 Engage in team activities such as a team icebreaker exercise, developing a team constitution, brainstorming session, and reaching a decision by consensus.
	21.10 Demonstrate knowledge of roles and responsibilities of production team members.
	21.11 Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.
	21.12 Communicate production and process information to team members.
	21.13 Organize or participate on a high-performance team to construct and analyze a project.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology Capstone**
Course Number: **9200250**
Course Credit: **1**

Course Description:
The Advanced Manufacturing Technology Capstone course provides students with extended content and skills essential to the planning, design, creation, and presentation of an advanced manufacturing capstone project.

CTE Standards and Benchmarks	
22.0	Conceive, design, and present a project(s) that encompass all the skills learned in the Advanced Manufacturing Technology program.--The student will be able to:
22.01	Create and produce an original working drawing using CAD/CAM software.
22.02	Create and produce a 3-D drawing using appropriate industry recognized software.
22.03	Create and produce a toolpath.
22.04	Create and produce a 3-D model of the project. (if applicable)
22.05	Compose a well written design proposal and present to instructor for approval.
22.06	Incorporate principles and practices of manufacturing processes into the design.
23.0	Plan, organize, and carry out a project plan.--The student will be able to:
23.01	Determine the scope of a project.
23.02	Organize tasks.
23.03	Determine project priorities.
23.04	Identify required resources.
23.05	Record project progress in a process journal.
23.06	Record and account for budget expenses during the life of the project.
23.07	Carry out the project plan to successful completion and delivery.

CTE Standards and Benchmarks	
24.0	Formulate strategies to properly manage resources.--The student will be able to:
24.01	Identify required resources and associated costs for each stage of the project plan.
24.02	Create a project budget based on the identified resources.
24.03	Determine the methods needed to acquire needed resources.
24.04	Demonstrate good judgment in the use of resources.
24.05	Recycle and reuse resources where appropriate.
24.06	Demonstrate an understanding of proper legal and ethical waste disposal.
25.0	Use tools, materials, and processes in an appropriate and safe manner.--The student will be able to:
25.01	Identify the proper tool for a given job.
25.02	Use tools and machines in a safe manner.
25.03	Adhere to laboratory safety rules and procedures.
25.04	Identify the application of processes appropriate to the task at hand.
25.05	Identify materials appropriate to their application.
26.0	Create a project portfolio describing the project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.--The student will be able to:
26.01	Create a Design Portfolio documenting drawings and specifications.
26.02	Create a Bill of Material (BOM) for your project.
26.03	Create and deliver a presentation to communicate project results.

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.

Academic Alignment

Secondary Career and Technical Education courses are pending alignment to the B.E.S.T. (Benchmarks for Excellent Student Thinking) Standards for English Language Arts (ELA) and Mathematics that were adopted by the State Board of Education in February 2020. Academic alignment is an ongoing, collaborative effort of professional educators that provide clear expectations for progression year-to-year through course alignment. This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/SI.pdf.
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.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student. Access MyCareerShines by visiting: www.mycareershines.org.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular career and technical student organizations for 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. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

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.

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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:

http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml