Wallenpaupack Area School District
Planned Course Curriculum Guide

Career and Technical Education

Engineering Technologies III

Course Description:
This hands-on, project-based course explores the cutting-edge technologies and systems that drive modern manufacturing and industrial automation. Students will gain in-depth experience with **Computer-Aided Manufacturing (CAM)**, **Programmable Logic Controllers (PLCs)**, and **industrial control systems**, while developing a strong foundation in **advanced manufacturing processes** and **digital fabrication techniques**. Through real-world applications and industry-standard tools, students will:

- Design and simulate manufacturing workflows using CAM software.
- Program and troubleshoot PLCs for automated control of industrial systems.
- Analyze and optimize production systems for efficiency and reliability.
- Explore robotics, sensors, and human-machine interfaces (HMIs).
- Understand safety protocols, lean manufacturing principles, and smart factory concepts.

This course prepares students for careers in **mechatronics, automation engineering, industrial maintenance**, and **advanced manufacturing**, and is ideal for those pursuing technical certifications or further education in engineering and technology fields.

Revision Date: November 19, 2025

Wallenpaupack Area School District Curriculum	
COURSE: Engineering Technologies III	**GRADE/S: 12**
PLC UNIT 1: Overview	**TIMEFRAME: 3 Blocks**

PA STANDARDS:

- 3.4.10.A1: Illustrate how the development of technologies is often driven by profit and an economic market
- 3.4.12.A3: Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).
- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1601 Choose appropriate machine control inputs and outputs based on the need of a technological system.
- 1603 Differentiate between the characteristics of digital and analog devices.

UNIT OBJECTIVES (SWBATS):

- Describe the history and development of programmable logic controller (PLC) systems.
- Discuss the benefits of PLCs over electromechanical relay logic systems.
- Distinguish between fixed and modular PLC devices.
- Describe the functions of the central processing unit in a PLC.
- Describe Allen-Bradley programmable controller devices.
- Compare the various types of Allen-Bradley PLCs.
- Describe other types of industrial controllers and compare them to PLCs.
- Describe the expansion and use of communication with intelligent industrial controllers.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 1 packet (Formative)
- Unit 1 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Data cache CISC based Computer Relay Logic Device
Flip-flop read only memory remote terminal unit

PLC UNIT 2: PLC Selection, Components, and Communication	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1608 Identify components needed to integrate computer controls for an automated system.
- 1609 Plan, design, program, and construct an automated system based on given constraints.

UNIT OBJECTIVES (SWBATS):

- Identify important questions to determine which PLC device to purchase.
- Select modular Allen-Bradley SLC 500 series components.
- Select input and output modules for Allen-Bradley SLC 500 PLCs.
- Recognize how to connect sensors and switches to PLC ports.
- Describe the different types of PLC memory.
- Explain how SLC 500 PLCs communicate with other industrial devices and components.
- Describe the method to connect PLC devices to programming modules.
- List features of the controllers in the Allen-Bradley ControlLogix family.
- Compare the features of the RSLogix 5000 and the RSLogix 500 programming software.
- Summarize the industrial control design process.
- Explain the design and setup of HMI in industrial control systems.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 2 packet (Formative)
- Unit 2 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Analog to digital converter data bus discrete port fieldbus octal latch

PLC UNIT 3: Number Systems and Codes	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1603 Differentiate between the characteristics of digital and analog devices.
- 1604 Select between open and closed loop systems to solve a technological problem.
- 1605 Create system control programs using flowchart logic.

UNIT OBJECTIVES (SWBATS):

- Explain the decimal number system.
- Explain integer numbers, fractional numbers, and real numbers.
- Describe the binary number system.
- Convert decimal numbers to binary and vice versa.
- Perform binary math operations such as add, subtract, multiply, and divide.
- Explain the hexadecimal number system.
- Convert binary numbers to hexadecimal numbers and vice versa.
- Explain the octal number system.
- Convert binary numbers to octal numbers and vice versa.
- Explain the binary coded decimal number system and its use.
- Convert decimal numbers to binary coded decimals.
- Explain the Gray code number system and its use.
- Explain the ASCII and EBCDIC alphanumeric codes.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 3 packet (Formative)
- Unit 3 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Baud rate duplex parity check simplex sourcing

PLC UNIT 4: Input/Output Devices and Motor Controls	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1603 Differentiate between the characteristics of digital and analog devices.
- 1604 Select between open and closed loop systems to solve a technological problem.
- 1605 Create system control programs using flowchart logic.

UNIT OBJECTIVES (SWBATS):

- Describe the operation of proximity, Hall effect, RADAR, LIDAR, and ultrasonic sensors.
- Explain how cameras can be used for quality assurance in a manufacturing plant.
- Explain the difference between passive and active triangulation systems.
- Describe the types of temperature sensors used in industrial settings.
- Name the common indicators used in PLC systems.
- Explain the purpose of using indicators in a PLC system.
- Explain the difference between a power relay and a control relay.
- Describe the operation of a relay.
- Describe the operation of a solenoid.
- Name the two major types of motor control devices.
- Name two types of overload relays.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 4 packet (Formative)
- Unit 4 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

LIDAR LED RADAR Relay Solenoid Thermocouple

PLC UNIT 5: Creating Relay Logic Diagrams	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1603 Differentiate between the characteristics of digital and analog devices.
- 1604 Select between open and closed loop systems to solve a technological problem.
- 1605 Create system control programs using flowchart logic.

UNIT OBJECTIVES (SWBATS):

- Use symbols to represent different types of input and output devices.
- Create relay logic diagrams using the standard relay logic rules.
- Create relay logic circuits for process and industrial control problems.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 5 packet (Formative)
- Unit 5 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Contact PLC ladder diagram Rails Relay coil Rung

PLC UNIT 6: PLC Programing	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1603 Differentiate between the characteristics of digital and analog devices.
- 1604 Select between open and closed loop systems to solve a technological problem.
- 1605 Create system control programs using flowchart logic.

UNIT OBJECTIVES (SWBATS):

- Use symbols to represent different types of input and output devices.
- Create relay logic diagrams using the standard relay logic rules.
- Create relay logic circuits for process and industrial control problems.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 5 packet (Formative)
- Unit 5 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Contact PLC ladder diagram Rails Relay coil Rung

PLC UNIT 7: Programming Logic Gate Functions in PLCs	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1608 Identify components needed to integrate computer controls for an automated system.
- 1609 Plan, design, program, and construct an automated system based on given constraints.
- 1611 Interface system output to another automated system.

UNIT OBJECTIVES (SWBATS):

- Describe combinational and sequential logic gate circuits.
- Create PLC ladder logic programs for NOT, AND, OR, NAND, NOR, XOR, and XNOR logic gates.
- Create Boolean expressions and logic gate circuits from truth tables.
- Simplify Boolean expressions.
- Convert Boolean expressions to PLC ladder logic diagrams.
- Convert PLC ladder logic diagrams to logic gate circuits and Boolean expressions.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 7 packet (Formative)
- Unit 7 Assessment (Summative)
- Lab Activity 7A, Programming Logic Gates on a PLC
- Lab Activity 7B, Programming Boolean Expressions on PLCs

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Boolean algebra Logic gate K-Map Quine-McCluskey routine Truth table

PLC UNIT 8: PLC Timer Instructions	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1612 Create and program a simulated work cell with simulation software.
- 1613 Program timers, counters, and loops.
- 1614 Select appropriate motors for an application.
- 1615 Interface output devices to a computer, microcontroller, or programmable logic controller.

UNIT OBJECTIVES (SWBATS):

- Use non-retentive and retentive ON-delay timer instructions to create PLC ladder logic diagrams.
- Use move (MOV) instructions to create variable preset value timer instructions.
- Use OFF-delay timers to create PLC ladder logic diagrams.
- Interlock timer instructions to turn an output on and off sequentially.
- Cascade timer instructions in a PLC ladder logic diagram to increase the timer preset values.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 8 packet (Formative)
- Unit 8 Assessment (Summative)
- Lab Activity 8A, PLC Timer Instructions

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Coil format enable bit Move (MOV) instruction single-input timer status register

PLC UNIT 9: PLC Counter Instructions	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1612 Create and program a simulated work cell with simulation software.
- 1613 Program timers, counters, and loops.
- 1614 Select appropriate motors for an application.
- 1615 Interface output devices to a computer, microcontroller, or programmable logic controller.

UNIT OBJECTIVES (SWBATS):

- Use count up instructions to create PLC ladder logic diagrams.
- Use count down instructions to create PLC ladder logic diagrams.
- Reset counter instructions.
- Connect different counter instructions and cascade counter instructions.
- Use timer and counter instructions to create PLC ladder logic diagrams.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 9 packet (Formative)
- Unit 9 Assessment (Summative)
- Lab Activity-9A, PLC Counter Instructions, 9B, PLC Counter and Timer Instructions

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

Count bit double-input counter overflow bit underflow bit

PLC UNIT 10: PLC Math Instructions	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1612 Create and program a simulated work cell with simulation software.
- 1613 Program timers, counters, and loops.
- 1614 Select appropriate motors for an application.
- 1615 Interface output devices to a computer, microcontroller, or programmable logic controller.

UNIT OBJECTIVES (SWBATS):

- Program the add instruction in the PLC ladder logic diagram.
- Program the subtract instruction in the PLC ladder logic diagram.
- Program the multiply instruction in the PLC ladder logic diagram.
- Program the divide instruction in the PLC ladder logic diagram.
- List advanced math instructions that are available in the Allen-Bradley SLC 5/03, SLC 5/04, and SLC 5/05 processors to perform mathematical computations.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 10 packet (Formative)
- Unit 10 Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

ADD DIV MUL SUB

PLC UNIT 11: Troubleshooting and Servicing the PLC System	TIMEFRAME: 5 Blocks

PA STANDARDS:

- 3.4.12.C2: Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- 3.4.12.C3: Apply the concept that many technological problems require a multi-disciplinary approach.

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- Differentiate between the characteristics of digital and analog devices.
- Select between open and closed loop systems to solve a technological problem.
- Create system control programs using flowchart logic.

UNIT OBJECTIVES (SWBATS):

- Explain the meaning of SLC 500 PLC indicator lights.
- Use forced instructions to check PLC input and output ports.
- Use PLC programming software to find CPU fault errors.
- Take corrective actions to correct CPU fault errors.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 8 packet (Formative)
- Unit 8 Assessment (Summative)
- Lab Activity 16A, PLC Troubleshooting

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Programmable Logic Textbook- Goodheart-Wilcox(2023)
- Test your knowledge review @ www.g-wlearning.com

RESOURCE SPECIFIC VOCABULARY:

CPU fault Forced condition PLC run light Power light

Manufacturing Unit 1: Manufacturing Systems	TIMEFRAME: 3 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1002 Determine the relationship of time and cost to manufacturing systems.
- 1003 Determine if a manufacturing process is primary or secondary.

UNIT OBJECTIVES (SWBATS):

- Describe how manufacturing has evolved.
- List the major components of a manufacturing system.
- Identify manufacturing inputs.
- Describe manufacturing processes.
- Identify manufacturing outputs.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 1 packet (Formative)
- Unit 1 Assessment (Summative)
- Activity 1-2: Manufacturing Process Symbols, Tech Lab Workbook

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- SME–Society of Manufacturing Engineers www.sme.org/cgi-bin/getsmepg.pl?/new-sme.html&&&SME&

RESOURCE SPECIFIC VOCABULARY:

Industrial materials Mentafacturing Primary processing Raw materials Secondary processing

Manufacturing Unit 2: Manufacturing Materials	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1012 Identify methods and sources for obtaining materials and supplies.
- 1013 Compile a materials list that includes vendors and costs for all required materials and equipment to build a prototype.

UNIT OBJECTIVES (SWBATS):

- Describe the relationship between materials and manufacturing.
- Distinguish between organic and inorganic materials.
- List the three major types of materials.
- Identify and describe metallic, polymeric, and ceramic materials.
- Give examples of composite materials.
- Select materials based on an understanding of various properties.
- Identify the seven major types of material properties.
- Name six characteristics that make up the physical properties of a material.
- Describe how mechanical properties can affect the way a material will react to an applied force or load.
- Cite examples of how chemical properties can affect a material's performance.
- List five thermal properties that can affect materials.
- Describe electrical and magnetic properties of materials.
- Explain how acoustical properties can affect material selection.
- Name the three general optical properties.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 2 packet (Formative)
- Unit 2 Assessment (Summative)
- Activity 2-1: Identifying Manufacturing Materials, Tech Lab Workbook, p. 21
- Activity 2-2: Manufacturing Materials: Grades and Sizes, Tech Lab Workbook, p. 22

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- SME–Society of Manufacturing Engineers www.sme.org/cgi-bin/getsmepg.pl?/new-sme.html&&&SME&

RESOURCE SPECIFIC VOCABULARY:

Alloy Composites Elastomers Ferrous Ores Thermoplastics Thermosets

Manufacturing Unit 3: Manufacturing Processes	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1008 Make a list of the production processes in manufacturing.
- 1009 Apply manufacturing systems to develop and produce a product.
- 1011 Write a step-by-step procedure for an assembly.
- 1012 Identify methods and sources for obtaining materials and supplies

UNIT OBJECTIVES (SWBATS):

- Identify manufacturing processes as primary or secondary.
- List and discuss major steps in the manufacturing processes.
- Define primary and secondary processes.
- Describe six types of secondary processes.
- Name outputs of manufacturing activities.
- Discuss the impact of manufacturing processes on the environment.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 3 packet (Formative)
- Unit 3 Assessment (Summative)
- Activity 2-1: Identifying Manufacturing Materials, Tech Lab Workbook, p. 21
- Activity 2-2: Manufacturing Materials: Grades and Sizes, Tech Lab Workbook, p. 22

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- Alcoa Inc. www.alcoa.com/global/en/home.asp
- Ford Motor Company www.ford.com

RESOURCE SPECIFIC VOCABULARY:

Clear-cutting Drift mining Harvesting Renewable Slurry Yarding

Manufacturing Unit 4: Layout and Measurement	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 2202 Make linear measurements to 1/16".
- 2203 Use a micrometer to measure to .001".
- 2204 Use a dial caliper to measure to .001".
- 2205 Perform angular measurement to the nearest one degree.
- 2206 Use a height gauge to measure to .001".
- 2207 Use inside micrometers and telescoping gauges to measure to .001".
- 2208 Express numbers in scientific notation and engineering notation.
- 2209 Use an engineer scale to measure a large-scale site plan.

UNIT OBJECTIVES (SWBATS):

- State the meaning of the terms measurement and layout.
- Identify surfaces of a part.
- Identify special features on a part.
- Identify measuring and layout tools.
- List principles of measurement for round and flat stock.
- Describe how to lay out a part.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 4 packet (Formative)
- Unit 4 Assessment (Summative)
- Activity 4-1: Secondary Processing, Tech Lab Workbook, p. 27
- Activity 4-2: Measuring, Tech Lab Workbook, p. 28
- Activity 4-3: Laying Out Material, Tech Lab Workbook, p. 29

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- How Stuff Works www.howstuffworks.com
- SkillsUSA www.skillsusa.org

RESOURCE SPECIFIC VOCABULARY:

Calipers Depth gauge Diameter Dividers Micrometer Protractor

Manufacturing Unit 5: Manufacturing System	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- Describe procedures used in manufacturing.
- Create and apply a flowchart that portrays a manufacturing process.
- Create a control system that replicates a factory cell.
- Evaluate a product and the processes used in its manufacture.

UNIT OBJECTIVES (SWBATS):

- Recognize the differences between custom, intermittent, and continuous manufacturing.
- Compare these three types of manufacturing.
- Define terms used with each type.
- List the major engineering tasks in organizing a manufacturing operation.
- Describe how the manufacturing engineer performs these tasks.
- Demonstrate the use of forms such as the operation process chart and the flow process chart.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 5 packet (Formative)
- Unit 5 Assessment (Summative)
- Activity 7-2: Flow Process Chart, Tech Lab Workbook, p. 77
- Activity 7-3: Tooling Design, Tech Lab Workbook, p. 78
- Activity 7-4: Plant Layout, Tech Lab Workbook, p. 79

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- How Stuff Works www.howstuffworks.com
- Lockheed Martin www.lockheedmartin.com

RESOURCE SPECIFIC VOCABULARY:

Flow process chart Manufacturing Engineer Process layout Product layout Resource flow Tooling

Manufacturing Unit 6: Control System	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 2101 Explain the eight "M's" as they relate to quality control in the manufacturing industry: machines, methods, materials, manpower, measurement, milieu, management, and maintenance.
- 2102 Demonstrate knowledge of industry quality standards.
- 2103 Identify various diagrams, charts and sheets used in quality control and management.
- 2104 Create a total quality control checklist for a product.
- 2106 Correct and improve a finding from an inspection document.
- 2107 Develop a report of inspection observations and findings.

UNIT OBJECTIVES (SWBATS):

- Name the four phases involved in developing and using a resource control system.
- List the major resources used to manufacture a product.
- Discuss the three major factors that affect labor costs.
- Name and discuss the two tasks in a total quality control system.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 6 packet (Formative)
- Unit 6 Assessment (Summative)
- Activity 7-7: Inspection, Tech Lab Workbook, p. 83
- Activity 7-8: Quality Control, Tech Lab Workbook, p. 84

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- How Stuff Works www.howstuffworks.com
- Lockheed Martin www.lockheedmartin.com

RESOURCE SPECIFIC VOCABULARY:

Automation Deskilling Inspection Productivity Resource control Rework

Advanced CAD UNIT 8: Tolerancing and Fits	**TIMEFRAME: 5 Blocks**

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 609 Apply principles of dimensioning and annotation.
- 610 Prepare drawings for product assembly, fabrication, or construction.
- 612 Revise an existing drawing to meet modifications or changes.

UNIT OBJECTIVES (SWBATS):

- Understand Tolerancing Nomenclature and Basics
- Understand the Tolerancing Designation Method
- Understand the Basics of ANSI Tolerances and Fits
- Use of ISO Metric Standard Fits
- Setup the Tolerancing Option in Inventor

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit Tutorial Exercise
- Topic demonstration
- Unit CAD Exercises

ANCHOR VOCABULARY:

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit CAD Exercises (Formative)
- Unit review questions (Summative) if applicable

EVIDENCE OF MASTERY/Cut Score (Keystone Exam):

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- www.Autodesk.com
- Inventor Quick Start Resources- Inventor Quick Start Guide | Autodesk
  https://www.autodesk.com/learn/ondemand/curated/inventor-quick-start-guide

RESOURCE SPECIFIC VOCABULARY:

- **N/A**

Advanced CAD UNIT 9: Auxiliary Views	**TIMEFRAME: 5 Blocks**

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 609 Apply principles of dimensioning and annotation.
- 610 Prepare drawings for product assembly, fabrication, or construction.
- 612 Revise an existing drawing to meet modifications or changes.

UNIT OBJECTIVES (SWBATS):

- Understand the Principles of Creating Auxiliary Views
- Utilize Reference Geometry
- Use Different Options to Create Reference Geometry
- Create Auxiliary Views in 2D Drawings
- Create and Adjust Center Lines
- Create Shaded Images in the 2D Drawing Mode

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit Tutorial Exercise
- Topic demonstration
- Unit CAD Exercises

ANCHOR VOCABULARY:

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit CAD Exercises (Formative)
- Unit review questions (Summative) if applicable

EVIDENCE OF MASTERY/Cut Score (Keystone Exam):

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- www.Autodesk.com
- Inventor Quick Start Resources- Inventor Quick Start Guide | Autodesk
  https://www.autodesk.com/learn/ondemand/curated/inventor-quick-start-guide

RESOURCE SPECIFIC VOCABULARY:

- **N/A**

Advanced CAD UNIT 10: Assembly Modeling	**TIMEFRAME: 10 Blocks**

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 609 Apply principles of dimensioning and annotation.
- 610 Prepare drawings for product assembly, fabrication, or construction.
- 612 Revise an existing drawing to meet modifications or changes.

UNIT OBJECTIVES (SWBATS):

- Understand the Terminology Related to Working Drawings
- Understand the Assembly Modeling Methodology
- Control Degrees of Freedom for Assembly Components
- Create Exploded Assemblies
- Create Assembly Drawings
- Create and Edit a Bill of Materials

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit Tutorial Exercise
- Topic demonstration
- Unit CAD Exercises

ANCHOR VOCABULARY:

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit CAD Exercises (Formative)
- Unit review questions (Summative) if applicable

EVIDENCE OF MASTERY/Cut Score (Keystone Exam):

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- www.Autodesk.com
- Inventor Quick Start Resources- Inventor Quick Start Guide | Autodesk
  https://www.autodesk.com/learn/ondemand/curated/inventor-quick-start-guide

RESOURCE SPECIFIC VOCABULARY:

- **N/A**

CNC Machining Unit 1: CNC Systems	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1101 Prepare a process, identify machines that will be used to carry out the process, and then describe the work that each machine performs.
- 1103 Demonstrate how to use computer assisted manufacturing (CAM) software to create a program for a machine part.

UNIT OBJECTIVES (SWBATS):

- Name and describe three kinds of automated machines and systems.
- Give examples of classes of NC machines.
- Explain the importance of NC programming coordinates.
- List and describe four systems that have advanced NC.
- Cite applications where robots are useful.
- Explain what end effectors are.
- Name and describe four management information systems.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Unit workbook activity
- Unit Review Activities - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit 1 packet (Formative)
- Unit 1 Assessment (Summative)
- Activity 11-3: Designing a Manufacturing Cell, Tech Lab Workbook, p. 116
- Activity 11-4: Computers and Product Design, Tech Lab Workbook, p. 117
- Activity 11-5: Computers in Manufacturing, Tech Lab Workbook, p. 118

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Manufacturing and Automation - Goodheart-Wilcox(2012)
- Test your knowledge review @ www.g-wlearning.com
- Manufacturing.net www.manufacturing.net
- How Stuff Works www.howstuffworks.com
- Lockheed Martin www.lockheedmartin.com

RESOURCE SPECIFIC VOCABULARY:

Adaptive control CNC CAPP DNC JIT manufacturing PTP machines Variable sequencing robot

CNC Machining Unit 2: Intro to CNC machining	TIMEFRAME: 6 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1101 Prepare a process, identify machines that will be used to carry out the process, and then describe the work that each machine performs.
- 1103 Demonstrate how to use computer assisted manufacturing (CAM) software to create a program for a machine part.

UNIT OBJECTIVES (SWBATS):

- Create a CAM setup for CNC Milling.
- Create a tool library.
- Create toolpaths for 2.5 and 3 axis motion.
- Validate toolpaths with simulation.
- Create documentation and NC code.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Inventor/Fusion activity
- Step by Step Tutorial
- Practice Exercises
- Unit Exercises - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit Final Assessment (Summative)
- Unit Challenge

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- AutoDesk online supplements- CNC Toolpaths for 3 Axis Milling | Autodesk
- CAD/CAM Software

RESOURCE SPECIFIC VOCABULARY:

2.5 Axis 3 Axis Toolpath GCode

CNC Machining Unit 3: CNC Machining Project 1-Wallet	TIMEFRAME: 18 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1101 Prepare a process, identify machines that will be used to carry out the process, and then describe the work that each machine performs.
- 1103 Demonstrate how to use computer assisted manufacturing (CAM) software to create a program for a machine part.

UNIT OBJECTIVES (SWBATS):

- Create multiple setups in sequence for manufacturing.
- Import tools and modify tool settings options.
- Describe considerations for fixturing stock.
- Plan for acquiring accurate part reference zero at each progressive setup.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- Unit presentation
- Inventor/Fusion activity
- Step by Step Tutorial
- Practice Exercises
- Unit Exercises - Know and Understand- Apply and Analyze-

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Unit Final Assessment (Summative)
- Unit Challenge- Machine or 3D print a wallet design

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- AutoDesk online supplements- CNC Toolpaths for 3 Axis Milling | Autodesk
- CAD/CAM Software

RESOURCE SPECIFIC VOCABULARY:

2.5 Axis 3 Axis Toolpath GCode

Fluid Power Review- Training Module	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 1401 Design, create, and test a fluid power system.
- 1402 Identify components of a fluid system.
- 1403 Calculate values in a fluid power system using Pascal's law.
- 1404 Calculate values in a pneumatic system using the ideal gas laws.
- 1405 Calculate mechanical advantage in a fluid power system.

UNIT OBJECTIVES (SWBATS):

- Learners will gain critical hands-on experience operating pneumatic cylinders, flow controls, directional control valves, air motors, and pressure gauges

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- E-Learning module
- Step by Step Tutorial
- Practice Exercises

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Module Final Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Amatrol Trainer
- Amatol E-Learning

RESOURCE SPECIFIC VOCABULARY:

pneumatic cylinders flow control directional control valves air motors pressure gauges

AC/DC Review- Training Module	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 2302 Define and describe basic terms in electricity and electronics.
- 2303 Identify electrical and electronic symbols on a schematic.
- 2304 Follow a schematic and construct series and parallel electrical and electronic circuits.
- 2305 Identify resistors by type and value.
- 2306 Use various types of sensing and control devices.
- 2307 Use a digital multimeter to measure circuit values of current, resistance, and voltage.

UNIT OBJECTIVES (SWBATS):

- Learners will review critical hands-on experience
    1. Principles of AC and DC Voltage and Current
    2. Principles of Resistance, Inductance, and Capacitance
    3. Power Generation Principles
    4. Ohm's Law & Kirchoff's Law
    5. Series and Parallel Circuits
    6. Manual Switches & Basic Output Devices
    7. Fuses & Circuit Breakers
    8. Resistors, Capacitors, & Inductors
    9. Potentiometers, Solenoids, Control Relays, & Circuit Testers
    10. Circuit Protection Calculations
    11. System Design & Troubleshooting

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- E-Learning module
- Step by Step Tutorial
- Practice Exercises

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Module Final Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Amatrol Trainer
- Amatol E-Learning

RESOURCE SPECIFIC VOCABULARY:

Current resistance capacitance voltage fuse breaker resistor relay switch

Electrical Relay Review- Training Module	TIMEFRAME: 5 Blocks

Competency Task List – Secondary Component- Engineering Technologies/Technicians CIP 15.9999

- 2302 Define and describe basic terms in electricity and electronics.
- 2303 Identify electrical and electronic symbols on a schematic.
- 2304 Follow a schematic and construct series and parallel electrical and electronic circuits.
- 2305 Identify resistors by type and value.
- 2306 Use various types of sensing and control devices.
- 2307 Use a digital multimeter to measure circuit values of current, resistance, and voltage.

UNIT OBJECTIVES (SWBATS):

- review critical hands-on experience on how to interpret, design, and operate relay control circuits using ladder diagrams.
- utilize electrical control to operate electric and fluid power actuators
- review programmed logic control using the electrical control schematic method and the ladder diagram.

INSTRUCTIONAL STRATEGIES/ACTIVITIES:

- E-Learning module
- Step by Step Tutorial
- Practice Exercises

ASSESSMENTS (Diagnostic/Benchmark/Formative/Summative):

- Module Final Assessment (Summative)

DIFFERENTIATED INSTRUCTION (Remediation/Extension) (Process, Product or Content)

- Peer tutoring
- Grouping with purpose
- Extended time
- Limited response
- Companion website
- Direct instruction

RESOURCES (Websites, Blogs, Videos, Whiteboard Resources, etc.):

- Amatrol Trainer
- Amatol E-Learning

RESOURCE SPECIFIC VOCABULARY:

Solenoid digital control valve sequencing delay