Computer Integrated Manufacturing					
Course Description					
implementation of automation. The course explores manufacturing history, individual processes, systems, and careers. In addition to technical concepts, the course incorporates finance, ethics, and engineering design. This reflects an integrated approach that leading manufacturers have adopted to improve safety, quality, and efficiency.					
Program of Study to which the course applies	**Course Code**				
STEM:	103170				
	Course Content	**Reference Standards**	**Crosswalk to Common Core Standards**	**Crosswalk to Nebraska Standards**	**Comments**
Standard 1	Students will understand the history of manufacturing.	PLTW-CIM			
Benchmark 1.1	Describe manufacturing as a series of interrelated activities and operations that involve product design, planning, producing, materials control, quality assurance, management, and marketing of that product	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Sample Performance Indicator 1.1.1	Explore manufacturing through research and projects.	PLTW-CIM			
Benchmark 1.2	Describe how manufacturing is essential to a healthy economy, including jobs and attainment of personal goals.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Sample Performance Indicator 1.2.1	Explore manufacturing through research and projects.	PLTW-CIM			

Benchmark 1.3	Understand national manufacturing avoids health risks that are accepted in other countries.	PLTW-CIM			
Sample Performance Indicator 1.3.1	Explore manufacturing through research and projects.	PLTW-CIM			
Sample Performance Indicator 1.3.2	Understand what the enterprise wheel represents and how it represents the overall manufacturing scheme.	PLTW-CIM			
Benchmark 1.4	Identify the many careers which are associated with the area of manufacturing.	PLTW-CIM	ELA.RST.11-12.4	LA.12.1.5	
Sample Performance Indicator 1.4.1	Understand what the enterprise wheel represents and how it represents the overall manufacturing scheme.	PLTW-CIM			
Sample Performance Indicator 1.4.2	Research a topic in manufacturing, develop a presentation, and present findings to a group.	PLTW-CIM			
Benchmark 1.5	Describe the different procedures that are used in the creation of products.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Sample Performance Indicator 1.5.1	Explain the different procedures used in manufacturing.	PLTW-CIM			
Standard 2	The student will understand the control systems of manufacturing.	PLTW-CIM			

Benchmark 2.1	Understand flowcharting is a powerful graphical organizer used by technicians, computer progammers, engineers, and professionals in a variety of roles and respoonsibilities.	PLTW-CIM			
Sample Performance Indicator 2.1.1	Identify basic flowcharting symbols and discuss their functions.	PLTW-CIM			
Sample Performance Indicator 2.1.2	Create a flowchart that portrays a manufacturing process.	PLTW-CIM			
	Apply flowcharting to areas other than manufacturing.				
Benchmark 2.2	Recognize that during the design and development process, flowcharting is used to plan and depict the process flow for an entire system and all of its subsystems.	PLTW-CIM	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performance Indicator 2.2.1	Identify basic flowcharting symbols and discuss their functions.	PLTW-CIM			
Sample Performance Indicator 2.2.2	Create a flowchart that portrays a manufacturing process.	PLTW-CIM			
	Apply flowcharting to areas other than manufacturing.				
Benchmark 2.3	Use flowcharting symbols to graphically organize the flow of program control, including all inputs, outputs, and conditions that may occur.	PLTW-CIM	ELA.RST.11–12.7	LA.12.1.6.f	
Sample Performance Indicator 2.3.1	Model and create a program to control an automated system.	PLTW-CIM			

Benchmark 2.4	Identify everyday products including cars, microwaves, ovens, hair dryers, coffee pots, and washing machines which all use control systems to manage their operations.	PLTW-CIM			
Sample Performance Indicator 2.4.1	Identify a control system and explain its application to manufacturing.	PLTW-CIM			
	Model and create a program to control an automated system.				
Standard 3	The student will understand the costs of manufacturing.	PLTW-CIM			
Benchmark 3.1	Consider cost and safety when designing a control system.	PLTW-CIM			
Sample Performance Indicator 3.1.1	Create a control system that replicates a factory cell.	PLTW-CIM			
Benchmark 3.2	Calculate the cost of manufacturing a product using a variety of variable factors.	PLTW-CIM		MA.12.1.3.d	
Sample Performance Indicator 3.2.1	Create a control system that replicates a factory cell.	PLTW-CIM			
Benchmark 3.3	Understand tradeoffs may be made between hiring highly skilled or experienced workers and keeping costs down.	PLTW-CIM			
Sample Performance Indicator 3.3.1	Maximize the efficiency of the manufacturing system with respect to time and cost.	PLTW-CIM			
Benchmark 3.4	Recognize the less time a part the make, the more potential profit is available.	PLTW-CIM		MA.12.1.3.d	

Sample Performance Indicator 3.4.1	Maximize the efficiency of the manufacturing system with respect to time and cost.	PLTW-CIM			
Sample Performance Indicator 3.4.2	Compare the efficiency of running multiple systems against that of one large system.	PLTW-CIM			
Benchmark 3.5	Describe how long term planning and investments may cost more up front but may provide additional saving in the future.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a MA.12.1.3.a MA.12.1.3.d MA.12.1.4.b	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Sample Performance Indicator 3.5.1	Compare the efficiency of running multiple systems against that of one large system.	PLTW-CIM			
Standard 4	The students will understand designing for manufacturability.	PLTW-CIM			
Benchmark 4.1	Understand design is a process that is used to systematically solve problems.	PLTW-CIM		SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d SC.12.1.3.e	
Sample Performance Indicator 4.1.1	Use the design process.	PLTW-CIM			
	Create a product using solid modeling software.				
Benchmark 4.2	Recognize many considerations must be made when manufacturing a quality part.	PLTW-CIM			
	Use solid modeling software to improve a flawed design.				

Sample Performance Indicator 4.2.1	Use knowledge of design to analyze products with flaws.	PLTW-CIM			
Sample Performance Indicator 4.2.2	Use calculated volume, mass, surface area of parts to determine material cost, waste, and packaging requirements.	PLTW-CIM			
Benchmark 4.3	Consider material properties as part of the design process.	PLTW-CIM		MA.12.2.5.c MA.12.2.5.f	Alignment presumes that students will convert between units and determine surface area and volume of packages when considering material properties as part of the design process (NE: MA.12.2.5.c, MA.12.2.5.f).
Sample Performance Indicator 4.3.1	Use knowledge of design to analyze products with flaws.	PLTW-CIM			
Sample Performance Indicator 4.3.2	Use calculated volume, mass, surface area of parts to determine material cost, waste, and packaging requirements.	PLTW-CIM			
Benchmark 4.4	Understand manufacturers have an ethical responsibility to create safe products and to provide a safe work environment.	PLTW-CIM			
Sample Performance Indicator 4.4.1	Determine whether a product is safe for a given audience (e.g., children under the age of three).	PLTW-CIM			
Benchmark 4.5	Describe how manufacturers have a legal responsibility to provide safety information about their products.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).

Benchmark 4.6	Research different engineering disciplines' code(s) of conduct or code(s) of ethics that their members are expected to follow.	PLTW-CIM	ELA.WHST.11-12.7-9	LA.12.1.6.j LA.12.4.1.a-c	The depth of students' investigations, and thus the research standards that apply, will be determined by the nature of the task (CC: ELA.WHST.11-12.7–9; NE: LA.12.1.6.j, LA.12.4.1.a–c).
Sample Performance Indicator 4.6.1	Make ethical decisions about manufacturing.	PLTW-CIM			
Benchmark 4.7	Appreciate how analyzing case studies of engineering failures is a good way for engineers to avoid future failures.	PLTW-CIM			
Sample Performance Indicator 4.7.1	Use solid modeling software to improve a flawed design.	PLTW-CIM			
Sample Performance Indicator 4.7.2	Create a product using solid modeling software.	PLTW-CIM			
Standard 5	The students will understand how we make things.	PLTW-CIM			
Benchmark 5.1	Understand prototyping is part of a design process where a physical model can be evaluated to refine the design.	PLTW-CIM		SC.12.1.3.b	
Sample Performance Indicator 5.1.1	Explain the difference between primary and secondary manufacturing processes.	PLTW-CIM			
	Analyze a product to propose the manufacturing processes used to create it.				
Benchmark 5.2	Understand that before raw material can be used in manufacturing, it must undergo primary processing.	PLTW-CIM			

Sample Performance Indicator 5.2.1	Explain the difference between primary and secondary manufacturing processes.	PLTW-CIM			
Benchmark 5.3	Understand the separating process is one of the oldest manufacturing processes.	PLTW-CIM			
Sample Performance Indicator 5.3.1	Explain the difference between primary and secondary manufacturing processes.	PLTW-CIM			
Benchmark 5.4	Milling and shearing utilize the subtractive process to create products.	PLTW-CIM			
Sample Performance Indicator 5.4.1	Analyze a product to propose the manufacturing processes used to create it.	PLTW-CIM			
Benchmark 5.5	ECM, EDM, water-, and laser-cutting are using newer technologies to enhance the accuracy and efficiency of material removal.	PLTW-CIM			
Sample Performance Indicator 5.5.1	Analyze a product to propose the manufacturing processes used to create it.	PLTW-CIM			
Benchmark 5.6	Identify metals, plastics, and ceramics as types of materials that are well suited to the manufacturing process.	PLTW-CIM	ELA.RST.11-12.4	LA.12.1.5	
Sample Performance Indicator 5.6.1	Analyze a product to propose the manufacturing processes used to create it.	PLTW-CIM			
Sample Performance Indicator 5.6.2	Explore manufacturing processes via research.	PLTW-CIM			

Benchmark 5.7	Understand the way in which a product is made is dependent upon the properties of the material that will be used.	PLTW-CIM			
Sample Performance Indicator 5.7.1	Explore prototyping processes.	PLTW-CIM			
Standard 6	The students will understand product development.	PLTW-CIM			
Benchmark 6.1	Understand many machines exist to perform manufacturing processes.	PLTW-CIM			
Sample Performance Indicator 6.1.1	Identify machines when given a process and identify the process that a given machine performs.	PLTW-CIM			
Benchmark 6.2	Recognize machine code is an essential tool used to communicate with some machines.	PLTW-CIM			
Sample Performance Indicator 6.2.1	Determine the appropriate speed rate for a given material using a tool with a given diameter.	PLTW-CIM			
Sample Performance Indicator 6.2.2	Read and interpret G & M codes.	PLTW-CIM			
Benchmark 6.3	Comprehend how jigs and fixtures are essential in maintaining consistency and quality control.	PLTW-CIM			
Sample Performance Indicator 6.3.1	Identify machines when given a process and identify the process that a given machine performs.	PLTW-CIM			

Benchmark 6.4	Computer Aided Manufacturing (CAM) programming tools make it possible to manufacture physical models using Computer Aided Design (CAD) programs.	PLTW-CIM	MTH.G.MG.1 MTH.G.MG.3	MA.12.2.4.a MA.12.2.4.b MA.12.2.5.b MA.12.2.5.g	
Sample Performance Indicator 6.4.1	Transfer the drawings made in CAD to a CAM program.	PLTW-CIM			
Sample Performance Indicator 6.4.2	Verify the creation of a part using a simulation software.	PLTW-CIM			
Benchmark 6.5	Describe how products manufactured today have been greatly influenced by the advancement of machines and technology.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a SC.12.1.2.b	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Sample Performance Indicator 6.5.1	Create numerical code using a CAM program.	PLTW-CIM			
Benchmark 6.6	Several variables in machining operations affect the final product in manufacturing.	PLTW-CIM		MA.12.3.1.f	Alignment presumes that students will calculate variables in machining operations, including the rate of change in speed (NE:MA.12.3.1.f).
Sample Performance Indicator 6.6.1	Determine the appropriate speed rate for a given material using a tool with a given diameter.	PLTW-CIM			
Sample Performance Indicator 6.6.2	Determine the feed rate for a given material using a tool with a given diameter.	PLTW-CIM			
Sample Performance Indicator 6.6.3	Create parts using the machines demonstrated by the instructor.	PLTW-CIM			

Sample Performance Indicator 6.6.4	Create a product on the computer using knowledge of manufacturing processes.	PLTW-CIM			
Benchmark 6.7	Profit margins are essential to a company's survival in a competitive market.	PLTW-CIM			
Sample Performance Indicator 6.7.1	Create a product on the computer using knowledge of manufacturing processes.	PLTW-CIM			
Benchmark 6.8	Understand prototyping a major step in design cycle of manufactured goods and has been greatly advanced with the advent and use of rapid prototyping processes.	PLTW-CIM		SC.12.1.3.b	
Sample Performance Indicator 6.8.1	Create a product on the computer using knowledge of manufacturing processes.	PLTW-CIM			
Standard 7	The students will understand the basics of automation.	PLTW-CIM			
Benchmark 7.1	Many factors have influenced the evolution of automation.	PLTW-CIM			
Sample Performance Indicator 7.1.1	Research a topic in automation.	PLTW-CIM			
Benchmark 7.2	Investigate automation careers.	PLTW-CIM	ELA.WHST.11-12.7-9	LA.12.1.6.j LA.12.4.1.a-c	The depth of students' investigations, and thus the research standards that apply, will be determined by the nature of the task (CC: ELA.WHST.11-12.7–9; NE: LA.12.1.6.j, LA.12.4.1.a-c)
Sample Performance Indicator 7.2.1	Explore automation careers.	PLTW-CIM			
Benchmark 7.3	Robots are widely used in industry to assist in the production of manufactured goods.	PLTW-CIM			

Sample Performance Indicator 7.3.1	Identify the advantages and disadvantages of robotic labor versus human labor.	PLTW-CIM			
Benchmark 7.4	Understand robots have distinct advantages over humans in some industrial settings (e.g., hazardous environments, repetitive motion or long hours).	PLTW-CIM			
Sample Performance Indicator 7.4.1	Identify the advantages and disadvantages of robotic labor versus human labor.	PLTW-CIM			
Sample Performance Indicator 7.4.2	Explore materials handling.	PLTW-CIM			
Benchmark 7.5	Understand robots and machines communicate and coordinate their activities through a process called handshaking.	PLTW-CIM			
Sample Performance Indicator 7.5.1	Create and program virtual robotic work cells with simulation software.	PLTW-CIM			
Sample Performance Indicator 7.5.2	Program the interface between a robot and another machine.				
Standard 8	The students will understand the elements of power.	PLTW-CIM			
Benchmark 8.1	Describe how power is produced (e.g. electrical, pneumatic, hydraulic, and motion).	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a SC.12.2.2.d SC.12.2.3.a SC.12.2.3.e SC.12.2.3.f	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).

Sample Performance Indicator 8.1.1	Identify the three main power types.	PLTW-CIM			
Sample Performance Indicator 8.1.2	Solve problems involving electrical, pneumatic, and mechanical power.	PLTW-CIM			
Sample Performance Indicator 8.1.3	Convert power between units.	PLTW-CIM			
Sample Performance Indicator 8.1.4	Calculate torque and use it to calculate power.	PLTW-CIM			
Sample Performance Indicator 8.1.5	Solve problems involving fluid power.	PLTW-CIM			
Benchmark 8.2	Understand fluid power is inversely proportional to the area upon which the force is being applied.	PLTW-CIM		MA.12.1.3.d MA.12.2.5.b MA.12.2.5.d SC.12.2.2.e	Alignment presumes that students convert between units of power and solve problems involving electrical, pneumatic, and mechanical power (NE: MA.12.1.3.d, MA.12.2.5.b, MA.12.2.5.d).
Sample Performance Indicator 8.2.1	Identify the three main power types.	PLTW-CIM			
Sample Performance Indicator 8.2.2	Solve problems involving electrical, pneumatic, and mechanical power.	PLTW-CIM			
Sample Performance Indicator 8.2.3	Convert power between units.	PLTW-CIM			
Sample Performance Indicator 8.2.4	Calculate torque and use it to calculate power.	PLTW-CIM			
Sample Performance Indicator 8.2.5	Solve problems involving fluid power.	PLTW-CIM			

Sample Performance Indicator 8.2.6	Construct a system to convert pneumatic power into mechanical power.	PLTW-CIM			
Benchmark 8.3	Describe how sensors provide feedback to control systems and products used by consumers.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Benchmark 8.4	Comprehend how pneumatics is one form of fluid power that can be used to operate machines and products.	PLTW-CIM		SC.12.2.2.e SC.12.2.3.d	Alignment presumes that students will convert between units of power when studying pneumatics and how it is used to operate machines (NE: MA.12.2.5.d).
Sample Performance Indicator 8.4.1	Construct a system to convert pneumatic power into mechanical power.	PLTW-CIM			
Standard 9	The students will understand robotic programming and usage.	PLTW-CIM			
Benchmark 9.1	Apply basic programming skills include variable declaration, loops, and debugging.	PLTW-CIM	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performance Indicator 9.1.1	Learn the programming language needed to operate the Lynx robot.	PLTW-CIM			
Sample Performance Indicator 9.1.2	Create programs using robotic software that will allow the robot to perform a set of tasks.	PLTW-CIM			
Benchmark 9.2	Investigate the variety of robots and unique programming languages are used in the manufacturing industry.	PLTW-CIM	ELA.WHST.11-12.7-9	LA.12.1.6.j LA.12.4.1.a-c	The depth of students' investigations, and thus the research standards that apply, will be determined by the nature of the task (CC: ELA.WHST.11-12.7–9; NE: LA.12.1.6.j, LA.12.4.1.a–c).

Sample Performance Indicator 9.2.1	Learn the programming language needed to operate the Lynx robot.	PLTW-CIM			
Sample Performance Indicator 9.2.2	Create programs using robotic software that will allow the robot to perform a set of tasks.	PLTW-CIM			
Benchmark 9.3	Understand that many every day products use microcontrollers.	PLTW-CIM			
Sample Performance Indicator 9.3.1	Create programs using robotic software that will allow the robot to perform a set of tasks.	PLTW-CIM			
Benchmark 9.4	Robots are used to perform diverse functions and work in diverse environments.	PLTW-CIM			
Sample Performance Indicator 9.4.1	Configure servo motors to operate the Lynxmotion robot.	PLTW-CIM			
Sample Performance Indicator 9.4.2	Formulate a list of tasks in which the robot used in class can be used in a large scale CIM cell operation.	PLTW-CIM			
Benchmark 9.5	Recognize the size of a robot is based on the work envelope and payload needed to perform the task.	PLTW-CIM			
Sample Performance Indicator 9.5.1	Configure servo motors to operate the Lynxmotion robot.	PLTW-CIM			
Sample Performance Indicator 9.5.2	Formulate a list of tasks in which the robot used in class can be used in a large scale CIM cell operation.	PLTW-CIM			
Standard 10	The student will understand integration of manufacturing elements.	PLTW-CIM			

Benchmark 10.1	Understand the process of mass production is used when the same product is created repeatedly.	PLTW-CIM			
Sample Performance Indicator 10.1.1	Identify the three categories of CIM systems.	PLTW-CIM			
Sample Performance Indicator 10.1.2	Compare and contrast the benefits and drawbacks of the three categories of CIM systems.	PLTW-CIM			
Benchmark 10.2	Identify how a workcell is a group of machines in which each individual machine has its own specialty.	PLTW-CIM	ELA.RST.11-12.4	LA.12.1.5	
Sample Performance Indicator 10.2.1	Identify the three categories of CIM systems.	PLTW-CIM			
Sample Performance Indicator 10.2.2	Compare and contrast the benefits and drawbacks of the three categories of CIM systems.	PLTW-CIM			
Benchmark 10.3	Comprehend that a flexible manufacturing system is one that can adapt to a wide variety of products.	PLTW-CIM			
Sample Performance Indicator 10.3.1	Identify the three categories of CIM systems.	PLTW-CIM	ELA.RST.11-12.4	LA.12.1.5	
Sample Performance Indicator 10.3.2	Compare and contrast the benefits and drawbacks of the three categories of CIM systems.	PLTW-CIM			
Benchmark 10.4	Understand tradeoffs are made when one system is utilized over another.	PLTW-CIM			
Sample Performance Indicator 10.4.1	Identify the three categories of CIM systems.	PLTW-CIM			

Sample Performance Indicator 10.4.2	Identify the components of a FMS	PLTW-CIM			
Benchmark 10.5	Recognize process flow design has a major impact on overall production time and product profit.	PLTW-CIM			
Sample Performance Indicator 10.5.1	Identify the components of a FMS	PLTW-CIM			
Benchmark 10.6	Apply flowcharting to plan and depict the detailed process flow for an entire system and all of its subsystems.	PLTW-CIM	ELA.RST.11–12.7	LA.12.1.6.f	
Sample Performance Indicator 10.6.1	Create a process design chart for a manufacturing process.	PLTW-CIM			
Benchmark 10.7	Flowcharting can be used to illustrate the phases of the product development process.	PLTW-CIM			
Sample Performance Indicator 10.7.1	Create a process design chart for amanufacturing process.	PLTW-CIM			
Benchmark 10.8	Describe manufacturing and automation careers.	PLTW-CIM	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Sample Performance Indicator 10.8.1	Explore a manufacturing or automation career of interest and determine the appropriateness and steps required to be a professional in that role.	PLTW-CIM			
Standard 11	The student will understand manufacturing application.	PLTW-CIM			

Benchmark 11.1	Understand process flow design has a major impact on overall production time and product profit.	PLTW-CIM			
Sample Performance Indicator 11.1.1	Identify the potential safety issues with a CIM system and identify solutions for these problems.	PLTW-CIM			
Sample Performance Indicator 11.1.2	Refine each component to improve the total process flow and cycle time.	PLTW-CIM			
Benchmark 11.2	Apply flowcharting to plan and depict the detailed process flow for an entire system as well as all of its subsystems.	PLTW-CIM	ELA.RST.11–12.7	LA.12.1.6.f	
Sample Performance Indicator 11.2.1	Understand the significance of teamwork and communication.	PLTW-CIM			
Sample Performance Indicator 11.2.2	Refine each component to improve the total process flow and cycle time.	PLTW-CIM			
Benchmark 11.3	Flowcharting can be used to illustrate the overall phases of the product development process.	PLTW-CIM			
Sample Performance Indicator 11.3.1	Design a manufacturing system that contains at least two automated components.	PLTW-CIM			
Benchmark 11.4	Recognize safe operating procedures must be addressed in a CIM environment at all times to avoid serious injury.	PLTW-CIM	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performance Indicator 11.4.1	Identify the potential safety issues with a CIM system and identify solutions for these problems.	PLTW-CIM			

Sample Performance Indicator 11.4.2	Design a manufacturing system that contains at least two automated components.	PLTW-CIM			
Benchmark 11.5	Recognize tradeoffs occur between efficiency and cost when choosing a manufacturing system.	PLTW-CIM			
Sample Performance Indicator 11.5.1	Design a manufacturing system that contains at least two automated components.	PLTW-CIM			
Benchmark 11.6	Engineers choose appropriate sensors to ensure high quality part production.	PLTW-CIM			
Sample Performance Indicator 11.6.1	Complete the construction of each individual component of the miniature FMS and verify that each component works.	PLTW-CIM			
Sample Performance Indicator 11.6.2	Assemble components into a working miniature FMS.	PLTW-CIM			
Benchmark 11.7	Understand proper sequencing of automated operations is important in factory design.	PLTW-CIM			
Sample Performance Indicator 11.7.1	Complete the construction of each individual component of the miniature FMS and verify that each component works.	PLTW-CIM			
Sample Performance Indicator 11.7.2	Assemble components into a working miniature FMS.	PLTW-CIM			
Benchmark 11.8	Identify correct electrical and fluid power systems to complete a desired manufacturing system.	PLTW-CIM	ELA.RST.11-12.4	LA.12.1.5	
