Advanced Manufacturing II continues concepts learned from Advanced Manufacturing I. Domains include safety and impact, drafting principles, manufacturing programming, CAD/CAM and CNC technologies, automation and robotics, and careers in advanced manufacturing. Hands-on projects and team activities will allow students to apply learning on the latest industry technologies. Students continue this course with the goal of being a skilled machine operator, repair technician, or management at any company that produces goods and services using advanced manufacturing techniques. Work-based learning experiences and industry partnerships are highly encouraged for an authentic industry experience.

- DOE Code: 5606
- Recommended Grade Level: 12
- Required Prerequisites: Advanced Manufacturing I
- Credits: 2-3 credits, maximum of 6 credits Counts as a Directed Elective or Elective for all diploma types

Career and Technical Student Organizations (CTSOs)
Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in SkillsUSA, the trade and industry CTSO.

Content Standards
Domain 1 – Safety and Impact
Core Standard 1 – Students will demonstrate safe practices and procedures with tools, machines, and equipment.

- AMII-1.1 Monitor equipment operation and design parameters to determine if machine is operating safely
- AMII-1.2 Make adjustments to equipment to ensure that it is operating within established safety and environmental parameters
- AMII-1.3 Complete training and certification on relevant emergency and first-aid procedures
- AMII-1.4 Demonstrate appropriate use of personal protective equipment
- AMII-1.5 Select the best tool for the assigned job
- AMII-1.6 Identify corrective actions for conditions that present a threat to healthy, safety, or the environment as related to advanced manufacturing
Domain 2 - Impact and Trends
Core Standard 2 Students will analyze how advance manufacturing impacts national and global economies.

- AMII-2.1 Investigate how advanced manufacturing impacts individuals, society, and the environment
- AMII-2.2 Discuss new and emerging technologies related to advanced manufacturing
- AMII-2.3 Apply current and emerging computer technologies utilized in industry

Domain 3 – CNC Programming
Core Standard 3 Students evaluate the fundamentals of CNC programming to perform processes and procedures.

Standards
- AMII-3.1 Relate design information to manufacturing processes
- AMII-3.2 Compare and contrast incremental coordinates vs. absolute coordinates
- AMII-3.3 Determine positive and negative directions along axes
- AMII-3.4 Identify G codes used to determine the mode of tool movement
- AMII-3.5 Examine the function of four types of mill toolpaths: contour 2D, pocket, letters, drill
- AMII-3.6 Describe the function of six types of chaining methods
- AMII-3.7 Explain the importance of a program’s cycle time
- AMII-3.8 Describe the function of roughing cuts and finish passes
- AMII-3.9 Locate the edge of a part
- AMII-3.10 Calculate spindle speeds for machine tools
- AMII-3.11 Apply proper speed and feed rates for machine tools

Domain 4 – CAD/CAM & CNC Technologies
Core Standard 4 Students create a part using CAD, CAM, & CNC programming.

Standards
- AMII-4.1 Select appropriate annotation to document features within drawings using a scale
- AMII-4.2 Produce a CAD Drawing using computer software
- AMII-4.3 Interpret existing CAD files
- AMII-4.4 Investigate the difference between machine zero and program zero on a CNC machine tool
- AMII-4.5 Determine the work offsets and tool geometry offsets for a CNC program
- AMII-4.6 Create programs using absolute and incremental coordinate positions
- AMII-4.7 Compare and contrast Computer-Integrated Manufacturing and Flexible Manufacturing
- AMII-4.8 Demonstrate how part shapes are created using CAM software
- AMII-4.9 Develop two types of CNC programming languages: G&M codes, conversational
- AMII-4.10 Demonstrate program verification techniques
Domain 5—Programmable Logic Controllers
Core Standard 5 Students examine the role of programmable logic controllers in manufacturing processes.

Standards
AMII-5.1 Describe the common parts of programmable controllers
AMII-5.2 Program a start/stop circuit using a PLC
AMII-5.3 Interpret programming diagrams
AMII-5.4 Create programming diagrams for real-world applications
AMII-5.5 Apply timer and counter principles to industry-related problems
AMII-5.6 Setup and test PLC’s
AMII-5.7 Perform basic maintenance and troubleshooting with PLC’s
AMII-5.8 Differentiate between different types of path control systems
AMII-5.9 Describe the safety precautions associated with teach pendant operation
AMII-5.10 Design programs with a minimum of 4 axis manipulators
AMII-5.11 Explain the basic work cell with I/O
AMII-5.12 Identify the basics of the I/O electrical control
AMII-5.13 Demonstrate I/O testing procedures from the Editor Software
AMII-5.14 Categorize the types of sensors and explain their significance
AMII-5.15 Recognize requirements for an industrial controller
AMII-5.16 Differentiate microcontrollers from PC processors

Domain 6—Automation Theory
Core Standard 6 Students evaluate theories and principles utilized within the automation and robotics industry to assess modern trends in advanced manufacturing.

Standards
AMII-6.1 Develop machine order of operations
AMII-6.2 Examine computer logic and scanning sequence in automated controls
AMII-6.3 Convert relay logic into ladder logic diagrams
AMII-6.4 Explore the impact of cycle time and timing diagrams on manufacturing processes

Domain 7—Robotics
Core Standard 7 Students develop a working knowledge of robotics and robotic parts to classify their roles in manufacturing processes.

Standards
AMII-7.1 Define robot coordinate systems
AMII-7.2 Identify the various types of robots
AMII-7.3 Classify robots by their power systems, coordinate systems, and path systems
AMII-7.4 Compare and contrast the advantages and disadvantages of various robot types
AMII-7.5 Identify a robot's axes of motion and determine the importance of each articulation
AMII-7.6 Determine the total number of degrees of freedom needed for a robot to perform a specific job task
AMII-7.7 Apply basic knowledge of robot physics in manufacturing environments
AMII-7.8 Demonstrate correct design, programming, troubleshooting, and editing of robot programs
AMII-7.9 Solve mathematical problems related to machine control operations
AMII-7.10 Identify the various coordinate types of industrial robots, list the advantages and disadvantages of each, and recognize the work envelope of each
AMII-7.11 Identify various end effectors (end of arm tooling) used with robots
AMII-7.12 Select appropriate end effectors for a given job task
AMII-7.13 Develop criteria to determine where, how, and with what force an end effector should grasp a part
AMII-7.14 Describe specific hazards associated with robots and determine appropriate safety methods for working around robots
AMII-7.15 Measure a robot’s performance, such as speed, positioning accuracy, and repeatability, to determine if a robot meets the manufacturer’s specifications
AMII-7.16 Indicate the advantages and limitations of robots in industry
AMII-7.18 Program a robot using a teach pendant

Domain 8 – Automation
Core Standard 8 Students will explore the role of automation in industry.

Standards
AMII-8.1 Describe the hazards associated with automated machines
AMII-8.2 Determine appropriate safety methods for working around automated machinery
AMII-8.3 Critique the common types of factory automation
AMII-8.4 Examine the role of software controls in manufacturing
AMII-8.5 Demonstrate a basic understanding of structured programming software
AMII-8.6 Design software utilizing programing software
AMII-8.7 Define the roles of input and output devices within automation

Domain 9 – Employability Skills and Careers in Advanced Manufacturing
Core Standard 9 Students will explore careers related skills to enhance employability in advanced manufacturing.

AMII-9.1 Investigate careers in the advanced manufacturing pathway.
AMII-9.2 Analyze education and skill requirements for careers relating to advanced manufacturing.
AMII-9.3 Report the outlook, demand, and projected wages for careers related to advanced manufacturing.
AMII-9.4 Set team goals that are specific, measurable, and achievable
AMII-9.5 Align team goals with customer and business needs
AMII-9.6 Solve problems using critical and creative thinking skills