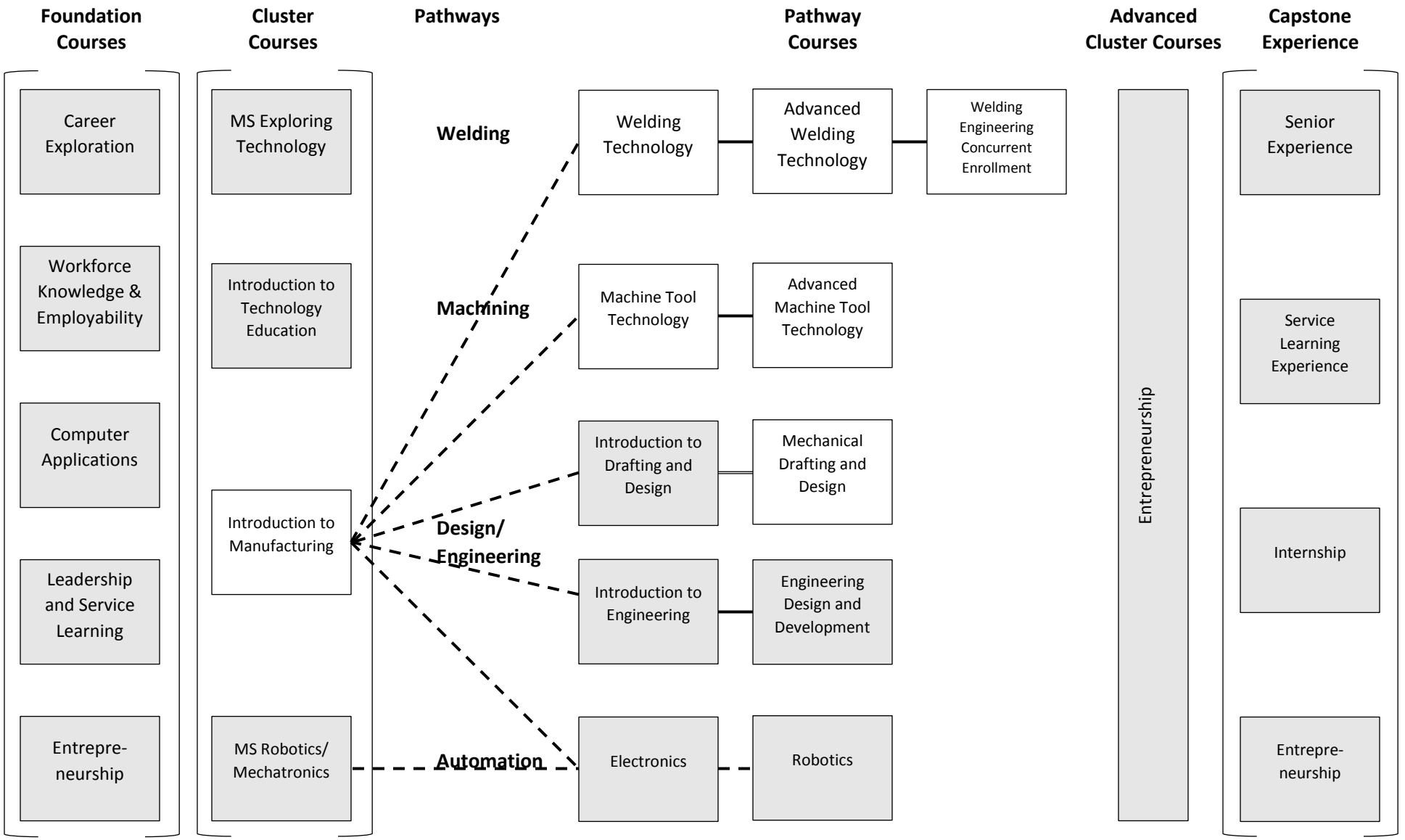
Manufacturing Programs of Study



Introduction to Manufacturing

Career Cluster	Manufacturing
Course Code	13002
Prerequisite(s)	None
Credit	.5 per semester
Graduation Requirement	
Program of Study and Sequence	Foundation courses – **Introduction to Manufacturing** – entry pathway course in any of four manufacturing pathways
Student Organization	Skills USA
Coordinating Work-Based Learning	Field trips or guest speakers
Industry Certifications	Options of OSHA 10, AWS SENSE Certification, or AWS Safety Certification
Dual Credit or Dual Enrollment	
Teacher Certification	
Resources	

Course Description:

Introduction to Manufacturing provides entry level exposure and career exploration in the manufacturing industry. This comprehensive course teaches students the various methods used to process and transform materials. Includes skills common to all manufacturing occupations such as reading working drawings, safety, hand and power tools, bonding casting, forming computer automations, LEAN manufacturing, soldering, metallurgy, and various welding processes. Students will learn the business and design process of manufacturing industry.

Planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.

Program of Study Application

Introduction to Manufacturing is a cluster course in the Manufacturing program of study. Upon completion of Introduction to Manufacturing, a student will be prepared to take an entry pathway course in any of the four manufacturing pathways: welding, machining, design/engineering, or automation.

Career Cluster: Manufacturing

Course: Introduction to Manufacturing

Course Standards

IM 1: Career exploration and development.

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	IM 1.1 Recognize the various career pathways/occupations that are available in manufacturing process/industry/business.	SD MyLife @ http://sdmylife.com/ Or other career exploring programs
Four Extended Thinking	IM 1.2 Design a career path for individual career interest in the manufacturing cluster.	Career Pathways • Welding • Machining • Design/Engineering • Automation

Notes

Career Cluster: Manufacturing

Course: Introduction to Manufacturing

IM 2: Plan, manage and perform the processing of materials into intermediate or final products and understand related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.

Webb Level	*Sub-indicator*	*Integrated Content*
Three Strategic Thinking	IM 2.1 Develop a business plan for manufacturing operations. Examples: Summarize how planning a budget is used in manufacturing and/or business. Identify the roles and functions of government in regulating and supporting manufacturing business	Writing a Business Plan South Dakota Business Help @ http://sdbusinesshelp.com/ South Dakota Manufacturing and Technology Solutions http://sdmanufacturing.com/
One Recall	IM 2.2 Explain trends and issues in the manufacturing industry. Examples: - SWOT analysis of various products and/or manufacturing companies. - Compare how social and economic changes have had an effect on business and various manufacturing processes. -Describe the cause and effect of risk management as it relates to a business or manufacturing process.	Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis
Three Strategic Thinking	IM 2.3 Demonstrate a management plan for the manufacturing process for the production of a product and/or business Example: Summarize how material controls are related to the production of products. Identify and apply accounting procedures.	LEAN Manufacturing Principles LEAN Manufacturing Principles @ http://www.sdmanufacturing.com/services/lean/

Notes

Career Cluster: Manufacturing

Course: Introduction to Manufacturing

IM 3: Implement manufacturing technology safety practices.

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	IM 3.1 Maintain general safety in accordance with government regulations, health standards, and company and/or school policy. Example: Identify state, federal and local worker safety, health and environmental regulations including correct use and storage of hazardous materials according to current safety standards.	American Welding Society- School Excelling through National Skills Standards Education- (AWS SENSE) Safety Certification @ http://awo.aws.org/sense/ AWS Safety Certification @ http://awo.aws.org/seminars/safety/ Occupational Safety and Health Administration OSHA10 @ http://www.careersafeonline.com/index.php/component/content/article/9-courses/36-osha-10-hour-construction-industry Safety Data Sheet (SDS)
Two Skill/Concept	IM 3.2 Evaluate ergonomic factors associated with the manufacturing industry.	

Notes

Career Cluster: Manufacturing

Course: Introduction to Manufacturing

IM 4: Apply ethical practices in the workplace as they relate to today's society.

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	IM 4.1 Identify and display professional practices in the workplace.	Student Handbook Classroom Rules Americn College Testing Program (ACT) KeyTrain Soft Skills Suite @ http://www.keytrain.com/softskills.asp

Notes

IM 5: Utilize the appropriate tools and equipment used in the manufacturing industry.

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	IM 5.1 Use basic tools and equipment common to the manufacturing processes.	

Notes

Career Cluster: Manufacturing

Course: Introduction to Manufacturing

IM 6: Differentiate among a variety of manufacturing industries.

Webb Level	*Sub-indicator*	*Integrated Content*
	IM 6.1: Research and understand basic concepts of the manufacturing career pathways. • Welding • Machining • Design/Engineering • Automation Examples: Describe: Electron theory and the related laws that apply. Basic hydraulic and pneumatic systems and the related laws that apply. Concepts and usage of robotics/automation. Welding procedures for various materials. Various material joining processes. Machining procedures for various materials/processes. Application of basic mechanical physics. How various materials (recyclable, ferrous/nonferrous, and synthetic) are produced and used. The impact of emerging technologies. Basic metallurgy and metal processing.	Standards from all Manufacturing courses. Resources for the Examples: • Ohm's/Watt's Law Video link- https://www.youtube.com/watch?v=CztiI0re5Eo • Coulomb's Law Video link- https://www.youtube.com/watch?v=gKKCcIzLHFU • DC Circuit Laws Video link- https://www.youtube.com/watch?v=u0ZIARKFQBU • Kirchoff's Law Video Link- https://www.youtube.com/watch?v=0gRtVz4XrZM • Voltage Divider Rule Video Link- https://www.youtube.com/watch?v=rIEnMpgIaU4 • Boyle's Law Video Link- https://www.youtube.com/watch?v=oiMMJJH8Phs • Bernoulli's principles Video Link- https://www.youtube.com/watch?v=8vqMotb6m3c • Newton's Laws of Motion and Forces Video Link- https://www.youtube.com/watch?v=NYVMlmL0BPQ

Notes

Career Cluster: Manufacturing

Course: Introduction to Manufacturing

IM 7: Design and create a product using the engineering design loop.

Webb Level	*Sub-indicator*	*Integrated Content*
Three Strategic Thinking	IM 6.1 Differentiate products/components in relationship to size, proportion and tolerances. Examples: Read and Sketch drawings Interpret working drawings and schematics. Design a working drawing and/or a schematic circuit	Standards in Manufacturing Courses ADDA Mechanical Drafting Standards Electronics/Robotics Standards
Three Strategic Thinking	IM 7.1 Develop a prototype of a product.	Engineering Design Process
Four Extended Thinking	IM 7.2 Test and evaluate a product.	Engineering Design Process
Three Strategic Thinking	IM 7.4 Redesign product for final production.	Engineering Design Process

Notes

Welding Technology

Career Cluster	Manufacturing
Course Code	13207
Prerequisite(s)	
Credit	½ to 1
Graduation Requirement	CTE
Program of Study and Sequence	Cluster Course – **Welding Technology** – Advanced Welding Technology
Student Organization	SkillsUSA
Coordinating Work-Based Learning	Manufacturing tours
Industry Certifications	AWS or OSHA 10
Dual Credit or Dual Enrollment	
Teacher Certification	
Resources	AWS, National Center for Construction Education (NCCER), and Industry

Course Description:

Welding Technology provides students with an understanding of manufacturing processes and systems common to careers in welding and related industries. Welding Technology is based on, but not limited to, American Welding Society (AWS) Guidelines for the Entry Level Welder.

Program of Study Application

Welding Technology is the first pathway course in the Manufacturing cluster, welding pathway. It follows a cluster course and is a prerequisite for the Advanced Welding course.

Course Standards

WT 1 Identify and understand welding safety.

Two Skill/Concept	WT 1.1 Identify and demonstrate proper industry safety standards. Examples: • Complete 10 hour Occupational Safety Health Administration (OSHA) certification • American Welding Society (AWS) Safety Certification • Identify some common hazards in welding • Explain and identify proper personal protections used in welding • Describe how to avoid welding fumes and the dangers associated with them • Identify and explain uses for material Safety Data Sheets (SDS) • Explain safety techniques for storing and handling cylinders • Describe proper material handling methods • Assume responsibilities under HazCom (Hazard Communication) regulations • Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed		

Notes:

WT 2 Read, comprehend, and communicate written and spoken technical terminology and instructions related to welding and welded assemblies

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	WT 2.1 Demonstrate mathematical skills related to work assignments. Examples: • Add, subtract, multiply, and divide whole numbers, fractions, mixed numbers, and decimals • Comprehend, demonstrate, and record measurements derived from using measuring devices • Analyze the functions of angles and parts of a circle • Construct parts using the principles of geometry	
One Recall	WT 2.2 Read and demonstrate understanding of welding terms and definitions from American National Standards Institute (ANSI)/American Welding Society (AWS) A3.0, *Standard Welding Terms and Definitions.* Examples: • Pronounce and use welding terms in conversation and in written work	

Notes

WT 3 Interpret drawings and welding symbol information.

Webb Level	*Sub-indicator*	*Integrated Content*
Three Strategic Thinking	WT 3.1 Read and sketch drawings. Examples: • Sketch parts and assign measurements to the sketch • Identify the six possible views of an object • Label height, width, and depth dimensions	
One Recall	WT 3.2 Identify basic weld symbols. Examples: • Understand basic weld symbols and their location significance within the weld symbol • Understand all supplementary weld symbols • Understand standard location of the elements of a weld symbol • Understand basic joint types	AWS A2.4 Weld symbols chart
One Recall	WT 3.3 Identify lines and joints. Examples: • Label objective, hidden, center, and break lines • Label butt, tee, lap, edge, and corner joints	

Notes

WT 4 Understand and Perform metal cutting operations.

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	WT 4.1 Identify and explain the use of oxyfuel and plasma cutting equipment. Examples: • Set up oxyfuel equipment • Light and adjust an oxyfuel torch • Shut down oxyfuel cutting equipment • Disassemble oxyfuel equipment • Change cylinders on oxyfuel equipment • Use a combination torch with welding, cutting and heating attachments • Properly set plasma cutting parameters • Identify parts of the plasma system torch: electrode, nozzle, contact tip, etc.	
Two Skill/Concept	WT 4.2 Prepare layouts for cutting individual parts. Examples: • Utilize rulers, straightedges, chalklines, scribes and other layout equipment to make a layout suitable for guiding a cutting operation • Use principles of algebra and geometry to assist in complex layout operations	
Two Skill/Concept	WT 4.3 Perform cuts using oxyfuel and plasma cutting processes. Examples: • Cut parts to specific dimensions • Cut shaped parts such as parts with radii and diameters • Cut beveled parts • Perform Piercing operations	

Notes

WT 5 Exhibit knowledge and perform base metal preparation.

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	WT 5.1 Prepare base metal for various welding processes. Examples: • Clean base metal for welding or cutting • Identify and explain joint design • Explain joint design considerations • Mechanically bevel the edge of a mild steel plate • Thermally bevel the end of a mild steel plate • Select the proper joint design based on a welding procedure specification (WPS) or instructor direction	

Notes

WT 6 Understand and Perform Shielded Metal Arc Welding (SMAW) process

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	WT 6.1 Identify and understand SMAW equipment and setup. Examples: • Identify and explain shielded metal arc welding (SMAW) safety • Explain welding electrical circuit • Identify welding power supplies and their characteristics • Explain how to set up welding power supplies • Set up a machine for welding • Understand the difference between Direct Current Electrode Positive (DCEP) and Direct Current Electrode Negative (DCEN)	
One Recall	WT 6.2 Define and understand the application for different Shielded Metal Arc (SMAW) electrodes. Examples: • Identify electrodes using the AWS specifications • Identify factors that affect electrode selection • Identify different types of filler metals • Explain the storage and control of filler metals • Identify and select the proper electrode for a specific welding task	
Two Skill/Concept	WT 6.3 Demonstrate knowledge of Shielded Metal Arc Welding (SMAW) process. Examples: • Demonstrate fillet welds in one or more positions. (Flat, horizontal (1F, 2F)) • Demonstrate grove welds in one or more positions (Flat, horizontal (1G, 2G)) • Complete a test plate in one or more positions	

Notes

WT 7 Identify and demonstrate knowledge of quality control of the welding process.

Webb Level	*Sub-indicator*	*Integrated Content*
Three Strategic Thinking	WT 7.1 Demonstrate knowledge of weld quality Examples: • Identify and explain codes governing welding • Identify and explain weld imperfections and their causes • Identify and explain nondestructive examination practices • Identify and explain welder qualification tests • Explain the importance of quality workmanship • Identify common destructive testing methods • Perform visual inspection of fillet welds	Acceptance per AWS D1.1 Table 6.1 for 7ga and thicker and AWS D1.3 Table 6.1 for all thinner steel materials.

Notes

WT 8 Participate in career exploration activities

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	WT 8.1 Research career opportunities in manufacturing/welding fields. Examples: • Utilize career exploration software • Research and write a report on career opportunities in the manufacturing field • Utilize the career exploration software to research educational requirements for a chosen career path • Utilize career exploration software, update a student portfolio • Invite local industry experts to speak in the classroom	SD MyLife

Notes

WT 9 Practice ethical work behaviors

Webb Level	***Sub-indicator***	***Integrated Content***
One **Recall**	WT 9.1 Students will follow the following required ethical practices of Manufacturing Industry: • Complete assignments efficiently and on time • Be aware of the importance of attendance • Utilize principles of time management • Present a positive attitude • Work well with peers/supervisor • Be prepared for work assignments	Student handbook and student contract [Lean manufacturing website]

Notes:

Advanced Welding Technology

Career Cluster	Manufacturing
Course Code	13208
Prerequisite(s)	Welding Technology
Credit	½ credit or 1 credit
Graduation Requirement	No
Program of Study and Sequence	Welding Technology – **Advanced Welding Technology** – Welding Engineering or Capstone Experience
Student Organization	Skills USA
Coordinating Work-Based Learning	Manufacturing tours, internships
Industry Certifications	AWS, OSHA 10
Dual Credit or Dual Enrollment	
Teacher Certification	
Resources	AWS, NCCER, and Industry

Course Description:

Advanced Welding provides students with opportunities to effectively perform cutting and welding applications of increasing complexity used in the advanced manufacturing industry. Proficient students will build on the knowledge and skills of the Welding Technology course while learning additional welding techniques not covered in previous courses. Specifically, students will be proficient in fundamental safety practices in welding, gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), shielded metal arc welding (SMAW), and quality control methods. Upon completion of the Advanced Welding Technology course, proficient students will be prepared to complete the American Welding Society (AWS) Entry Welder qualification and certification.

Program of Study Application

Advanced Welding Technology is the second pathway course in the Manufacturing cluster, welding pathway. Welding Technology is a prerequisite for this course. The course may be followed by further dual-enrollment studies or a capstone experience.

Career Cluster: Manufacturing

Course: Advanced Welding Technology

Course Standards

AWT 1 Identify and conform to basic welding safety standards

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	AWT 1.1 Identify and practice the proper industry safety standards. Examples: • Complete 10 hour OSHA (Occupational Safety Health Administration) certification • American Welding Society Certification	Link http://awo.aws.org/seminars/safety/

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 2 Interpret, layout, and fabricate in conformance to fabrication drawings

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	AWT 2.1 Correctly interpret dimensions and locations of components in fabrication drawings. Examples: • Make a bill of materials to construct and fabricate in accordance to drawing specifications • Lay out structural and other components and their locations to dimensions and tolerances indicated on construction and fabrication drawing.	
Two Skill/Concept	AWT 2.2 Correctly scale dimensions in fabrication drawings. Examples: • Use the scale of a drawing to determine locations not explicitly dimensioned • Use the scale of drawing to determine dimension not explicitly shown on the drawing	
Two Skill/Concept	AWT 2.3 Correctly interpret orthographic and pictorial plan views shown in fabrication drawings. Examples: • Interpret two and three-dimensional features found in construction and fabrication drawing	
Two Skill/Concept	AWT 2.4 Recognize and correctly interpret lines and symbols commonly used in fabrication drawings. Examples: • Identify and explain a welding detail drawing • Identify and explain line types • Interpret welding symbols to determine type, geometry, process, extent, and required testing of welds	

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 3 Exhibit knowledge and perform base metal preparation.

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	AWT 3.1 Prepare base metal for various welding processes. Examples: • Safely use stationary and hand-held grinders • Clean base metal for welding and cutting • Identify and explain joint design • Explain joint design considerations • Mechanically and thermally bevel the end of mild steel	AWS D1.1 Section 7.4.3

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 4 Understand and perform Gas Metal Arc Welding (GMAW) process

Webb Level	Sub Indicator	Integrated content
Two Skill/Concept	AWT 4.1 Identify and understand GMAW equipment and setup. Examples: • Explain gas metal arc welding (GMAW) safety • Explain the characteristic of welding current and power sources • Demonstrate knowledge of GMAW equipment • Set up GMAW equipment • Identify tools for weld cleaning	
Two Skill/Concept	AWT 4.2 Demonstrate Gas Metal Arc Welding (GMAW) on steel. Examples: • Demonstrate fillet welds in one or more positions • Demonstrate groove welds in one or more positions • Complete a test plate in the flat weld position	AWS D1.1 Table 6.1 AWS D1.3 6.1

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 5 Understand and perform Gas Tungsten Arc Welding (GTAW) process

Webb Level	Sub Indicator	Integrated Content
Two Skill/Concept	AWT 5.1 Understand GTAW equipment and filler metals. Examples: • Explain and demonstrate GTAW safety • Identify and explain the function of GTAW equipment, filler metals, and shielding gases • Set up GTAW equipment	
Two Skill/Concept	AWT 5.2 Demonstrate Gas Tungsten Arc Welding (GTAW) process on Steel. Examples: • Demonstrate fillet welds in one or more positions • Demonstrate groove welds in one or more positions • Complete a test plate in the flat weld position	AWS D1.1 Table 6.1 AWS D1.3 6.1

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 6 Understand and perform Shielded Metal Arc Welding (SMAW) process

Webb Level	Sub Indicator	Integrated Content
Two Skill/Concept	AWT 6.1 Understand SMAW equipment and filler metals. Examples: • Explain arc welding (SMAW) safety • Identify and explain the function of SMAW equipment • Identify and explain the function of SMAW filler metals • Set up SMAW equipment	
Two Skill/Concept	AWT 6.2 Demonstrate knowledge of the Shielded Metal Arc Welding (SMAW) process. Examples: • Demonstrate fillet welds in one or more positions • Demonstrate groove welds in one or more positions • Complete a welder qualification test record	AWS D1.1 Table 6.1 AWS D1.3 6.1 AWS D1.1 Figure 4.37 & Figure 4.31 AWS D1.3 Figure 4.2A

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 7 Understand and perform Carbon Arc cutting and gouging process

Webb Level	Sub Indicator	Integrated Content
Two Skill/Concept	AWT 7.1 Understand carbon arc equipment. Examples: • Explain carbon arc safety • Identify and explain the function of carbon arc equipment • Identify and explain the function of carbon arc cutting and filler removal • Set up carbon arc equipment	
Two Skill/Concept	AWT 7.2 Demonstrate Carbon Arc cutting process. Examples: • Demonstrate removal of filler metal • Demonstrate the cutting of base metals	

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 8 Identify and demonstrate knowledge of quality control of the welding process including visual and destructive testing.

Webb Level	Sub Indicator	Integrated Content
Three Strategic Thinking	AWT 8.1 Demonstrate knowledge of weld quality Examples: • Explain codes governing welding • Explain weld imperfections and their causes • Explain nondestructive examination practices • Explain welder qualification tests • Explain the importance of quality workmanship • Identify common destructive testing methods • Perform visual inspection of fillet welds	AWS D1.1 Table 6.1 Visual Inspection Acceptance Criteria AWS D1.3 6.1 Visual Inspection Acceptance Criteria

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 9 Participate in career exploration activities

Webb Level	Sub Indicator	Integrated Content
Two Skill/Concept	AWT 9.1 Research career opportunities in the welding pathways. Examples: • Utilizing career exploration software research and write a report on career opportunities in the manufacturing fields • Utilizing career exploration software research educational requirements for a chosen career path • Utilizing career exploration software, update a student's portfolio	SDMyLife.com

Notes:

Career Cluster: Manufacturing

Course: Advanced Welding Technology

AWT 10 Demonstrate ethical work behaviors.

Webb Level	Sub Indicator	Integrated Content
One Recall	AWT 10.1 Follow the following required ethical practices of Manufacturing Industry: • Complete assignments efficiently and on time • Be aware of the importance of attendance • Utilize principles of time management • Present a positive attitude • Work well with peers/supervisor • Be prepared for work assignments	Student handbook and student contract Lean manufacturing

Notes:

Machine Tool Technology

Career Cluster	Manufacturing
Course Code	13203
Prerequisite(s)	Algebra 1 Recommended
Credit	TBD
Graduation Requirement	No
Program of Study and Sequence	Manufacturing Cluster Course – **Machine Tool Technology** – Advanced Machine Tool Technology
Student Organization	Skills USA
Coordinating Work-Based Learning	Field trips
Industry Certifications	National Institute for Metalworking Skills (NIMS)
Dual Credit or Dual Enrollment	Articulated credit available
Teacher Certification	
Resources	

Course Description:

Machine Tool Technology students will be exposed to basic machining processes, safety, math skills, and machining operations. The desire is for the student to succeed at a basic level through fabrication of various required projects.

Program of Study Application

Machine Tool Technology is a pathway course in the Manufacturing cluster Machining pathway. This course follows a cluster course and is a prerequisite for Advanced Machine Tool Technology.

Career Cluster: Manufacturing

Course: Machine Tool Technology

Course Standards

MT 1 Demonstrate knowledge of safety and essential academic concepts in Machine Tool

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	MT 1.1 Explain and show knowledge of machine shop operations and tool safety procedures consistent with Occupational Safety and Health Administration (OSHA) standards	Suggested: • Introduction of Personal Protective Equipment (PPE) and uses. • Identify hazards present in the machine shop. • Test knowledge of safety practices used in the shop. • Identify and recall basic parts to machines • Introduction to Occupational Safety & Health Administration (OSHA)
Two Skill/Concept	MT 1.2 Introduce concepts of basic mathematics, blueprint reading, science, and communications used in machine tool processes.	Suggested: • Ability to read tape measures, steel rules fractions, and decimals. • Calculate basic machine tool formulas related to various machining projects. • Identify characteristics of various materials used. • Identify and differentiate line types, tolerances and views of blueprints

Career Cluster: Manufacturing

Course: Machine Tool Technology

One Recall	MT 1.3 Understand basic CNC programming and processes.	Suggested: • Introduction thru use of u-tube or other video presentation. • Use of online resources such as simulation software. • Identify thru use of Industry tours and featured speakers

Notes

Career Cluster: Manufacturing

Course: Machine Tool Technology

MT 2 Show proper machine use and functions, utilizing problem solving skills to resolve machining issues

Webb Level	*Sub-indicator*	*Integrated Content*
Level 3 Strategic Thinking	MT 2.1 Demonstrate knowledge of terminology, tools, methods of measurement, and material layout.	Suggested: • Identify basic machine shop terminology. • Demonstrate use and care of tools and measuring equipment used in the shop. • Show ability to measure and document parts consistently. • Demonstrate proper layout methods using blueprints or working drawings
Two Skill/Concept	MT 2.2 Demonstrate problem solving skills in basic lathe and milling setups and operations.	Suggested: • Through completion of required parts. • Familiarity of equipment used. • Show ability to set up and run lathe and milling machines to do basic machining operations.

Notes

Career Cluster: Manufacturing

Course: Machine Tool Technology

MT 3 Apply proper ethical standards to machining skills and processes

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	MT 3.1 Identify and demonstrate professional practices used in the machine shop	Suggested: • Student handbook. • Local instructor rules. • http://www.aprahome.org/p/cm/ld/fid=110

Notes

MT 4 Explore Careers in the Manufacturing cluster

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	MT 4.1 Identify machine tool related career pathways.	Suggested: • Through use of industry tours. • Using featured speakers • Through post-secondary involvement. • Introduction thru use of u-tube or other video presentation.

Notes

Advanced Machine Tool Technology

Career Cluster	Manufacturing
Course Code	
Prerequisite(s)	Algebra 1/Machine Tool Technology
Credit	
Graduation Requirement	No
Program of Study and Sequence	Cluster course – Machine Tool Technology – **Advanced Machine Tool Technology** – Capstone Experience
Student Organization	Skills USA
Coordinating Work-Based Learning	Field trips/ Speakers
Industry Certifications	National Institute for Metalworking Skills (NIMS)
Dual Credit or Dual Enrollment	Articulated credit available
Teacher Certification	
Resources	OSHA/NIMS

Course Description:

Advanced Machine Tool Technology students will be introduced to advanced machining processes in the areas of safety, applied math skills and machining operations. The desire is for the student to use basic learned techniques from machine tool technology to obtain higher levels of competency through creation of projects to emulate industry needs.

Program of Study Application

Advanced Machine Tool Technology is the second pathway course in the Manufacturing cluster, Machining pathway. Machine tool technology is a prerequisite to the Advanced Machining course.

Course Standards

AMT 1 Demonstrate knowledge of safety and essential academic concepts in machine tool.

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	AMT 1.1 Prove knowledge of shop operations and tool safety procedures consistent with Occupational Safety and Health Administration (OSHA) standards.	Suggested: • Demonstrate use of Personal Protective Equipment (PPE). • Identify hazards present in the machine shop. • Test knowledge of safety practices used in the shop. • Identify and recall basic parts to machines • Occupational Safety and Health Administration (OSHA)/Lock out-Tag out/ Safety Data Sheets (SDS)
Two Skill/Concept	AMT 1.2 Apply advanced concepts, including machine tool mathematics, blueprint reading, science, and communications to machine tool processes.	Suggested: • Ability to apply higher level measuring skills. • Calculate machine tool formulas related to various tools and materials. • Distinguish the differences of various materials used. • Ability to produce finished products using working drawings and practices

Two Skill/Concept	AMT 1.3 Demonstrate and apply computer numerical control (CNC) programming concepts	Suggested: • Instruction thru use of U-tube or other video presentation. • Use of simulation or other software. • Apply concepts for completion of part. • Identify through use of industry tours and featured speakers.

Notes

AMT 2 Demonstrate ability through research, development, and implementation to create a project

Webb Level	*Sub-indicator*	*Integrated Content*
Three Strategic Thinking	AMT 2.1 Design, analyze and create various types of projects utilizing previous knowledge and skills to manufacture a single or assembled project.	Suggested: • Research appropriate project ideas to present for approval. • Identify material needs to complete project. • Create or modify drawings in preparation for manufacturing process. • Analyze the manufacturability of the researched part or product.
Three Strategic Thinking	AMT 2.2 Evaluate and solve issues related to lathe and milling setups and operations.	Suggested: • Through completion of required parts. • Show ability to identify and correct problems related to machining operations on project at hand.

Notes

AMT 3 Demonstrate ethical practices and research career pathways

Webb Level	*Sub-indicator*	*Integrated Content*
Three Strategic Thinking	AMT 3.1 Identify and demonstrate professional practices used in the machine shop	Suggested: • Student handbook. • Local instructor rules. • http://www.aprahome.org/p/cm/ld/fid=110
Four Extended Thinking	AMT 3.2 Evaluate and describe career exploration activities to follow for a minimum of two different career pathways.	Suggested: • Through use of industry tours. • Using featured speakers • Through post-secondary involvement. • Introduction thru use of u-tube or other video presentation. • Internship/job shadowing • Analyze data and develop a report for chosen pathways

Notes

Mechanical Drafting and Design

Career Cluster	Manufacturing
Course Code	21106
Prerequisite(s)	Introduction to Drafting and Design course 21102
Credit	1
Graduation Requirement	
Program of Study and Sequence	Introduction of Drafting and Design – **Mechanical Drafting and Design** – Capstone Experience
Student Organization	Skills USA
Coordinating Work-Based Learning	Field trips, youth internships
Industry Certifications	ADDA Mechanical Apprentice certification
Dual Credit or Dual Enrollment	
Teacher Certification	
Resources	

Course Description:

People with careers in design and pre-construction create our future. They turn a concept into a set of plans whether it's a component, a system, or a building. Their plans guide other construction or manufacturing professionals as they continue the building process. Mechanical Drafting and Design will expose students to the American Design Drafting Association (ADDA) Apprentice standards in mechanical drafting and then the students will be given the option to take the ADDA Apprentice drafting test.

Program of Study Application

This is the second pathway course in the Manufacturing cluster, Design and Engineering pathway. Introduction to Drafting and Design Course number 21102 is a prerequisite for this course. The course would be followed by a capstone experience.

Career Cluster: Manufacturing

Course: Mechanical Drafting and Design

Course Standards

MDD 1 Demonstrate the use of geometric construction

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	MDD 1.1 Apply geometric design and descriptive geometry to the design process. • Demonstrate accuracy when producing a geometric drawing • Draw elements that are accurate and to scale • Use geometric construction techniques	ADDA Apprentice Mechanical #6
Three Strategic Thinking	MDD 1.2 Demonstrate basic geometric dimensioning and tolerancing (GD&T). • Geometric symbols and terms related to geometric dimension and tolerancing (GD&T) • Describe the normal size, tolerance, limits, and allowance of two mating parts • Dimension two mating parts using limit dimension, unilateral tolerances and bilateral tolerances • Draw and place feature control symbols and datum references on a drawing	ADDA Apprentice Drafting Competency Mechanical #12

Notes:

Career Cluster: Manufacturing

Course: Mechanical Drafting and Design

MDD 2: Prepare mechanical drawings.

Webb Level	*Sub-indicator*	*Integrated Content*
3 -strategic thinking	MDD 2.1 Create a multi-view drawing. • Draw an orthographic projection with proper top, front and side views • Properly align views	ADDA Apprentice Drafting Competency Mechanical #7
Three Strategic Thinking	MDD 2.2 Create sectional views of a mechanical drawing. • Complete a technical drawing using standard sectional views such as full, half, offset, broken-out, removed, & revolved	ADDA Apprentice Drafting Competency Mechanical #8
Three Strategic Thinking	MDD 2.3 Develop auxiliary views of mechanical drawings. • Create a primary auxiliary view from any orthographic projection • Draw folding lines or reference plane lines between any two adjacent views • Construct depth, height, or width auxiliary views • Construct partial auxiliary views • Create auxiliary sectional views • Find true lengths of an oblique line by constructing an auxiliary view • Create secondary auxiliary views	ADDA Apprentice Drafting Competency Mechanical #9
Three Strategic Thinking	MDD 2.4 Generate pictorial drawings. • Identify plane surfaces on isometric boxes • Construct an isometric view in the center of a drawing space • Identify the views of perspectives • Construct a drawing to the appropriate size and scale • Construct a one- & two point perspective	ADDA Apprentice Drafting Competency Mechanical #10
Two Skill/Concept	MDD 2.5 Examine drawing identification and management techniques used in mechanical drafting. • Apply necessary notes, material specifications, symbols, and other data to a drawing • Complete an assembly drawing showing the relationships the parts have to each other • Create a title block and border on each production drawing sheet	ADDA Apprentice Drafting Competency Mechanical #14

Notes

Career Cluster: Manufacturing

Course: Mechanical Drafting and Design

MDD 3: Understand the design for manufacturing and assembly.

Webb Level	*Sub-indicator*	*Integrated Content*
One Recall	MDD 3.1 Analyze different manufacturing processes. • Identify various types of machined holes	
One Recall	MDD 3.2 Identify basic welding symbols used in manufacturing design process. • Draw basic weld symbols • Create detail drawings for a welded part • Indicate welding process on a drawing	ADDA Apprentice Drafting Competency Mechanical #11

Notes

MDD 4: Explore careers in drafting fields.

Webb Level	*Sub-indicator*	*Integrated Content*
Two Skill/Concept	MDD 4.1 Define/compare career pathways in drafting • Industry tours specifically in drafting businesses • Conduct career matcher quiz on sdmylife.com research drafting careers • Power point presentation on one career in drafting	SDMyLife.com

Notes: