# Scope & Sequence

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| Course Name: Metal Fabrication and Machining I**TSDS PEIMS Code:** 13032700 | **Course Credit:** 2.0**Course Requirements:** This course is recommended for students in grades 10-12. **Prerequisites:** None.**Recommended Prerequisites:** Algebra I or Geometry. |
| **Course Description:** Metal Fabrication and Machining I provides the knowledge, skills, and certifications required for equal employment opportunities in the metal production industry. Students must have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. |
| **NOTE:** This is a suggested scope and sequence for the course content. This content will work with any textbook or instructional materials. If locally adapted, make sure all TEKS are covered. |
| **Total Number of Periods****Total Number of Minutes****Total Number of Hours** | 350 Periods15,750 Minutes262.5 Hours\* | \*Schedule calculations based on 175/180 calendar days. For 0.5 credit courses, schedule is calculated out of 88/90 days. Scope and sequence allows additional time for guest speakers, student presentations, field trips, remediation, extended learning activities, etc. |
| **Unit Number, Title, and Brief Description** | **# of Class Periods\***(assumes 45-minute periods)Total minutes per unit | **TEKS Covered****130.357 Knowledge and skills** |
| **Unit 1: Overview of Metal Fabrication and Machining**This unit is designed to acquaint students with the three major technical occupations -welding, sheet metal, and machining. Students will research, describe, and examine the history of the machining, welding, and sheet metal trade by utilizing technology, collaboration, and other sources. | 35 Periods1,350 Minutes | 3. The student differentiates the technical concepts that form the knowledge and skills of metal manufacturing. The student is expected to:(B) examine the theory of shielded metal arc welding and gas metal arc welding; and(C) examine the sheet metal industry |
| **Unit 2: Academic Knowledge and Skills for Manufacturing**This unit will include lessons on terminology and skills that are associated with mathematics and science knowledge specifically pertaining to welding. Students will focus on understanding, interpreting, analyzing and knowing how to correctly use units of measure, mathematics concepts, and science principles in order to solve problems.  | 40 Periods1,800 Minutes | 2. The student applies academic skills to the requirements of metal manufacturing. The student is expected to:(B) interpret engineering drawings, charts, diagrams, and welding symbols; and(C) select algebraic and geometric principles and formulas required for precision measuring operations 3. The student differentiates the technical concepts that form the knowledge and skills of metal manufacturing. The student is expected to:(A) analyze the resources found in *The Machinery's Handbook* as well as the specifications and codes written by the American Welding Society (AWS), Canadian Welding Bureau (CWB), American National Standards Institute (ANSI), and American Petroleum Institute (API)7. The student applies the technical concepts and skills of the sheet metal industry to simulate actual work situations. The student is expected to:(A) use mathematics in precision measuring operations; and(B) interpret, engineering drawings, charts, and diagrams as related to the sheet metal industry |
| **Unit 3: Workplace Regulations, Safety & Compliance**This unit will expose students to the important regulations and safety standards that are implemented within this industry. Students will learn that such practices are in place to manage resources to minimize losses and liabilities to businesses in the industry. During this unit students will acquire and apply basic knowledge of using and maintaining professional welding equipment and sheet metal materials. Students will identify materials and resources commonly used and recycled in welding and sheet metal. Students will demonstrate the proper use and care of Personal Protection Equipment (PPE) used in machining, sheet metal, and welding. | 40 Periods1,800 Minutes | 9. The student understands the function and application of the tools, equipment, technologies, and materials used in sheet metal manufacturing. The student is expected to:(A) practice safe use of equipment; and(B) dispose of hazardous materials used in sheet metal manufacturing4. The student differentiates the function and application of the tools, equipment, technologies, and materials used in metal manufacturing. The student is expected to:(B) dispose of environmentally hazardous materials used in metal manufacturing. |
| **Unit 4: Tools, Equipment, Technology, and Materials**During this unit, students will learn about the types of technology integrated into the metal fabrication and machining industry. Students will understand how computerized systems increase businesses’ effectiveness and completing workplace tasks with accuracy and efficiency. Students will identify and describe trends in the use of emerging technology in the welding industry, including the use of automated welding machines such as numerical control, computer numerical control, and robotics-controlled machines. | 35 Periods1,350 Minutes | 3. The student differentiates the technical concepts that form the knowledge and skills of metal manufacturing. The student is expected to:(D) examine the nomenclature of abrasive wheels4. The student differentiates the function and application of the tools, equipment, technologies, and materials used in metal manufacturing. The student is expected to:(A) use hand and power tools and equipment commonly employed in metal manufacturing5. The student applies the technical concepts and skills of the machining industry to simulated and actual work situations. The student is expected to:(A) use various work mounting procedures on all appropriate machines; and(B) operate machine tools such as drill press, lathe, saw, grinders, and milling machines  |
| **Unit 5: Machine Processes & Procedures**Students will identify and explain the parts of an engine lathe and milling machine. Students will perform necessary operations in order to use a lathe and mill. Students will demonstrate lathe procedures such as cutting threads, turing tapers, drilling, reaming, polishing, knurling and boring. Students will demonstrate milling procedures such as milling flat surfaces, bevels, chamfers, grooves, and key-way seats. | 40 Periods1,800 Minutes | 5. The student applies the technical concepts and skills of the machining industry to simulated and actual work situations. The student is expected to:(C) execute lathe procedures such as cutting threads, turning tapers, drilling, reaming, polishing, knurling, and boring; and(D) execute milling procedures such as milling flat surfaces, bevels, chamfers, grooves, and key-way seats needed to machine precision pieces |
| **Unit 6: Welding and Cutting Processes**Students will be able to identify and explain oxy-fuel and plasma arc cutting. Students will demonstrate the safe setting up and disassembly process of oxy-fuel, plasma arc, propane, propylene, and Chemtane 2® equipment. Students will demonstrate lighting, adjusting, and making cuts including straight, bevel, and hole piercing. Students will be able to identify and understand some common hazards in welding and cutting. Students will identify and use welding symbols and read detailed drawings; sketches will include basic welding symbols for fillet, groove, spot, plug, flanged, and other basic welds. Students will demonstrate the use of elements within a detailed drawing and interpret welding symbols from a detailed drawing. Additionally, students will be able to identify and use the basic weld types, weld joints, and weld positions. | 45 Periods2,025 Minutes | 6. The student applies the technical concepts and skills of the welding industry to simulated and actual work situations. The student is expected to:(A) perform cutting processes such as straight cuts, bevel cuts, and hole piercing with oxy-fuel and plasma;(B) use the common types of electrodes with the shield metal arc welding process;(C) practice using gas metal arc welding to weld in multiple positions to produce groove and fillet welds; and(D) inspect groove and fillet welds to AWS, CWB, ANSI, and API codes8. The student differentiates the concepts that form the technical knowledge and skills of sheet metal manufacturing. The student is expected to:(B) analyze the fundamentals of oxy-fuel processes as related to sheet metal; and(C) analyze the fundamentals of shielded metal arc welding and gas metal arc welding as related to sheet metal under various AWS codes |
| **Unit 7: Metallurgy**Students will learn that metallurgy is the study of the properties and characteristics of metals. In this unit students will explore the cause and effects of oxidation on metal, what types of metal are best used for products based on functionality and quality. Students will demonstrate the ability to identify and measure different types of metals used in sheet metal. Students will identify and demonstrate using various metals in sheet metal, including alloys and pure metals and their properties. | 30 Periods1,350 Minutes | 7. The student applies the technical concepts and skills of the sheet metal industry to simulate actual work situations. The student is expected to:(B) interpret, engineering drawings, charts, and diagrams as related to the sheet metal industry8. The student differentiates the concepts that form the technical knowledge and skills of sheet metal manufacturing. The student is expected to:(A) analyze the types, sizes, and properties of sheet metal materials |
| **Unit 8: Sheet Metal Manufacturing**Students will understand the edges and seams created with sheet metal have several purposes - to improve the appearance of finished products to strengthen the work piece, to fasten pieces of metal together. Students will be able to identify common sheet metal seams. Students will construct the common seams used in sheet metal development.  | 45 Periods2,025 Minutes | 10. The student applies the knowledge and skills of sheet metal manufacturing in simulated and actual work situations. The student is expected to:(A) draw simple metal layouts; and(B) construct common sheet metal seams |
| **Unit 9: Employability Skills**This unit explores the professional standards and employability skills required by business and industry. Students will grow to understand that responsibility, time management, organization, positive attitude, and good character have a large impact on employability and job retention. Students will understand the professional ethics legal responsibilities pertaining to the welding industry. This unit will help students better understand the various career opportunities within the welding industry. Students will develop a career plan designed to achieve their career goals within this industry. This unit will help students better understand the various career opportunities within the welding industry. Students will focus on expanding their knowledge about the education, training, and/or certification required to obtain employment in the industry. Students will develop a career plan designed to achieve their career goals within this industry. | 40 Periods1,800 Minutes | 1. The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:(A) demonstrate skills related to health and safety in the workplace as specified by appropriate governmental regulations;(B) use teamwork to solve problems; and(C) demonstrate the standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, positive attitude, and integrity in a work situation2. The student applies academic skills to the requirements of metal manufacturing. The student is expected to:(A) demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers |