# Scope & Sequence

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| Course Name: Metal Fabrication and Machining II **TSDS PEIMS Code:** 13032800 | | | **Course Credit:** 2.0  **Course Requirements:** This course is recommended for students in grades 11-12.  **Prerequisites:** Metal Fabrication and Machining I.  **Recommended Prerequisites:** Algebra II or Geometry. |
| **Course Description:** Metal Fabrication and Machining II builds on the knowledge, skills, and certifications students acquire in Metal Fabrication and Machining I. Students will develop advanced concepts and skills as related to personal and career development. This course integrates academic and technical knowledge and skills. Students will 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 Periods  15,750 Minutes  262.5 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 Periods  1,350 Minutes | 4. The student knows the advanced concepts that form the technical knowledge and skills of metal fabrication and machining. The student is expected to:  (B) demonstrate knowledge of the various welding processes; 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. | 35 Periods  1,350 Minutes | 3. The student applies advanced academic skills to the requirements of metal fabrication and machining. The student is expected to:  (C) estimate labor costs using various algebraic formulas;  (D) interpret advanced engineering drawings, charts, diagrams, and welding symbols; and  (E) demonstrate calculation of precision measuring operations using algebra, geometry, and trigonometry  4. The student knows the advanced concepts that form the technical knowledge and skills of metal fabrication and machining. The student is expected to:  (A) analyze the resources found in various manufacturing reference materials  8. The student applies the advanced concepts and technical knowledge and skills of the sheet metal industry to simulated and actual work situations. The student is expected to:  (B) use advanced mathematics in precision measuring operations | |
| **Unit 3: Planning and Layout Operations**  Students will convert blueprints into shop drawings, determining project requirements, developing and completing layout patterns, layout, measurement, marking dimensions and referencing lines on materials. Students will also include the safe and proper use of layout tools when used for sheet metal and machine tool operations. | 35 Periods  1,350 Minutes | 3. The student applies advanced academic skills to the requirements of metal fabrication and machining. The student is expected to:  (C) estimate labor costs using various algebraic formulas; and  (D) interpret advanced engineering drawings, charts, diagrams, and welding symbols  8. The student applies the advanced concepts and technical knowledge and skills of the sheet metal industry to simulated and actual work situations. The student is expected to:  (C) interpret industrial standard blueprints, drawings, charts, and diagrams  11. The student applies the advanced concepts and technical skills in simulated and actual work situations. The student is expected to:  (A) draw advanced sheet metal layouts | |
| **Unit 4: 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. | 35 Periods  1,350 Minutes | 1. The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:  (F) demonstrate skills related to health and safety in the workplace as specified by the Occupational Safety and Health Administration and other appropriate agencies  5. The student knows the function and application of the tools, equipment, technologies, and materials used in metal fabrication and machining. The student is expected to:  (E) dispose of environmentally hazardous materials associated with and used in metal fabrication manufacturing  8. The student applies the advanced concepts and technical knowledge and skills of the sheet metal industry to simulated and actual work situations. The student is expected to:  (A) estimate labor costs  10. The student knows the function and application of the tools, equipment, technologies, and materials used in sheet metal. The student is expected to:  (A) use equipment commonly employed in sheet metal safely; and  (B) dispose of environmentally hazardous materials used in sheet metal manufacturing properly | |
| **Unit 5: 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 Periods  1,350 Minutes | 4. The student knows the advanced concepts that form the technical knowledge and skills of metal fabrication and machining. The student is expected to:  (D) examine the advanced use of abrasives  5. The student knows the function and application of the tools, equipment, technologies, and materials used in metal fabrication and machining. The student is expected to:  (A) operate various welding machines, cutting equipment, and grinding equipment commonly employed in metal fabrication;  (B) demonstrate knowledge of computer numerical control (CNC) machines;  (C) demonstrate knowledge of the concepts of automated welding machines; and  (D) demonstrate knowledge of emerging technologies that may affect metal manufacturing  6. The student applies the advanced concepts and technical knowledge and skills of the machining industry to simulated and actual work situations. The student is expected to:  (A) use various work mounting procedures on appropriate machines; and  (B) examine the cutting operations such as drill press, lathe, saw, grinders, and milling machines  10. The student knows the function and application of the tools, equipment, technologies, and materials used in sheet metal. The student is expected to:  (C) demonstrate knowledge of emerging technologies that may affect sheet metal | |
| **Unit 6: 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. | 35 Periods  1,350 Minutes | 6. The student applies the advanced concepts and technical knowledge and skills of the machining industry to simulated and actual work situations. The student is expected to:  (A) use various work mounting procedures on appropriate machines;  (B) examine the cutting operations such as drill press, lathe, saw, grinders, and milling machines;  (C) execute lathe procedures such as cut threads, turn tapers, drills, reams, polishes, knurls, and bores;  (D) mill flat surfaces, bevels, chamfers, grooves, and key-seats; and  (E) machine precision pieces | |
| **Unit 7: 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. | 35 Periods  1,350 Minutes | 7. The student applies the advanced concepts and technical knowledge and skills of the welding industry to simulated and actual work situations. The student is expected to:  (A) demonstrate cutting processes such as oxy-fuel and plasma;  (B) demonstrate the use of the common types of electrodes using the shielded metal arc welding process;  (C) use shielded metal arc welding, gas metal arc welding, and gas tungsten arc welding to weld fillet and groove welds using various positions; and  (D) inspect welds to the American Welding Society (AWS), Canadian Welding Bureau (CWB), American National Standards Institute (ANSI), and American Petroleum Institute (API) codes  9. The student knows the advanced concepts and technical knowledge and skills of sheet metal manufacturing. The student is expected to:  (B) analyze oxy-fuel processes as related to sheet metal; and  (C) demonstrate knowledge of shielded metal arc welding, gas metal arc welding, and gas tungsten arc welding as related to sheet metal under AWS code  11. The student applies the advanced concepts and technical skills in simulated and actual work situations. The student is expected to:  (D) use the gas tungsten arc welding process in sheet metal construction | |
| **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. | 35 Periods  1,350 Minutes | 9. The student knows the advanced concepts and technical knowledge and skills of sheet metal manufacturing. The student is expected to:  (A) analyze properties of sheet metal materials and fasteners  11. The student applies the advanced concepts and technical skills in simulated and actual work situations. The student is expected to:  (B) construct sheet metal seams; and  (C) construct transitions and offsets  (E) apply the principles of sheet metal construction to the fabrication of various sheet metal products; and  (F) apply skills in sheet metal to career preparation learning experiences | |
| **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. | 35 Periods  1,350 Minutes | 1. The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:  (A) determine advanced knowledge and skills required to gain industry-recognized certifications; and  (B) identify employers' work expectations  (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, promptness, attendance, and integrity in a work situation  (D) evaluate personal career goals; and  (E) communicate effectively with others in the workplace to clarify objectives  3. The student applies advanced academic skills to the requirements of metal fabrication and machining. The student is expected to:  (A) demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers | |
| **Unit 10: Leadership Development**  During this unit, students will learn more about the qualities and characteristics required to be successful in business and industry. While a basic understanding and development of employability skills will help students obtain employment, they will learn that developing leadership skills will aid them in job retention and potential promotion opportunities. | 35 Periods  1,350 Minutes | 2. The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:  (A) use teamwork to solve problems;  (B) distinguish among team roles such as team leaders and team members;  (C) discuss Equal Employment Opportunity law in the workplace; and  (D) use time-management techniques to develop work schedules  11. The student applies the advanced concepts and technical skills in simulated and actual work situations. The student is expected to:  (F) apply skills in sheet metal to career preparation learning experiences | |