# School District of Marshfield Course Syllabus

**Course Name: Metal Tech II**
**Length of Course: 1 Year**
**Credit: 1**

## Program Goal(s):

Empower learners to be college and career ready through standards-based experiences in the classroom and career-based learning experiences with business and industry partners. Learners will engage through technology in design, building, problem-solving, repair or service, in a collaborative environment through theory and hands-on experiences.

## Course Description:

Metal Tech II is designed to further students' knowledge in all areas of metal working and other manufacturing processes. Students will be assigned several hands on assignments to build a strong understanding in each of the major areas of metalworking; sheet metal fabrication, machining, welding, cutting, forming, and CNC programming and operations. Lectures, demonstrations and labs will make up the class.

## Standards:

| Wisconsin Technology & Engineering Broad Based (BB) | | |
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| **Standard** | **Learning Priority** | **Performance Indicators** |
| BB1: Students will analyze the core concepts of technology. | BB1.a Analyze and use technological systems | BB1.a.3.m: Identify inputs, processes, outputs and, at times, feedback components for technological systems.<br>BB1.a.5.h: Describe how systems |

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| | | can fail because of design flaws, defect parts, poorly matched parts or they were used beyond their design capabilities. |
| | BB1.b: Analyze and use tools and materials. | BB1.b.3.m: Students will describe how resources are the things needed to complete a task (e.g., tools, machines, materials, information, energy, people, capital and time).<br>BB1.b.4.m: Use appropriate tools to measure and layout a piece of material (e.g., length, width, thickness, angles, circles, arcs and volume) within tolerances.<br>BB1.b.5.h: Select appropriate resources and explain how trade-offs between competing values, such as availability, cost, desirability and waste influenced their decision.<br>BB1.b.6.h: Choose and perform the material processing operations of forming (e.g., bending, pressing, drawing, rolling), bonding (e.g., gluing, soldering, brazing, spot welding, gas welding, arc welding), fastening (e.g., screws, nuts & bolts, rivets, clips, pins, nails) and finishing (e.g., surface preparation, cleaning, treatment, coating). |
| | BB1.e: Analyze, explain and use control systems. | BB1.e.4.m: Explain how quality control is a planned process to ensure that a product, service or system meets established criteria. |
| | BB1.f: Identify and analyze structures. | BB1.f.3.m: Identify and describe basic types of structures (i.e., mass, bearing wall, framed) as they relate to their function.<br>BB1.f.6.h: Justify the application of structural materials and their trade-offs in the design of structures based on design requirements through optimization (i.e., engineering design process). |
| **Wisconsin Technology & Engineering- Manufacturing (MNF)** | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| Standard: MNF1: Students will be able to select and use manufacturing technologies. | MNF1.a: Identify, select and safely use tools, machines, products and systems for specific tasks. | MNF1.a.4.m: Discuss health and safety procedures in the workplace that keep workers safe.<br>MNF1.a.5.m: Use tools, materials and machines safely to diagnose, adjust and repair systems.<br>MNF1.a.7.h: Identify safety and health protections and procedures |

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| | | that are critical to worker well-being.<br>MNF1.a.8.h: Use appropriate tools, materials, and machines to repair a malfunctioning system.<br>MNF1.a.9.h: Select and apply the appropriate units and scales for situations involving measurement. |
| | MFN1.b: Create and communicate alternative solutions. | MNF.1.b.3.m: Practice appropriate problem-solving approaches and critical thinking skills to on-the-job issues and tasks.<br>MNF.1.b.4.m: Comprehend and engage in communication methods to convey ideas, concepts and requirements to other individuals and teams.<br>MNF.1.b.5.h: Apply methodical problem-solving models which include input, process, outcome and feedback components. |
| | MNF1.c: Demonstrate cooperation with others in ways to exhibit respect for individual and cultural differences and for the attitudes and feelings of others. | MNF1.c.3.m: Learn how to cooperate with others in ways to exhibit respect for individual and cultural differences and for the attitudes and feelings of others.<br>MNF1.c.4.m: Recognize characteristics and benefits of teamwork, leadership and citizenship in the school, community and manufacturing settings.<br>MNF1.c.5.m: Participate in the student organization SkillsUSA competitive career development events to enrich academic skills, encourage career choices and contribute to employability.<br>MNF1.c.6.h: Learn how to cooperate with others in ways to exhibit respect for individual and cultural differences and for the attitudes and feelings of others.<br>MNF1.c.7.h: Recognize characteristics and benefits of teamwork, leadership and citizenship in the school, community and manufacturing settings.<br>MNF1.c.8.h: Participate in the student organization SkillsUSA competitive career development events to enrich academic skills, encourage career choices and contribute to employability. |

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| | | MNF1.c.10.h: Recognizing how to bring together projects individually and in teams for effective performance and the achievement of objectives. |
| | MNF1.d: Select, use and identify manufacturing processes, such as casting, forming, machining, joining, rapid manufacturing (CNC) and treating/coating. | MNF1.d.3.m: Identify manufactured goods as durable and nondurable.<br>MNF1.d.4.m: Identify the manufacturing process; including the designing, development, making and servicing of products and systems.<br>MNF1.d.5.h: Recognize durable goods are designed to operate for a long period of time, while nondurable goods are designed to operate for a short period of time.<br>MNF1.d.6.h: Demonstrate the interchangeability of parts increases the effectiveness of manufacturing processes. |
| | MNF1.e: Select, use and identify manufacturing systems. | MNF1.e.3.m: Identify that manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining and conditioning.<br>MNF1.e.4.m: Define the purposes of marketing.<br>MNF1.e.5.m: Identify the sub-components of a manufacturing system.<br>MNF1.e.6.h: Recognize manufacturing systems may be classified into types, such as customized production, batch production and continuous production.<br>MNF1.e.7.h: Use marketing to establish a product's identity, conduct research on its potential, advertise it, distribute it and sell it.<br>MNF1.e.8.h: Use a manufacturing system to produce a product. |
| | MNF1.f: Select and use manufacturing technologies. | MNF1.f.4.m: Define harvesting, drilling and mining processes.<br>MNF1.f.5.m: Discuss how technologies are used to modify or alter chemical substances.<br>MNF1.f.6.m: Describe the relationship between materials and manufacturing.<br>MNF1.f.7.h: Recognize servicing keeps products in good operating condition. |

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| | | MNF1.f.8.h: Recognize technologies provide a means for humans to alter or modify materials and to produce products.<br>MNF1.f.9.h: Identify materials have different qualities and may be classified as natural, synthetic or mixed and their effects on our world. |
| | MNF1.g: Analyze and use GMAW, GTAW, SMAW and oxy-acetylene welding. | MNF1.g.3.m: Analyze the different processes needed to fuse metal together (i.e., MIG, TIG, oxy-acetylene, Arc, etc.).<br>MNF1.g.4.m: Identify various types of metal, both ferrous and non-ferrous.<br>MNF1.g.5.m: Identify the importance of safety and different types of safety equipment needed for different welding processes.<br>MNF1.g.6.m: Demonstrate basic welding joints and processes used to weld them.<br>MNF1.g.7.m: Discuss how robotics and automation play a role in manufacturing.<br>MNF1.g.8.h: Demonstrate the ability to choose proper welding supplies given the process.<br>MNF1.g.9.h: Identify different types of welding machines.<br>MNF1.g.10.h: Demonstrate appropriate use of welding blueprint symbols and codes used in industry.<br>MNF1.g.11.h: Demonstrate safety and chose the proper safety equipment given the process being used (i.e., oxy-acetylene, GMAW, SMAW, GTAW, etc.).<br>MNF1.g.12.h: Identify different types of welding joints and be able to demonstrate the ability perform the welds (i.e., butt, corner, edge, lap, tee).<br>MNF1.g.13.h: Identify the different type of welding positions and be able to demonstrate the ability to perform the welds (i.e., flat, horizontal, vertical and overhead). |
| | MNF1.h: Analyze and use metal and manufacturing cutting operations. | MNF1.h.2.m: Identify the importance of safety and different types of safety equipment needed for different metal and manufacturing cutting processes.<br>MNF1.h.3.m: Compare and |

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| | | contrast different metal and manufacturing cutting operations.<br>MNF1.h.4.m: Demonstrate different metal and manufacturing cutting operations.<br>MNF1.h.5.m: Discuss how robotics and automation play a role in manufacturing cutting operations.<br>MNF1.h.6.h: Demonstrate the proper use and proper way to set-up and close down oxy-acetylene equipment and check for leaking gases.<br>MNF1.h.7.h: Demonstrate the proper safety and use with plasma cutting equipment.<br>MNF1.h.8.h: Demonstrate how to use oxy-acetylene and plasma cutting.<br>MNF1.h.9.h: Compare the pros and cons with plasma cutting and oxy-acetylene cutting manufacturing operations and analyze other cutting operations used in industry.<br>MNF1.h.10.h: Analyze the metallurgical effects heat has on metal during a cutting process or in forming and heat treating. |
| **Wisconsin Common Career Technical Standards (WCCTS)**-Creativity, Critical Thinking, Communication and Collaboration (C) | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| Standard: 4C1: Students will think and work creatively to develop innovative solutions to problems and opportunities. | 4C1.a: Develop original solutions, products and services to meet a given need. | 4C1.a.4.m: Analyze elements of a problem to develop creative solutions.<br>4C1.a.6.m: Describe how past experiences can inform current problem solving.<br>4C1.a.7.h: Develop original ways to solve a given problem.<br>4C1.a.8.h: Design a product or service that could fulfill a human need or desire.<br>4C1.a.9.h: Apply past experiences to current problems in developing innovative solutions. |
| | 4C1.b: Work creatively with others to develop solutions, products and services. | 4C1.b.4.m: Explain how multiple people can develop better solutions than an individual.<br>4C1.b.5.m: Explain how multiple people and perspectives can develop better ideas than an individual.<br>4C1.b.6.m: Explain how multiple people and perspectives can improve an existing product or process better than an individual. |

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| | | 4C1.b.7.h: Incorporate the skills and experiences of others to develop a new solution to a problem.<br>4C1.b.8.h: Work as part of a team to design a product or service that could fulfill a human need or desire.<br>4C1.b.9.h: Work as part of a team to improve an existing product or process. |
| Standard: 4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills. | 4C2.a: Develop effective resolutions for a given problem, decision or opportunity using available information. | 4C2.a.5.m: Analyze symptoms to identify the root cause of a problem.<br>4C2.a.6.m: Develop multiple resolutions for a given problem, decision or opportunity.<br>4C2.a.7.m: Identify problems that became worse due to poorly thought out or poorly informed solutions.<br>4C2.a.8.m: Explain how implementation of a solution or action may affect one or more corresponding systems.<br>4C2.a.9.m: Explain how different resolutions may be appropriate under different circumstances.<br>4C2.a.10.m: Explain the process for choosing an action or making a decision.<br>4C2.a.11.h: Determine the information needed to address an identified problem.<br>4C2.a.12.h: Contrast the benefits and drawbacks of various proposed resolutions to a given situation.<br>4C2.a.13.h: Predict how an action could result in unintended consequences, both positive and negative.<br>4C2.a.14.h: Analyze the impact of a decision using a systems thinking model.<br>4C2.a.15.h: Determine the best resolution for a problem, decision or opportunity based on given criteria.<br>4C2.a.16.h: Defend an action taken or a decision implemented. |
| | 4C2.b: Develop and implement a resolution for a new situation using personal knowledge and experience. | 4C2.b.3.m: Analyze problems to determine what past experiences might be related and relevant.<br>4C2.b.4.m: Analyze a problem to determine how it relates to existing knowledge.<br>4C2.b.5.h: Apply past experience to develop a course of action for a new situation. |

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| | | 4C2.b.6.h: Use existing knowledge to develop a resolution for a new situation, problem or opportunity. |
| Standard: 4C3: Students will communicate and collaborate with others to accomplish tasks and develop solutions to problems and opportunities. | 4C3.a: Communicate thoughts and feelings with others using verbal and non-verbal language. | 4C3.a.8.m: Implement effective listening skills in resolving a situation.<br>4C3.a.9.h: Develop a mutually acceptable response to a question or problem.<br>4C3.a.11.h: Communicate effectively in the presence of a language barrier.<br>4C3.a.12.h: Utilize effective listening skills in creating consensus in a group. |
| | 4C3.b: Work collaboratively with others. | 4C3.b.4.m: Use idea generating practices as part of a group.<br>4C3.b.5.m: Describe ways to facilitate group collaboration.<br>4C3.b.6.m: Demonstrate the use of various tools to communicate effectively with an individual or a group.<br>4C3.b.7.h: Participate in group processes to generate consensus.<br>4C3.b.8.h: Lead group processes to generate consensus. |
| | 4C3.c: Use interpersonal skills to resolve conflicts with others in an ethical manner. | 4C3.c.5.m: Contribute to resolving conflicts that occur within a team or group.<br>4C3.c.6.m: Explore the ethical considerations of a current or historical action or decision.<br>4C3.c.7.h: Resolve conflicts productively with individuals as they arise.<br>4C3.c.8.h: Lead a team or group through a conflict resolution process to reach a productive outcome. |
| **Wisconsin Common Career Technical Standards (WCCTS)-Career Development (CD)** | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| Standard: CD1: Students will consider, analyze and apply an awareness of self, identity and culture to identify skills and talents. | CD1.a: Identify person strengths, aptitudes and passions. | CD1.a.2.m: Assess personal strengths, aptitudes and passions related to potential future careers<br>CD1.a.3.h: Evaluate various occupations and career pathways to identify personal, academic and career goals based on personal strengths, aptitudes and passions. |
| | CD1.b: Demonstrate effective decision-making, problem solving and goal setting. | CD1.b.4.m: Identify long and short-term goals.<br>CD1.b.5.h: Use a decision-making and problem-solving model. |
| | CD1.c: Interact effectively with others in similar and diverse teams. | CD1.c.7.m: Display cooperative behavior and identify personal strengths and assets in groups. |

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| | | CD1.c.11.h: Evaluate how the personal strengths and assets of others contribute to a cooperative group atmosphere.<br>CD1.c.12.h: Assess how respect and appreciation for individual and cultural differences impacts group processes. |
| | CD1.d: Apply a range of relevant decision-making strategies. | CD1.d.4.m: Apply decision-making strategies to personal and team interactions.<br>CD1.d.5.h: Predict the outcome of various decisions on personal, social and career success.<br>CD1.d.6.h: Evaluate the impact of personal decision-making strategies on specific outcomes. |
| Standard: CD2: Students will identify the connection between educational achievement and work opportunities in order to reach personal and career goals. | CD2.a: Apply academic experiences to the world of work, inter-relationships and the community. | CD2.a.2.m: Describe a diverse range of opportunities available beyond high school.<br>CD2.a.3.h: Evaluate how performance and connections within the learning community enhance future opportunities.<br>CD2.a.4.h: Determine those opportunities that best support attainment of a specific career goal. |
| | CD2.b: Assess attitudes and skills that contribute to successful learning in school and across the life span. | CD2.b.5.m: Apply academic information from a variety of sources to enhance career preparedness and lifelong learning.<br>CD2.b.6.m: Research local and regional labor market and job growth information to analyze career opportunities.<br>CD2.b.7.h: Interpret and analyze the impact of current education, training and work trends on life, learning and career plans.<br>CD2.b.8.h: Assess education and training opportunities to acquire new skills necessary for career advancement.<br>CD2.b.9.h: Analyze local and regional labor market and job growth information to select a career pathway for potential advancement. |
| Standard: CD3: Students will create and manage a flexible and responsive individualized learning plan to meet their career goals. | CD3.a: Investigate the world of work in order to gain knowledge of self in order to make informed career decisions. | CD3.a.5.m: Demonstrate the ability to use technology to retrieve and manage career information that inspires educational achievement.<br>CD3.a.6.m: Build an ongoing awareness of personal abilities, skills, interests and motivation and |

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| | | determine how these fit with chosen career pathway.<br>CD3.a.7.m: Develop an individual learning plan to enhance educational achievement and attain career goals based on a career pathway.<br>CD3.a.9.m: Use assessment results in educational planning including career awareness.<br>CD3.a.10.h: Analyze how career plans may be affected by personal growth, external events and changes in motivations and aspirations.<br>CD3.a.11.h: Apply academic and employment readiness skills in work-based learning situations such as internships, shadowing and/or mentoring experiences.<br>CD3.a.12.h: Evaluate changes in local, national and global employment trends, societal needs and economic conditions related to career planning.<br>CD3.a.14.h: Implement an individual learning plan to maximize academic ability and achievement. |
| | CD3.b: Examine and evaluate opportunities that could enhance life and career plans and articulate plan to guide decisions and actions. | CD3.b.2.m: Describe educational levels (e.g., work-based learning, certificate, two-year, four-year and professional degrees) and performance skills needed to attain personal and career goals.<br>CD3.b.3.m: Demonstrate openness to exploring a wide range of occupations and career pathways.<br>CD3.b.4.h: Implement strategies for responding to transition and change with flexibility and adaptability.<br>CD3.b.5.h: Evaluate the relationship between educational achievement and career development. |
| | CD3.c: Employ career management strategies to achieve future career success and satisfaction. | CD3.c.3.m: Identify work values and needs.<br>CD3.c.4.m: Define adaptability and flexibility in the world of work.<br>CD3.c.5.h: Determine how principles of equal opportunity, equity, respect, inclusiveness and fairness, affect career planning and management.<br>CD3.c.6.h: Discuss how adaptability and flexibility, especially when initiating or responding to change, contributes to career success. |
| Standard: CD4: Students will identify and apply employability skills. | CD4.a: Identify and demonstrate positive work behaviors and personal qualities needed to be employable. | CD4.a.4.m: Demonstrate flexibility and willingness to learn new knowledge and skills. |

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| | | CD4.a.5.m: Identify positive work-qualities typically desired in each of the career cluster's pathways.<br>CD4.a.6.h: Evaluate how self-discipline, self-worth, positive attitude and integrity displayed in a work situation affect employment status.<br>CD4.a.7.h: Assess how flexibility and willingness to learn new knowledge and skills affect employment status.<br>CD4.a.8.h: Apply communication strategies when adapting to a culturally diverse environment.<br>CD4.a.9.h: Use positive work-qualities typically desired in each of the career cluster's pathways.<br>CD4.a.10.h: Manage work roles and responsibilities to balance them with other life roles and responsibilities. |
| | CD4.b: Demonstrate skills related to seeking and applying for employment to find and obtain a desired job. | CD4.b.3.m: Use technology to assist in career exploration and job-seeking activities.<br>CD4.b.4.m: Compare and contrast personal attributes with employment needs and trends.<br>CD4.b.5.h: Use multiple resources to locate job opportunities.<br>CD4.b.6.h: Prepare a resume, cover letter, employment application.<br>CD4.b.7.h: Employ critical thinking and decision-making skills to exhibit qualifications to a potential employer in an interview. |
| | CD4.c: Identify and exhibit traits for retaining employment. | CD4.c.3.m: Distinguish between appropriate behaviors in a social vs. professional setting.<br>CD4.c.4.h: Model behaviors that demonstrate reliability and dependability.<br>CD4.c.5.h: Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite.<br>CD4.c.6.h: Complete required employment forms and documentation.<br>CD4.c.7.h: Summarize key activities necessary to retain a job in an industry. |
| | CD4.d: Develop positive relationships with others. | CD4.d.4.m: Use cooperative behavior in helping peers accomplish goals and tasks. |

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| | | CD4.d.5.h: Participate in co-curricular and community activities to enhance the school experience.<br>CD4.d.6.h: Evaluate the best method to assist co-workers in accomplishing goals and tasks.<br>CD4.d.7.h: Examine the skills required to enable students to successfully transition to post-secondary opportunities.<br>CD4.d.8.h: Use a systematic approach to academic and career planning for students to achieve their learning, socio-cultural and work goals. |
| **Wisconsin Common Career Technical Standards (WCCTS)-Environmental Health and Safety (EHS)** | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| Standard: EHS1: Students will identify the importance and interrelationships of health, safety and environmental systems and evaluate the impacts of these systems on organizational performance for continuous improvement. | EHS1.a: Assess the interdependency among natural and human-built systems, including social, ecological and economic health. | EHS1.a.6.m: Compare ways in which social, ecological and economic systems have been managed.<br>EHS1.a.7.m: Analyze the impact of personal choices regarding natural and human-built systems on future actions.<br>EHS1.a.8.m: Evaluate the advantages and disadvantages of short-term and long-term solutions and the impacts on social, ecological and economic environments.<br>EHS1.a.9.h: Assess systems dynamics, including constant change and carrying capacity within social, ecological and economic systems.<br>EHS1.a.10.h: Evaluate the societal, ecological and economic costs and benefits of allocating resources in various ways.<br>EHS1.a.11.h: Identify strategies to maintain societal, ecological and environmental health.<br>EHS1.a.12.h: Evaluate the impact of personal choices on the interactions or interdependency between natural and human-built systems.<br>EHS1.a.13.h: Assess how the human-built environment can be designed or modified to promote ecological and economic health and provide a better quality of life. |
| | EHS1.b: Engage in systems thinking and inquiry processes that identify problems while analyzing the | EHS1.b.4.m: Plan investigations to collect information, make predic-tions and offer explanations |

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| | impacts of decisions made now and in the future. | about the social, economic, and ecological questions asked.<br>EHS1.b.5.h: Formulate a plan of action that addresses a current issue that considers the impact on social, economic and ecological systems now and in the future.<br>EHS1.b.6.h: Communicate the results of an investigation of current issues' effects on social, economic and ecological systems. |
| | EHS1.c: Develop solutions to social, economic and ecological problems without compromising the ability of future generations to meet their needs. | EHS1.c.5.m: Explain the political, legal or economic reasons for resolving local, state and national social, economic or ecological issues.<br>EHS1.c.6.m: Develop a plan for personal contribution toward improving or maintaining some part of the social, economic or ecological system.<br>EHS1.c.7.h: Analyze political, educational, economic and governmental influences on systems and identify the roles individuals play within the systems.<br>EHS1.c.8.h: Explain the factors that contribute to the development of social, economic and ecological systems issues and policies.<br>EHS1.c.9.h: Formulate a plan to maintain or improve some part of the local or regional social, economic or ecological system. |
| | EHS1.d: Implement personal and jobsite safety rules and regulations to maintain and improve safe and healthful working conditions and environments. | EHS1.d.5.m: Recognize and use systems in school and in the community that protect and enhance personal, environmental health and safety.<br>EHS1.d.6.m: Discuss employee rights and responsibilities and how to apply them in a workplace setting.<br>EHS1.d.7.h: Assess workplace conditions with regard to personal and environmental health and safety.<br>EHS1.d.8.h: Identify different workplace systems that protect and enhance personal and environmental health and safety.<br>EHS1.d.9.h: Describe employee rights and responsibil-ities to maintain workplace health and safety, including compliance with rules and laws. |

| Key Vocabulary: | | | |
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| Automation | Dial Indicator | Jig | Tap |
| Bevel | Die | Major Diameter | Tensile Strength |
| Blank | Dividing Head | Minor Diameter | Thread Pitch |
| Brittleness | Feed | Oxyacetylene | Tungsten |
| Casting | Fixture | Press Fit | |
| Collet | Grain | Spindle | |

## Topics/Content Outline- Units and Themes:

### Quarter 1:

- Orientation
- Safety
- Advanced Measurement and Layout
- Product Development
- Advanced Welding

### Quarter 2:

- Career Options/Pathways
- Advanced Sheetmetal Fabrication
- Advanced Machine Tools

### Quarter 3:

- Employment Skills
- Advanced Print Reading
- Advanced Welding Fabrication
- Advanced Wrought Iron Bending Techniques

### Quarter 4:

- Torch and Plasma Cutting
- CNC Plasma Table Programing
- Advanced Mass Production

## Primary Resource(s):

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| • **Metalwork Technology and Practice**<br>Glencoe<br>ISBN: 0-02676-460-1<br>© 1989 | • **Machining Fundamentals, 8th Edition**<br>Goodheart Wilcox<br>ISBN: 1-59070-249-2<br>© 2004 |
| • **Welding Technology Fundamentals, 3rd Edition**<br>Goodheart Wilcox<br>ISBN: 1-59070-405-3<br>© 2005 | |