School District of Marshfield Course Syllabus

Course Name: Innovative Fabrication
Length of Course: Semester
Credit: 1/2 Credit

Program Goal:

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:

Art and Tech students will be challenged to find creative solutions to assigned projects. Art and metalworking will be combined to create work that requires technical expertise with inventiveness. Students will create functional and aesthetic objects using techniques ranging from found object assemblage to CNC design. If you are creative and interested in using ferrous metal or if you have interest in metal tech you are invited to this cross-curricular experience.

Wisconsin Standards for Technology and Engineering (TE)

Broad-Based (BB)

BB1: Students will analyze the core concepts of technology.

Analyze and use technological systems BB1.a	1.a.5.h: Describe how systems can fail because of design flaws, defective parts, poorly matched parts, or they were used beyond their design capabilities.
Analyze and use tools and materials BB1.b	1.b.5.h: Select appropriate resources and explain how trade-offs between competing values, such as availability, cost, desirability, and waste influenced their decision. 1.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).
Identify and analyze structures BB1.f	1.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).

Manufacturing (MNF)

MNF1: Students will be able to select and use manufacturing technologies.

Identify, select, and safely use tools, machines, products, and systems for specific tasks MNF1.a	1.a.7.h: Identify safety and health protections and procedures that are critical to worker well-being. 1.a.8.h: Use appropriate tools, materials, and machines to repair a malfunctioning system. 1.a.9.h: Select and apply the appropriate units and scales for situations involving measurement.
Create and communicate alternative solutions MNF1.b	1.b.5.h: Apply methodical problem-solving models which include input, process, outcome, and feedback components.
Demonstrate cooperation with others in ways to exhibit respect for individual and cultural differences and for the attitudes and feelings of others MNF1.c	1.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. 1.c.7.h: Recognize characteristics and benefits of teamwork, leadership and citizenship in the school, community, and manufacturing settings. 1.c.8.h: Participate in the student organization SkillsUSA competitive career development events to enrich academic skills, encourage career choices and contribute to employability. 1.c.10.h: Recognizing how to bring together projects individually and in teams for effective performance and the achievement of objectives.
Select, use, and identify manufacturing processes, such as casting, forming, machining, joining, rapid	1.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.

manufacturing (CNC) and treating/coating MNF1.d	1.d.6.h: Demonstrate the interchangeability of parts increases the effectiveness of manufacturing processes.
Select, use and identify manufacturing systems MNF1.e	1.e.6.h: Recognize manufacturing systems may be classified into types, such as customized production, batch production and continuous production. 1.e.7.h: Use marketing to establish a product's identity, conduct research on its potential, advertise it, distribute it and sell it. 1.e.8.h: Use a manufacturing system to produce a product.
Select and use manufacturing technologies MNF1.f	1.f.7.h: Recognize servicing keeps products in good operating condition. 1.f.8.h: Recognize technologies provide a means for humans to alter or modify materials and to produce products. 1.f.9.h: Identify materials have different qualities and may be classified as natural, synthetic, or mixed and their effects on our world.
Analyze and use GMAW, GTAW, SMAW and oxy-acetylene welding MNF1.g	1.g.8.h: Demonstrate the ability to choose proper welding supplies given the process. 1.g.9.h: Identify different types of welding machines. 1.g.10.h: Demonstrate appropriate use of welding blueprint symbols and codes used in industry. 1.g.11.h: Demonstrate safety and chose the proper safety equipment given the process being used (i.e., oxy-acetylene, GMAW, SMAW, GTAW, etc.). 1.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). 1.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).
Analyze and use metal and manufacturing cutting operations MNF1.h	1.h.6.h: Demonstrate the proper use and proper way to set-up and close down oxy-acetylene equipment and check for leaking gases. 1.h.7.h: Demonstrate the proper safety and use with plasma cutting equipment. 1.h.8.h: Demonstrate how to use oxy-acetylene and plasma cutting. 1.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. 1.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 (4C)

4C1: Students will think and work creatively to develop innovative solutions to problems and opportunities.

Develop original solutions, products, and services to meet a given need 4C1.a	1.a.7.h: Develop original ways to solve a given problem. 1.a.8.h: Design a product or service that could fulfill a human need or desire. 1.a.9.h: Apply past experiences to current problems in developing innovative solutions.
Work creatively with others to develop solutions, products, and services 4C1.b	1.b.7.h: Incorporate the skills and experiences of others to develop a new solution to a problem. 1.b.8.h: Work as part of a team to design a product or service that could fulfill a human need or desire. 1.b.9.h: Work as part of a team to improve an existing product or process.
4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.	
Develop effective resolutions for a given problem, decision or opportunity using available information 4C2.a	2.a.11.h: Determine the information needed to address an identified problem. 2.a.12.h: Contrast the benefits and drawbacks of various proposed resolutions to a given situation. 2.a.13.h: Predict how an action could result in unintended consequences, both positive and negative. 2.a.14.h: Analyze the impact of a decision using a systems thinking model. 2.a.15.h: Determine the best resolution for a problem, decision or opportunity based on given criteria. 2.a.16.h: Defend an action taken or a decision implemented.
Develop and implement a resolution for a new situation using personal knowledge and experience 4C2.b	2.b.5.h: Apply past experience to develop a course of action for a new situation. 2.b.6.h: Use existing knowledge to develop a resolution for a new situation, problem, or opportunity.
4C3: Students will communicate and collaborate with others to accomplish tasks and develop solutions to problems and opportunities.	
Communicate thoughts and feelings with others using verbal and non-verbal language 4C3.a	3.a.9.h: Develop a mutually acceptable response to a question or problem. 3.a.11.h: Communicate effectively in the presence of a language barrier. 3.a.12.h: Utilize effective listening skills in creating consensus in a group.
Work collaboratively with others 4C3.b	3.b.7.h: Participate in group processes to generate consensus. 3.b.8.h: Lead group processes to generate consensus.
Use interpersonal skills to resolve conflicts with others in an ethical manner 4C3.c	3.c.7.h: Resolve conflicts productively with individuals as they arise. 3.c.8.h: Lead a team or group through a conflict resolution process to reach a productive outcome.
Career Development (CD)	
CD1: Students will consider, analyze, and apply an awareness of self, identity, and culture to identify skills and talents.	

Identify person strengths, aptitudes, and passions CD1.a	1.a.3.h: Evaluate various occupations and career pathways to identify personal, academic and career goals based on personal strengths, aptitudes, and passions.
Demonstrate effective decision-making, problem solving and goal setting CD1.b	1.b.5.h: Use a decision-making and problem-solving model.
Interact effectively with others in similar and diverse teams CD1.c	1.c.11.h: Evaluate how the personal strengths and assets of others contribute to a cooperative group atmosphere. 1.c.12.h: Assess how respect and appreciation for individual and cultural differences impacts group processes.
Apply a range of relevant decision-making strategies CD1.d	1.d.5.h: Predict the outcome of various decisions on personal, social and career success. 1.d.6.h: Evaluate the impact of personal decision-making strategies on specific outcomes.
CD2: Students will identify the connection between educational achievement and work opportunities in order to reach personal and career goals.	
Apply academic experiences to the world of work, inter-relationships, and the community CD2.a	2.a.3.h: Evaluate how performance and connections within the learning community enhance future opportunities. 2.a.4.h: Determine those opportunities that best support attainment of a specific career goal.
Assess attitudes and skills that contribute to successful learning in school and across the life span CD2.b	2.b.7.h: Interpret and analyze the impact of current education, training, and work trends on life, learning and career plans. 2.b.8.h: Assess education and training opportunities to acquire new skills necessary for career advancement. 2.b.9.h: Analyze local and regional labor market and job growth information to select a career pathway for potential advancement.
CD3: Students will create and manage a flexible and responsive individualized learning plan to meet their career goals.	
Investigate the world of work in order to gain knowledge of self in order to make informed career decisions CD3.a	3.a.10.h: Analyze how career plans may be affected by personal growth, external events and changes in motivations and aspirations. 3.a.11.h: Apply academic and employment readiness skills in work-based learning situations such as internships, shadowing and/or mentoring experiences. 3.a.12.h: Evaluate changes in local, national, and global employment trends, societal needs and economic conditions related to career planning. 3.a.14.h: Implement an individual learning plan to maximize academic ability and achievement.
Examine and evaluate opportunities that could enhance life and career plans and articulate plans to guide decisions and actions CD3.b	3.b.4.h: Implement strategies for responding to transition and change with flexibility and adaptability. 3.b.5.h: Evaluate the relationship between educational achievement and career development.

Employ career management strategies to achieve future career success and satisfaction CD3.c	3.c.5.h: Determine how principles of equal opportunity, equity, respect, inclusiveness, and fairness, affect career planning and management. 3.c.6.h: Discuss how adaptability and flexibility, especially when initiating or responding to change, contributes to career success.
CD4: Students will identify and apply employability skills.	
Identify and demonstrate positive work behaviors and personal qualities needed to be employable CD4.a	4.a.6.h: Evaluate how self-discipline, self-worth, positive attitude, and integrity displayed in a work situation affect employment status. 4.a.7.h: Assess how flexibility and willingness to learn new knowledge and skills affect employment status. 4.a.8.h: Apply communication strategies when adapting to a culturally diverse environment. 4.a.9.h: Use positive work-qualities typically desired in each of the career cluster's pathways. 4.a.10.h: Manage work roles and responsibilities to balance them with other life roles and responsibilities.
Demonstrate skills related to seeking and applying for employment to find and obtain a desired job CD4.b	4.b.5.h: Use multiple resources to locate job opportunities. 4.b.6.h: Prepare a resume, cover letter, employment application. 4.b.7.h: Employ critical thinking and decision-making skills to exhibit qualifications to a potential employer in an interview.
Identify and exhibit traits for retaining employment CD4.c	4.c.4.h: Model behaviors that demonstrate reliability and dependability. 4.c.5.h: Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite. 4.c.6.h: Complete required employment forms and documentation. 4.c.7.h: Summarize key activities necessary to retain a job in an industry.
Develop positive relationships with others CD4.d	4.d.5.h: Participate in co-curricular and community activities to enhance the school experience. 4.d.6.h: Evaluate the best method to assist co-workers in accomplishing goals and tasks. 4.d.7.h: Examine the skills required to enable students to successfully transition to post-secondary opportunities. 4.d.8.h: Use a systematic approach to academic and career planning for students to achieve their learning, socio-cultural and work goals.
Environment, Health, and Safety (EHS)	
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.	
Assess the interdependency among natural and human-built systems, including social, ecological, and economic health	1.a.9.h: Assess systems dynamics, including constant change and carrying capacity within social, ecological, and economic systems.

EHS1.a	1.a.10.h: Evaluate the societal, ecological, and economic costs and benefits of allocating resources in various ways. 1.a.11.h: Identify strategies to maintain societal, ecological, and environmental health. 1.a.12.h: Evaluate the impact of personal choices on the interactions or interdependency between natural and human-built systems. 1.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.
Engage in systems thinking and inquiry processes that identify problems while analyzing the impacts of decisions made now and in the future EHS1.b	1.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. 1.b.6.h: Communicate the results of an investigation of current issues' effects on social, economic, and ecological systems.
Develop solutions to social, economic and ecological problems without compromising the ability of future generations to meet their needs EHS1.c	1.c.7.h: Analyze political, educational, economic, and governmental influences on systems and identify the roles individuals play within the systems. 1.c.8.h: Explain the factors that contribute to the development of social, economic, and ecological systems issues and policies. 1.c.9.h: Formulate a plan to maintain or improve some part of the local or regional social, economic, or ecological system.
Implement personal and jobsite safety rules and regulations to maintain and improve safe and healthful working conditions and environments EHS1.d	1.d.7.h: Assess workplace conditions with regard to personal and environmental health and safety. 1.d.8.h: Identify different workplace systems that protect and enhance personal and environmental health and safety. 1.d.9.h: Describe employee rights and responsibilities to maintain workplace health and safety, including compliance with rules and laws.

Wisconsin Standards for Art and Design (AA)

Standard 1: CREATE (Cr) - Students will generate, develop, and refine artistic work.

Investigate Cr.10	10.h: Engage in critical thinking, problem solving, and research through elements and principles of art and design studio practices and processes.
Plan Cr.11	11.h: Formulate original concepts by practice, experimentation, and revision.
Make Cr.12	12.h: Develop unique, well-crafted works of art utilizing deliberate choice of media, tools, and techniques.

Standard 2: PRESENT (Pr) - Students will develop, refine, and convey meaning through the production and presentation of artistic work.

Develop Meaning Pr.10	10.h: Curate a body of work incorporating personal, historical, and contemporary art to communicate one or more points of view.

Share Pr.12	12.h: Curate and exhibit artwork for presentation, portfolio development, and/or preservation.
Standard 3: RESPOND (R) - Students will critically interpret intent and meaning in order to evaluate artistic work.	
Describe R.16	16.h: Describe the commonalities within a group of artists or visual images attributed to a particular type of art, timeframe, or culture.
Evaluate R.20	20.h: Determine or develop relevant criteria and evaluate the effectiveness of design, media, and artworks to influence ideas, feelings, and reactions of specific audiences.
Standard 4: CONNECT (Cn) - Students will relate their artistic work with prior experience and external context.	
Interdisciplinary Cn.10	10.h: Apply interdisciplinary perspectives in own artistic work.
Career Connections Cn.11	11.h: Research or experience options in art and design careers.

Tech Ed Key Vocabulary:

Abrasive	Layout	Tolerance	Finish
Alloy	Slag	Turning	Burr
CNC	SMAW	Welding	Metal
Dimension	GMAW	Machine Tools	Flux
Electrode	GTAW	Sheet Metal	
Kerf	Plasma Cutter	Bar Stock	

Art Key Vocabulary:

Balance	Formal	Modernist	Organic
Focus	Subject	Art Deco	Geometric
Narrative	Line Quality	Art Nouveau	Presentation
Similarity	Texture	Assemblage	Display
Unified	Patina	Repetition	
Contrast	Symmetry	Depth	

Topics/Content Outline- Units and Themes:

Quarter 1:
- Orientation
- Safety
- Fasteners Form

- Wire Décor
- Scrap Figure/Form

Quarter 2:

- Scrap Figure/Form
- Sheet Metal Figure/Form
- Commissioned Industrial Design and Fabrication

Primary Resource(s):
Metalwork Technology and Practice Glencoe ISBN: 0-02676-460-1 © 1989
Machining Fundamentals, 8th Edition Goodheart Wilcox ISBN: 1-59070-249-2 © 2004
Welding Technology Fundamentals, 3rd Edition Goodheart Wilcox ISBN: 1-59070-405-3 © 2005