School District of Marshfield Course Syllabus

Course Name: Innovative Fabrication
Length of Course: 1 Semester
Credit: .5

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:

Innovative Fabrication is a class where students will fabricate works that provide innovative solutions to projects presented. Applying learned skills and craftsmanship to aesthetic objects will be our central task. Students are encouraged to work hard to achieve great work and investigate their own strengths and weaknesses.

Standards:

Wisconsin Technology & Engineering Broad Based (BB)		
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. BB1.a.5.h: Describe how systems 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). 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. 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. 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.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. 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. MNF1.a.5.m: Use tools, materials and machines safely to diagnose, adjust and repair systems. MNF1.a.7.h: Identify safety and health protections and procedures that are critical to worker well-being. MNF1.a.8.h: Use appropriate tools, materials, and machines to repair a malfunctioning system. 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. MNF.1.b.4.m: Comprehend and engage in communication methods to convey ideas, concepts and requirements to other individuals and teams. 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. MNF1.c.4.m: Recognize characteristics and benefits of teamwork, leadership and citizenship in the school, community and manufacturing settings. 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. 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. MNF1.c.7.h: Recognize characteristics and benefits of teamwork, leadership and citizenship in the school, community and manufacturing settings. 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. 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. MNF1.d.4.m: Identify the manufacturing process; including the designing, development, making and

		servicing of products and systems. 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. 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. MNF1.e.4.m: Define the purposes of marketing. MNF1.e.5.m: Identify the sub-components of a manufacturing system. MNF1.e.6.h: Recognize manufacturing systems may be classified into types, such as customized production, batch production and continuous production. MNF1.e.7.h: Use marketing to establish a product's identity, conduct research on its potential, advertise it, distribute it and sell it. 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. MNF1.f.5.m: Discuss how technologies are used to modify or alter chemical substances. MNF1.f.6.m: Describe the relationship between materials and manufacturing. MNF1.f.7.h: Recognize servicing keeps products in good operating condition. MNF1.f.8.h: Recognize technologies provide a means for humans to alter or modify materials and to produce products. 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.).

		MNF1.g.4.m: Identify various types of metal, both ferrous and non-ferrous. MNF1.g.5.m: Identify the importance of safety and different types of safety equipment needed for different welding processes. MNF1.g.6.m: Demonstrate basic welding joints and processes used to weld them. MNF1.g.7.m: Discuss how robotics and automation play a role in manufacturing. MNF1.g.8.h: Demonstrate the ability to choose proper welding supplies given the process. MNF1.g.9.h: Identify different types of welding machines. MNF1.g.10.h: Demonstrate appropriate use of welding blueprint symbols and codes used in industry. 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.). 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). 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. MNF1.h.3.m: Compare and contrast different metal and manufacturing cutting operations. MNF1.h.4.m: Demonstrate different metal and manufacturing cutting operations. MNF1.h.5.m: Discuss how robotics and automation play a role in manufacturing cutting operations. 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. MNF1.h.7.h: Demonstrate the

		proper safety and use with plasma cutting equipment. MNF1.h.8.h: Demonstrate how to use oxy-acetylene and plasma cutting. 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. 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. 4C1.a.6.m: Describe how past experiences can inform current problem solving. 4C1.a.7.h: Develop original ways to solve a given problem. 4C1.a.8.h: Design a product or service that could fulfill a human need or desire. 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. 4C1.b.5.m: Explain how multiple people and perspectives can develop better ideas than an individual. 4C1.b.6.m: Explain how multiple people and perspectives can improve an existing product or process better than an individual. 4C1.b.7.h: Incorporate the skills and experiences of others to develop a new solution to a problem. 4C1.b.8.h: Work as part of a team to design a product or service that could fulfill a human need or desire. 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. 4C2.a.6.m: Develop multiple resolutions for a given problem, decision or opportunity.

		4C2.a.7.m: Identify problems that became worse due to poorly thought out or poorly informed solutions. 4C2.a.8.m: Explain how implementation of a solution or action may affect one or more corresponding systems. 4C2.a.9.m: Explain how different resolutions may be appropriate under different circumstances. 4C2.a.10.m: Explain the process for choosing an action or making a decision. 4C2.a.11.h: Determine the information needed to address an identified problem. 4C2.a.12.h: Contrast the benefits and drawbacks of various proposed resolutions to a given situation. 4C2.a.13.h: Predict how an action could result in unintended consequences, both positive and negative. 4C2.a.14.h: Analyze the impact of a decision using a systems thinking model. 4C2.a.15.h: Determine the best resolution for a problem, decision or opportunity based on given criteria. 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. 4C2.b.4.m: Analyze a problem to determine how it relates to existing knowledge. 4C2.b.5.h: Apply past experience to develop a course of action for a new situation. 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. 4C3.a.9.h: Develop a mutually acceptable response to a question or problem. 4C3.a.11.h: Communicate effectively in the presence of a language barrier. 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. 4C3.b.5.m: Describe ways to facilitate group collaboration.

		4C3.b.6.m: Demonstrate the use of various tools to communicate effectively with an individual or a group. 4C3.b.7.h: Participate in group processes to generate consensus. 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. 4C3.c.6.m: Explore the ethical considerations of a current or historical action or decision. 4C3.c.7.h: Resolve conflicts productively with individuals as they arise. 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 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. 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. CD1.c.11.h: Evaluate how the personal strengths and assets of others contribute to a cooperative group atmosphere. 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. CD1.d.5.h: Predict the outcome of various decisions on personal, social and career success. 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. CD2.a.3.h: Evaluate how performance and connections within the learning community enhance future opportunities. 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. CD2.b.6.m: Research local and regional labor market and job growth information to analyze career opportunities. CD2.b.7.h: Interpret and analyze the impact of current education, training and work trends on life, learning and career plans. CD2.b.8.h: Assess education and training opportunities to acquire new skills necessary for career advancement. 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. CD3.a.6.m: Build an ongoing awareness of personal abilities, skills, interests and motivation and determine how these fit with chosen career pathway. CD3.a.7.m: Develop an individual learning plan to enhance educational achievement and attain career goals based on a career pathway. CD3.a.9.m: Use assessment results in educational planning including career awareness. CD3.a.10.h: Analyze how career plans may be affected by personal growth, external events and changes in motivations and aspirations. CD3.a.11.h: Apply academic and employment readiness skills in work-based learning situations such as internships, shadowing and/or mentoring experiences.

		CD3.a.12.h: Evaluate changes in local, national and global employment trends, societal needs and economic conditions related to career planning. 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. CD3.b.3.m: Demonstrate openness to exploring a wide range of occupations and career pathways. CD3.b.4.h: Implement strategies for responding to transition and change with flexibility and adaptability. 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. CD3.c.4.m: Define adaptability and flexibility in the world of work. CD3.c.5.h: Determine how principles of equal opportunity, equity, respect, inclusiveness and fairness, affect career planning and management. 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. CD4.a.5.m: Identify positive work-qualities typically desired in each of the career cluster's pathways. CD4.a.6.h: Evaluate how self-discipline, self-worth, positive attitude and integrity displayed in a work situation affect employment status. CD4.a.7.h: Assess how flexibility and willingness to learn new knowledge and skills affect employment status. CD4.a.8.h: Apply communication strategies when adapting to a culturally diverse environment. CD4.a.9.h: Use positive work-qualities typically desired in each of the career cluster's pathways. 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. CD4.b.4.m: Compare and contrast personal attributes with employment needs and trends. CD4.b.5.h: Use multiple resources to locate job opportunities. CD4.b.6.h: Prepare a resume, cover letter, employment application. 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. CD4.c.4.h: Model behaviors that demonstrate reliability and dependability. CD4.c.5.h: Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite. CD4.c.6.h: Complete required employment forms and documentation. 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. CD4.d.5.h: Participate in co-curricular and community activities to enhance the school experience. CD4.d.6.h: Evaluate the best method to assist co-workers in accomplishing goals and tasks. CD4.d.7.h: Examine the skills required to enable students to successfully transition to post-secondary opportunities. 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	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. EHS1.a.7.m: Analyze the impact of personal choices regarding natural and human-built systems on future actions.

organizational performance for continuous improvement.		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. EHS1.a.9.h: Assess systems dynamics, including constant change and carrying capacity within social, ecological and economic systems. EHS1.a.10.h: Evaluate the societal, ecological and economic costs and benefits of allocating resources in various ways. EHS1.a.11.h: Identify strategies to maintain societal, ecological and environmental health. EHS1.a.12.h: Evaluate the impact of personal choices on the interactions or interdependency between natural and human-built systems. 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 impacts of decisions made now and in the future.	EHS1.b.4.m: Plan investigations to collect information, make predic-tions and offer explanations about the social, economic, and ecological questions asked. 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. 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. EHS1.c.6.m: Develop a plan for personal contribution toward improving or maintaining some part of the social, economic or ecological system. EHS1.c.7.h: Analyze political, educational, economic and governmental influences on systems and identify the roles individuals play within the systems. EHS1.c.8.h: Explain the factors that contribute to the development of

		social, economic and ecological systems issues and policies. 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. EHS1.d.6.m: Discuss employee rights and responsibilities and how to apply them in a workplace setting. EHS1.d.7.h: Assess workplace conditions with regard to personal and environmental health and safety. EHS1.d.8.h: Identify different workplace systems that protect and enhance personal and environmental health and safety. EHS1.d.9.h: Describe employee rights and responsibil-ities to maintain workplace health and safety, including compliance with rules and laws.

Wisconsin Academic Standards for Art and Design
A.12.2 Know advanced vocabulary related to their study of art
A.12.5 Explain that art is one of the greatest achievements of human beings
A.12.6 Use art as a basic way of thinking and communicating about the world
B.12.3 Relate works of art and designed objects to specific cultures, times, and places
C.12.2 Understand the procedures of developing quality design
C.12.3 Use design to create artworks that have different meanings
C.12.6 Experiment visually with sketches for complex solutions involving concepts and symbols
C.12.7 Apply advanced craft and skills to consistently produce quality art
C.12.8 Use the natural characteristics of materials and their possibilities and limitations to create works of art
C.12.9 Use ongoing reflective strategies to assess and better understand one's work and that of others during the creative process
C.12.10 Assume personal responsibility for their learning and the creative process
D.12.2 Know about artists and designers, such as architects, furniture designers, critics, preservationists, museum curators, and gallery owners, in their community
D.12.4 Use basic concepts in art, such as “form follows function,” “destruction of the box,” “less is more,” balance, symmetry, integrity, authenticity, and originality
D.12.6 Apply problem-solving strategies that promote fluency, flexibility, elaboration, and originality
E.12.1 Communicate ideas by producing sophisticated studio art forms, such as drawings, paintings, prints, sculpture, jewelry, fibers, and ceramics
E.12.4 Communicate ideas by producing advanced visual communication forms useful in everyday life, such as sketches, diagrams, graphs, plans, and models
H.12.4 Create two-dimensional plans to make three-dimensional models
I.12.7 Work independently, collaboratively, and with deep concentration when creating works of art

J.12.10 Reflect and talk about works of art
L.12.1 Use their knowledge, intuition, and experiences to develop ideas for artwork

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 Decor
- 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	