



Wood Manufacturing V: Life as a Modern Woodworker

Course Information

Grade(s):	12
Discipline/Course:	Technology education
Course Title:	Wood Manufacturing V: Life as a Woodworker
Prerequisite(s):	Wood Manufacturing IV: Skills for the Modern Woodworker (Full Year) or Wood Manufacturing IV: Skills for the Modern Woodworker (Semester) with teacher’s permission
Course Description: Program of Studies	This course is an advanced level course in manufacturing and construction. Students will construct a “modern” cabinet using the 32mm system and CAD in tandem with the CNC router to create most of their parts. Self-direction, motivation, experience and demonstrated skills must be utilized and are required for success at this level. After completion of their modern cabinet, a student-selected individualized project continues to build on prior manufacturing courses challenging the students’ abilities.
Course Essential Questions:	<ul style="list-style-type: none"> ● Why are shop safety rules and policies so important? ● What are some of the challenges of maintaining a safe woodworking environment, and how can we overcome them? ● What are some of the things to consider when choosing a woodworking project? ● How can you create a woodworking project plan that is both feasible and realistic? ● What are some of the common challenges that people face when constructing woodworking projects, and how can these challenges be overcome? ● How can you use feedback from others to improve your woodworking skills and project outcomes? ● What advantages are gained using CAD and CNC machines to do work? ● What are some of the challenges of turning raw materials into usable products efficiently and with minimal waste? ● What are some of the common challenges of setting up and adjusting wood manufacturing power equipment, and how can they be overcome?

	<ul style="list-style-type: none"> ● How can you choose a new woodworking technique or process that is appropriate for your skill level and interests? ● What are some of the challenges of constructing cabinets accurately and efficiently within the 32mm system? ● What is the best way to assemble a large project? ● What are some innovative ways to use these joints to create unique and functional drawers? ● How does modern hardware change cabinets design and construction? ● What are the different methods for sanding wood, and how do they affect the finished product? ● How can we ensure that a wood finish is both aesthetically pleasing and functional for the intended use of the product? ● How do you choose the right stain or finish for a particular project? ● What are the different factors to consider when choosing from the different European drawer and hinge hardware for a particular cabinet? ● How can we use European hardware to enhance the function and aesthetics of our woodworking projects? ● How do you identify the positives and negatives of a projects' CNC construction, as well as the processes and techniques used? ● What are the different criteria that you can use to assess a CNC woodworking project? ● How can woodworking project assessment be used to promote continuous learning and improvement?
Course Enduring Understandings:	<ul style="list-style-type: none"> ● Woodworking can be a way to express oneself creatively and uniquely. ● Safety is the most important rule in the woodshop. ● Everyone has a role to play in creating and maintaining a safe workplace. ● Planning is essential for successful woodworking projects. ● Woodworking joints are the foundation of strong and durable projects. ● Plans and technical drawings communicate the design intent of the woodworker. ● CAD and CNC can help to maximize production and minimize waste. ● Portable power and cutting tools are essential for many woodworking tasks. ● Modern wood manufacturing power equipment can be used to create a variety of woodworking

	<p>projects, including but not limited to, modern cabinetry.</p> <ul style="list-style-type: none"> ● Specialty CNC machinery can be used to create a variety of complex and intricate woodworking projects. ● Wood finishes are used to protect and enhance the appearance of wood and it is important to choose the “right” wood finish that is appropriate for the intended use of the product and the desired appearance ● The proper sanding and finishing techniques can produce a beautiful and durable wood finish. ● Some CNC processed parts are made from plywood and require special sanding and finishing techniques. ● Hardware for CNC processed components must be installed correctly to ensure proper function and safety. ● Hardware installation requires a variety of tools and skills ● The quality of a finished woodworking project depends on the quality of the raw materials used and the care taken in the construction process. ● Plans and technical drawings must be followed carefully to ensure a successful project. ● Self-evaluation can also help students to develop a critical eye for detail and a high standard for quality. Self-evaluation is a lifelong skill that can be applied to all areas of life, including school, work, and personal relationships.
Duration:	Year/1.0 Credit
Course Materials/Resources:	Machinery and consumables
FPS Course Academic Expectation(s):	CC Creating and Constructing CS Collaborating Strategically
Year at a Glance (Units)	Unit 1 - Course Introduction and General Safety (1 week) Unit 2 - Project Design (1-2 Weeks) Unit 3 - Machine Use (4 weeks) Unit 4 - Project Construction (20 weeks) Unit 5 – Joinery and Assembly (4 weeks)

	Unit 6 - Finishing (2 weeks) Unit 7 – Hardware (2 weeks) Unit 8 - Project Review and Evaluation (1 week)
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Unit Number and Title:	Unit 1 - Course Introduction and General Safety
Duration:	1 week
Resource(s):	Consumables and machines
Unit Overview:	Students will review safety practices and policies. This will include the safety practices for specific machinery and include the procedures related to workplace and job-site safety, personal protective equipment, machine safety, and material handling practices.
Learning Goals	
Standard(s):	Standards Wood Technology WM.02 Describe and demonstrate the procedures related to workplace and job-site safety including personal protective equipment, machine safety, and material handling practices. WM.02.01, WM.02.02, WM.02.03, WM.02.04, WM.02.05
Essential Question(s):	<ul style="list-style-type: none"> • Why are shop safety rules and policies so important? • What are some of the challenges of maintaining a safe woodworking environment, and how can we overcome them?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Woodworking can be a way to express oneself creatively and uniquely. • Safety is the most important rule in the woodshop. • Everyone has a role to play in creating and maintaining a safe workplace.
Learning Goal(s): Students will be able to use their learning to: (Content/ Skills)	Content: (Students will know...) <ul style="list-style-type: none"> • advanced machine setup. • elements to make machines safer. • the considerations in creating and utilizing jigs and custom push sticks to help with finger safety and parts creation for specialty machines like CAD driven CNC equipment. • duties and responsibilities of an apprentice.

Skills: (Students will be able to...)

- assess workplace conditions with regard to safety and health.
- describe safety practices for specific machines.
- follow OSHA, EPA and other safety regulations.
- align safety issues with appropriate safety standards to ensure a safe workplace/jobsite.

Unit Number and Title:	Unit 2 - Project Design
Duration:	1-2 weeks
Resource(s):	Equipment and Consumables
Unit Overview:	Students will create full scale and isometric drawings of their project including all the necessary joinery utilizing one of the many CAD programs. They will take into consideration the 32mm system of cabinet construction in designing the look and construction of their cabinet. From that they will create a stock-list and optimal toolpath that will guide them while they mill and machine their project pieces with the CNC router.
Learning Goals	
Standard(s):	<p>Standards Wood Technology</p> <p>WM.04 Explain and be able to demonstrate the methods involved in turning raw materials into useable products.</p> <p>WM.04.01 Describe and interpret technical drawings.</p> <p>WM.04.02 Describe and prepare rough drawings and sketches.</p> <p>WM.04.03 Explain and prepare a cut list or bill of material from a basic plan and assembly drawing.</p> <p>WM.04.04 Interpret a design to facilitate replication.</p> <p>WM.04.05 Describe and identify fractional measurements from a basic plan and assembly drawings.</p> <p>WM.04.07 Extrapolate information from a set of plans.</p> <p>WM.04.08 Measure accurately to a sixteenth of an inch.</p> <p>WM.04.09 Estimate materials quantities in both board feet and linear feet.</p> <p>WM.04.10 Interpret a design to facilitate replication.</p>
Essential Question(s):	<ul style="list-style-type: none"> ● What are some of the things to consider when choosing a woodworking project? ● How can you create a woodworking project plan that is both feasible and realistic? ● What are some of the common challenges that people face when constructing woodworking projects, and how can these challenges be overcome?

	<ul style="list-style-type: none"> ● How can you use feedback from others to improve your woodworking skills and project outcomes?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Planning is essential for successful woodworking projects. ● Woodworking joints are the foundation of strong and durable projects. ● Plans and technical drawings communicate the design intent of the woodworker.
Learning Goal(s): <i>Students will know and will be able to use their learning to:</i> (Content/ Skills)	<p>Content: Students will know:</p> <ul style="list-style-type: none"> ● measure using the metric system. ● how to apply the 32mm system to the design of a frameless cabinet with modern hardware. ● how to draw using a CAD program specific to CNC machine processing.. ● the rules for using the 32mm system <p>Skills: Students will:</p> <ul style="list-style-type: none"> ● demonstrate an understanding of CAD drawing and CNC machining and their interfaces. ● explain and use metric measurements. ● identify, use and maintain measuring, layout, and marking tools. ● measure accurately to a millimeter. ● create a full-scale drawing of their project with CAD.

Unit Number and Title:	Unit 3 – Machine Use
Duration:	2-3 weeks/ on going as needed
Resource(s):	Consumables and machines
Unit Overview:	Students will continue expanding their knowledge of new tools and new techniques utilizing tools they have already learned how to use in new ways, such as table saws and routers. In addition, students will utilize the CNC router to create the parts of their modern cabinet.
Learning Goals	
Standard(s):	Wood Technology Standards WM.03 Identify and describe the safe and appropriate use of various types of hand and power tools and machinery used for building. WM.03.02, WM.03.04, WM.03.07 WM.04 Explain and be able to demonstrate the methods involved in turning raw materials into useable products. WM.04.04
Essential Question(s):	<ul style="list-style-type: none"> ● What advantages are gained using CAD and CNC machines to do work? ● What are some of the challenges of turning raw materials into usable products efficiently and with minimal waste? ● What are some of the common challenges of setting up and adjusting wood manufacturing power equipment, and how can they be overcome?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● CAD and CNC can help to maximize production and minimize waste. ● Portable power and cutting tools are essential for many woodworking tasks.
Learning Goal(s): Students will be able to use their learning to:	Content: (Students will know...) <ul style="list-style-type: none"> ● advanced machine setup for manufacturing projects.

(Content/ Skills)	<ul style="list-style-type: none"> ● advanced operation of woodshop machines. ● advanced operation of wood surfacing equipment. ● the procedure to layout, cut, and assemble joinery cut from the CNC router. ● the 32mm system for cabinetry and hardware. ● the different uses of shaper bits to create custom moldings. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● utilize specialty CNC machinery to fabricate all components for use in major projects. ● properly set-up and make all necessary special adjustments to CNC machinery as indicated on plans to complete CNC machining processes. ● create CNC router toolpaths from CAD programs. ● utilize all portable power and cutting tools in the manufacture of student selected projects.
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Unit Number and Title:	Unit 4 – Major Project Construction
Duration:	10-20 weeks
Resource(s):	Consumables and machines
Unit Overview:	Students will explore different construction techniques as they apply to their project and use this knowledge to construct and produce the necessary parts. They will learn how to properly make and utilize several basic wood joints with the CNC router and how to plan and design around modern European drawer slides and hinges. In the process they will continue to learn and practice setting-up and adjusting a variety of wood manufacturing power equipment.
Learning Goals	
Standard(s):	<p>Wood Technology Standards</p> <p>WM.04 Explain and be able to demonstrate the methods involved in turning raw materials into useable products. WM.04.01, WM.04.06</p> <p>WM.05 Identify and assemble wood joinery and install mechanical fasteners. WM.05.01, WM.05.02, WM.05.06, WM.05.07, WM.05.08, WM.05.09, WM.05.11, WM.05.13, WM.05.14, WM.05.15</p> <p>WM.07 Set-up, adjusts, and maintains a variety of wood manufacturing power equipment. WM.07.01, WM.07.03, WM.07.12, WM.07.13, WM.07.14, WM.07.15, WM.07.16, WM.07.17, WM.07.18, WM.07.19, WM.07.20, WM.07.21, WM.07.22, WM.07.23, WM.07.24, WM.07.25, WM.07.26, WM.07.27, WM.07.28, WM.07.29, WM.07.30, WM.07.31, WM.07.32, WM.07.33, WM.07.34, WM.07.35</p> <p>WM.09 Fabricate Traditional and Modern Casework (wall, base, and utility cabinets) WM.09.02, WM.09.03, WM.09.07, WM.09.08, WM.09.09, WM.09.16</p> <p>WM.11 Fabricate Furniture WM.11.01, WM.11.02, WM.11.06, WM.11.07, WM.11.08</p>
Essential Question(s):	<ul style="list-style-type: none"> • How can you choose a new woodworking technique or process that is appropriate for your skill level and interests? • What are some of the challenges of constructing cabinets accurately and efficiently within the 32mm system?

Enduring Understanding(s):	<ul style="list-style-type: none"> ● Modern wood manufacturing power equipment can be used to create a variety of woodworking projects, including but not limited to, modern cabinetry. ● Specialty CNC machinery can be used to create a variety of complex and intricate woodworking projects.
Learning Goal(s): Students will be able to use their learning to: (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● the process of setting up a CNC router with proper hold downs and spoil boards. ● proper techniques for using a CNC router.. ● CNC machine tool path optimization. ● different types of European drawer slides and hinges and how they fit into the 32mm system. ● cabinet construction ● rabbet and dado joinery and its variations. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● setup a CNC router with proper hold downs and spoil boards. ● use a CNC router. ● create optimized toolpaths ● prepare a plywood panel for the CNC router. ● build a cabinet with full overlay, ½ overlay or inset drawers and doors.

Unit Number and Title:	Unit 5 – Assembly
Duration:	4-6 week
Resource(s):	Consumables and machines
Unit Overview:	The students will be learning how to utilize various clamps, cauls, glues, dowels and mechanical fasteners, like Conformat fasteners in the assembly of their project.
Learning Goals	
Standard(s):	Wood Technology Standards WM.09 Fabricate Traditional and Modern Casework (wall, base, and utility cabinets) WM.09.03, WM.09.05, WM.09.06 WM.11 Fabricate Furniture WM.11.03, WM.11.06, WM.11.08
Essential Question(s):	<ul style="list-style-type: none"> ● What is the best way to assemble a large project? ● What are some innovative ways to use these joints to create unique and functional drawers? ● How does modern hardware change cabinets design and construction?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Woodworking projects are made up of individual components that CNC processes can help to make faster, more efficiently and assembled more carefully to create a strong and durable product. ● There are a variety of construction and assembly techniques and in some cases CNC machining may be the most appropriate choice for a project. ● Precision is essential when constructing and assembling woodworking components.
Learning Goal(s): Students will be able to use their learning to: (Content/ Skills)	Content: (Students will know...) <ul style="list-style-type: none"> ● the methods for assembling their project with modern fasteners. ● the procedure for a good grain match for plywood panels. ● techniques for adding edge banding.

- the proper use of square clamping blocks to aid in assembly.

Skills: (Students will be able to...)

- construct and assemble their project.
- demonstrate the procedures for CNC machined components of applying glue, clamping parts of a project, and attaching fasteners to the finished product.
- demonstrate methods to fasten European hinges and drawer slides to a project.

Unit Number and Title:	Unit 6 – Finishing
Duration:	2 weeks
Resource(s):	Machines and Consumables
Unit Overview:	Students will demonstrate how to properly sand and prepare their projects for finish. They will determine the “best” finish from the various types of finishes and their characteristics for their cabinet. They will use this knowledge to choose and apply the finish on their cabinet.
Learning Goals	
Standard(s):	Wood Technology WM.16 Finish woodwork. WM.16.01, WM.16.02, WM.16.04, WM.16.07
Essential Question(s):	<ul style="list-style-type: none"> • What are the different methods for sanding wood, and how do they affect the finished product? • How can we ensure that a wood finish is both aesthetically pleasing and functional for the intended use of the product? • How do you choose the right stain or finish for a particular project?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Wood finishes are used to protect and enhance the appearance of wood and it is important to choose the “right” wood finish that is appropriate for the intended use of the product and the desired appearance • The proper sanding and finishing techniques can produce a beautiful and durable wood finish. • Some CNC processed parts are made from plywood and require special sanding and finishing techniques.
Learning Goal(s): Students will be able to use their learning to: (Content/ Skills)	Content: (Students will know...) <ul style="list-style-type: none"> • the benefits of different finishes, such as, top coats, hard waxes, and penetrating finishes. • the method of creating their own wood putty from sawdust and glue. • the uses of cyanoacrylate adhesive to repair cracks and checks. • pigments and dyes and how they are used in epoxy.

- the differences between color dyes and oil based stains.

Skills: (Students will be able to...)

- apply a protective finish to their wood project.
- understand the difference between stains, primer coats and top coats.
- utilize the correct solvent when cleaning brushes.
- sand their project to a “finished” smoothness utilizing correct abrasive papers.

Unit Number and Title:	Unit 7 – Hardware
Duration:	2 weeks
Resource(s):	Equipment and Consumables
Unit Overview:	Students will learn how to utilize layout techniques to place hardware on CNC machined parts for maximum functionality.
Learning Goals	
Standard(s):	Standards Wood Technology WM.10 Identify types, finishes, and mechanisms of hardware WM.10.02, WM.10.04 WM.11 Fabricate Furniture WM.11.11
Essential Question(s):	<ul style="list-style-type: none"> • What are the different factors to consider when choosing from the different European drawer and hinge hardware for a particular cabinet? • How can we use European hardware to enhance the function and aesthetics of our woodworking projects?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Hardware for CNC processed components must be installed correctly to ensure proper function and safety. • Hardware installation requires a variety of tools and skills
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	Content: (Students will know...) <ul style="list-style-type: none"> • the role of European drawer slides and cup hinges play in the overall aesthetic of a cabinet. • the different drawer slides and how they fit within the 32mm system and their pros and cons. • the layout for European drawer slides and cup hinges on doors. • why and when a pilot hole and countersink might be necessary.

Skills: (Students will be able to...)

- lay out for European drawer slides and cup style hinges..
- drill the proper holes to accommodate screws.
- mount knobs and handles to the drawer fronts.
- apply pulls and European hinges to cabinet doors and drawers.

Unit Number and Title:	Unit 8 - Project Review and Evaluation
Duration:	1 week
Resource(s):	Equipment and Consumables
Unit Overview:	Students will reflect on the process of designing, building and finishing their cabinet, evaluating the entire process in addition to the end product.
Learning Goals	
Standard(s):	<p>Standards Wood Technology</p> <p>WM.04 Explain and be able to demonstrate the methods involved in turning raw materials into useable products.</p> <p>WM.04.01 Describe and interpret technical drawings.</p> <p>WM.04.02 Describe and prepare rough drawings and sketches. *(C14)</p> <p>WM.04.03 Explain and prepare a cut list or bill of material from a basic plan and assembly drawing.(C15)</p> <p>WM.05 Describe and demonstrate the attributes of wood design.</p> <p>WM.05.01 Utilize the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.</p> <p>WM.05.02 Check and critique a design continually, and improve and revise the idea of the design as needed.</p> <p>WM.05.03 Design and create cabinet and wood products</p> <p>WM.05.04 Develop a production plan, including the layout, bill of materials, and cost analysis, for the production of cabinets or wood products.</p>
Essential Question(s):	<ul style="list-style-type: none"> ● How do you identify the positives and negatives of a projects' CNC construction, as well as the processes and techniques used?

	<ul style="list-style-type: none"> ● What are the different criteria that you can use to assess a CNC woodworking project? ● How can woodworking project assessment be used to promote continuous learning and improvement?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● The quality of a finished woodworking project depends on the quality of the raw materials used and the care taken in the construction process. ● Plans and technical drawings must be followed carefully to ensure a successful project. ● Self-evaluation can also help students to develop a critical eye for detail and a high standard for quality. Self-evaluation is a lifelong skill that can be applied to all areas of life, including school, work, and personal relationships.
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● the elements that make a project successful. ● the elements make a project aesthetically pleasing. ● the procedure for assessing errors and mistakes of a finished project. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● self-evaluate woodworking projects. ● identify quality aspects of completed work. ● identify changes which could improve the process.