STRANDS AND STANDARDS
FURNITURE DESIGN AND MANUFACTURING

Course Description
The second instructional course in a sequence that prepares individuals to apply technical knowledge and skills to prepare and execute furniture design projects; assemble and finish furniture articles; repair furniture; and stresses the safe use of a variety of hand and power tools and machinery. Recommended projects would be anything that would allow students to incorporate all joints and tools, e.g. a chest of drawers.

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<th>Intended Grade Level</th>
<th>10-12</th>
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<tr>
<td>Units of Credit</td>
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<td>Skill Certification Test Number</td>
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<tr>
<td>Endorsement 1</td>
<td>Cabinetmaking/Millwork</td>
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<td>Endorsement 3</td>
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STRAND 1
Students will understand furniture design, manufacturing, and theory.

Standard 1
Understand basic elements of the furniture manufacturing industry.
- Identify career opportunities using career pathways in furniture and cabinetmaking/millwork manufacturing.
- Identify career opportunities in related millwork industries.
- Describe the integration of cabinetmaking into construction schedules.

Standard 2
Understand the design, planning, and estimation process.
- Identify elements and principles of design as they apply to woodworking and cabinetmaking/millwork manufacturing.
- Identify standard furniture dimensions relating to tables, seating, and shelving.
- Draw/sketch the necessary views of a selected project.
- Create a material list for the selected project and determine the project cost.
- Follow a procedure list for construction of a cabinet.
- Extract pertinent cabinet information and specifications from working drawings and specifications.

Standard 3
Understand and demonstrate basic math and measuring concepts.
- Add two- and three-digit numbers.
- Subtract two-, three-, and four-digit numbers.
- Solve two-digit divisor numbers.
- Multiply a two-digit factor.
- Add, subtract, multiply, and divide fractions and mixed numbers.
- Convert fractions to decimals.
- Reduce fractions.
- Add, subtract, multiply, and divide decimal numbers.
- Calculate percentages and basic rations.
- Add and subtract linear measurement in feet and inches.
- Use a ruler or measuring tape to measure within a sixteenth (1/16) of an inch.
- Calculate board feet and square feet.
- Demonstrate the optimization of materials.

Performance Skill
Understand furniture design, manufacturing, and theory.
- Understand basic elements of the furniture manufacturing industry.
- Understand the design, planning, and estimation process.
- Understand and demonstrate basic math and measuring concepts.
STRAND 2
Students will understand and demonstrate the safe use of woodworking tools.

Standard 1
Understand and demonstrate the safe use of hand tools.

- Describe the purpose and demonstrate the proper use of the following measuring and layout tools:
  - Measuring tape
  - Caliper (digital or dial)
  - Scratch awl
  - Framing square
  - Combination square
  - Try square
  - Sliding T-bevel

- Describe the purpose and demonstrate the proper use of the following cutting and shaping tools:
  - Back saw
  - Block plane
  - Wood chisel
  - Wood file/rasp
  - Hand saw
  - Glue scraper
  - Putty knife
  - Jack plane
  - Card scraper

- Describe the purpose and demonstrate the proper use of the following striking tools:
  - Claw hammer
  - Nail set
  - Dead-blow hammer

- Describe the purpose and demonstrate the proper use of the following drill bits:
  - Twist
  - Spade
  - Countersink
  - Driver bits: Phillips, Square, Flat
  - Multi-spur bit

Standard 2
Understand and demonstrate the safe use of portable power tools.

- Describe the purpose and demonstrate the proper use of the following portable power tools:
  - Pneumatic/power nail gun
  - Power drills
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- Router
- Finish sander
- Belt sander
- Orbital sander
- Biscuit jointer
- Hand jig saw

**Standard 3**
Understand and demonstrate the safe use of power machines.

- Describe the purpose and demonstrate the proper use of the following sawing machines:
  - Table saw
  - Power miter saw
  - Band saw
- Describe the purpose and demonstrate the proper use of the following surfacing machines:
  - Surface planer
  - Jointer
- Describe the purpose and demonstrate the proper use of the following sanding machines:
  - Disc sander
  - Wide belt sander
  - Spindle sander
- Describe the purpose and demonstrate the proper use of the following shaping machines:
  - Router table
  - Shaper
  - CNC machine
  - Lathe
- Describe the purpose and demonstrate the proper use of the following drilling machines:
  - Drill press
  - Line boring machine
  - Mortising machine

**Performance Skill**
Understand and demonstrate the safe use of woodworking tools.

- Understand and demonstrate the safe use of hand tools.
- Understand and demonstrate the safe use of portable power tools.
- Understand and demonstrate the safe use of power machines.
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STRAND 3

Students will understand the methods of processing materials.

Standard 1
Understand and demonstrate safe practices.
- Demonstrate the ability to work safely in a cabinet shop following general safety rules.
- Demonstrate how to handle, store, and dispose of materials according to SDS sheets.
- Pass a written safety test with a score of 100 percent.

Standard 2
Understand and demonstrate the use of fasteners and adhesives.
- Identify the various woodworking fasteners and the application of each.
  - Nails
  - Screws
  - Staples
  - Pins
  - Bolts
- Properly use an adhesive in the construction of a project.
  - Yellow glue
  - Polyurethane glue
  - Cyanoacrylate
  - Epoxy
- Identify the different types of clamps.
  - Bar
  - “C”
  - Spring
  - HandscREW
  - Band
- Understand the gage system (nails, staples, pins, etc.).

Standard 3
Understand wood products, characteristics, and procedures.
- Describe the parts of a tree and the significance that it has in cabinet construction.
  - Bark
  - Sap wood
  - Heart wood
  - Pith
  - Annual (growth) rings
  - Lignin
• Describe and identify natural defects in wood.
  • Warp
  • Cracks
  • Bark inclusions
  • Knots
• Understand the methods of the seasoning and drying lumber.
  • Standard moisture content levels for kiln and air dried lumber.
  • The effects of moisture on materials (expansion and contraction).
• Distinguish between softwoods and hardwoods.
• Identify the difference between solid wood and manufactured materials and describe the use of each.
• Identify wood species and their specific characteristics.
  Alder  Walnut  Pine
  Cherry  Maple  Mahogany
  Oak      Poplar  Red Cedar
• Identify common manufactured wood products.
  • Plywood
  • Particle board
  • MDF
  • Baltic birch
• Identify common grades of lumber and sheet goods.
  • FAS
  • Select
  • #1COM
  • Rustic

Performance Skill
Understand the methods of processing materials.
• Understand and demonstrate safe practices.
• Understand and demonstrate the use of fasteners and adhesives.
• Understand wood products, characteristics, and procedures.

STRAND 4
Students will understand milling and assembly.

Standard 1
Understand and demonstrate the use of joinery.
• Identify the basic woodworking joints.
  Butt       Mortise and tenon       Dowel
  Miter     Dovetail               Biscuit
  Rabbet    Groove (plough)        Blind dado
  Dado      Lap                    Pocket
  Spline
• Construct the basic wood joints used in furniture construction.

**Standard 2**
Understand and demonstrate the use of furniture components and hardware.
• Identify the components of a face frame and cabinet box.
  - Stile
  - Rail
  - Mullion
  - Side
  - Veneer
  - Base
  - Shelf
  - Web frame
  - Kicker
  - Drawer runner/glide
  - Back
• Identify the door options in furniture making:
  • Flush
  • Overlay
  • Lip
  • Tambour
• Identify the components of a drawer.
• Identify and properly install common furniture hardware such as:
  • Hinges - offset, overlay, European, butt
  • Drawer guides
  • Pulls and knobs
  • Shelf supports
• Assemble a project with the proper adhesive and fasteners.
• Construct a drawer.
• Install a lid or door and drawer.
• Identify basic construction methods.
  • Frame and panel
  • Casework construction
  • Post and rail

**Standard 3**
Understand and demonstrate sanding and finishing techniques.
• Understand and properly apply the basic rules of sanding.
• Select and correctly use each specified grit size.
• Properly prepare a surface for finishing.
• Properly apply stain, penetrating oil, and/or a clear finish.
• Properly apply a clear coat.

**Standard 4**
Understand order of operations.
• Identify the steps for squaring a board.
  • Joint an edge
  • Rip to width
  • Cut one end square
  • Cut to length
Performance Skill
Understand milling and assembly.
- Understand and demonstrate the use of joinery.
- Understand and demonstrate the use of furniture components and hardware.
- Understand and demonstrate sanding and finishing techniques.
- Understand order of operations.

STRAND 5
Students will be able to perform automated manufacturing processes using CNC equipment.

Standard 1
Understand X, Y, Z axis.

Standard 2
Understand vector lines.

Standard 3
Define G-code.

Standard 4
Create a tool path and use a CNC machine to make a cut.

Standard 5
Define vector and raster.

Performance Skill
Perform automated manufacturing processes using CNC equipment.
- Understand X, Y, Z axis.
- Understand vector lines.
- Define G-code.
- Create a tool path and use a CNC machine to make a cut.
- Define vector and raster.

STRAND 6
Students will understand the importance of career readiness skills as it relates to the workplace and outlined in the SkillsUSA Framework – Level 2.

Standard 1
Understand and demonstrate reliability.
- Determine individual time management skills.
- Explore what’s ethical in the workplace or school.
- Demonstrate awareness of government.
- Demonstrate awareness of professional organizations and trade unions.
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Standard 2
Understand and demonstrate responsiveness.
- Define the customer.
- Recognize benefits of doing a community service project.
- Demonstrate social etiquette.
- Identify customer expectations.

Standard 3
Understand resiliency.
- Discover self-motivation techniques and establish short-term goals.
- Select characters of a positive image.
- Identify a mentor.

Standard 4
Understand and demonstrate workplace habits.
- Participate in a shadowing activity.
- Explore workplace ethics: codes of conduct.
- Recognize safety issues.
- Perform a skill demonstration.
- Exercise your right to know.

Standard 5
Understand and develop initiative.
- Develop personal financial skills.
- Develop a business plan.
- Investigate entrepreneurship opportunities.

Standard 6
Understand and demonstrate continuous improvement.
- Conduct a worker interview.
- Demonstrate evaluation skills.
- Examine ethics and values in the workplace.
- Develop a working relationship with a mentor.
- Construct a job search network.

Skill Certificate Test Points by Strand

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<th>Test Name</th>
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