Wood Design and Production II

Curriculum/Content Area: Applied Technology & Engineering (ATE)	Course Length: 1 Term
Course Title: Woods Design and Production I	Date last reviewed: October 21, 2015
Prerequisites: Woods Design and Production I	Board approval date: November 17, 2015

Desired Results

Course description and purpose:
This advanced level course builds on the foundations learned in Woods I. Modern manufacturing technology methods will be emphasized as the student learns advanced skills in project planning and production, joinery, CNC machining and finishing techniques while producing a personal project. Advanced use of jigs and fixtures will be employed while students may participate in mass production of a consumer good. Through project based applications students will learn the proper care and application of industry standard tools and equipment to produce a manufactured product. This course is designed for students with a sincere interest in woodworking or related field as a possible profession or serious hobby. There is a fee for the materials used in this course.

Enduring Understandings (EUs):	**Essential Questions (EQs)**:
1. Manufactured products are made from a variety of materials, many products are constructed of wood. 2. Wood is a renewable resource. 3. Manufacturing involves many processes including cutting, boring, joining, turning, finishing, and assembly. 4. Workplace safety is one of the most important aspects of any career. 5. Sketches, drawings, and images are used to record and convey specific types of information depending upon the audience and the purpose of the communication. 6. Variation in a process and the measurement of its product is unavoidable, these properties are characterized by precision and accuracy. 7. There is value in the use and	1. Why is design a major factor in determining product selection for mass production? 2. When solving a problem, how can one be reasonably sure that the BEST solution possible has been created? 3. How are CNC machines used in industry to speed production and increase accuracy 4. How can math concepts and skills be applied to solve woodworking design problems? 5. What are the post-secondary and employment opportunities available in woodworking, manufacturing or carpentry? 6. What is the the impact of new technologies, both in materials, tools and processes on the manufacturing, woods and construction industries? 7. How are the processes learned in

understanding of measurement systems when producing a manufactured good or product. 8. Imagination (creativity) and skill (craftsmanship) are interwoven and must both be valued in the production of any quality piece. 9. Unlimited potential for employment exists within the manufacturing, carpentry and related fields. 10. Manufactured products exist to fulfil a societal need or want. 11. The federal Occupational Safety and Health Act provides a mechanism for creating a safe work environment for all workers	woodworking applied to other manufacturing processes involving different raw materials (plastic, metal, glass, etc.)? 8. Why is safety of the utmost importance in the workplace? 9. What potential workplace safety hazards exist in every shop or manufacturing facility?

Assessment Evidence

Performance assessment: Project based assessments will be used in all units to assess student mastery. In addition other performance assessments will include portfolios, performance tests and student produced products.	Other assessments may include: ● oral presentations ● self & peer assessment tools ● (rubric/checklists rating scales) ● demonstrations ● paper-and-pencil tests ● laboratory reports ● portfolio analysis

UNITS
1. Planning and Design 2. Safety 3. Materials & Processes 4. Computer Aided Manufacturing 5. Mass Production

Unit #1: Planning and Design
Major Topics: 1. Layout 2. Plan reading (blueprints) 3. Plan design for mass production.

a. Design Decisions
b. Human Factors
c. Design Process

4. Code generation for cnc machine tool operation
5. Measurement

Standards:

Wisconsin Technology and Engineering Standards

AC1.b: Apply measurement systems in the planning and layout process

AC1.b.3.e: Demonstrate scale and proportion (i.e. a toy car is a scale model of a full-sized car).

AC1.b.4.e: Demonstrate use of the Standard Measuring System to the 1/4” and the Metric Measuring System to centimeters.

AC1.b.5.e: Add, subtract, multiply and divide in the Standard Measuring System to the 1/4” and the Metric Measuring System to centimeters.

AC1.b.7.m: Calculate the required materials for simple structures.

AC1.b.8.m: Demonstrate basic dimensioning skills including the use of: dimension, extension, center and leader lines.

AC1.b.9.m: Demonstrate use of the Standard Measuring System to the 1/16” and the Metric Measuring System to millimeters.

AC1.b.10.m: Add, subtract, multiply and divide in the Standard Measuring System to the 1/16” and the Metric Measuring System to millimeters.

AC1.b.13.h: Convert scaled blueprint drawing measurements to full dimensions for a given construction project.

ICT1.a.2.e: Discuss how technology enables people to communicate by sending and receiving information.

ICT1.a.3.e: Identify symbols which can be used when communicating. (i.e., a logo)

ICT1.a.4.e: Identify how knowledge can be acquired and sent through a variety of technological sources, including print and electronic media.

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: Analyze and use tools and materials.

BB1.b.1.e: Explain that tools are used to design, make, use, assess technology and extend human capabilities such as holding, lifting, carrying, fastening, separating and computing.

MFN1.b: Create and communicate alternative solutions.

MNF.1.b.1.e: Introduce critical thinking skills to make educated decisions and solve problems.

MNF.1.b.2.e: Learn basic methods of verbal, written and graphical communication as it relates to manufacturing.

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.

CCSS

CCSS.ELA-Literacy.SL.9-10.1
Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CCSS.ELA-Literacy.SL.9-10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Learning Targets:

I can:

- create a shop operation sequence and lab layout to mass produce a pre-designed product
- match worker skill with production needs
- generate gcode from a working CAD file in order to operate a cnc milling type machine
- analyze a designed product and determine best joinery to be used for aesthetics and function
- interpret a drawing and transfer required measurements to stock for production
- read a blueprint in order to produce a manufactured good
- measure accurately to 1/16th of an inch
- Use appropriate tools to measure and layout a piece of material
- Add, subtract, multiply and divide in the Standard Measuring System

Unit #2: Safety

Major Topics:

1. Electrical Hazards
2. Mechanical Hazards
3. Chemical Hazards
4. Hand Tools
5. Hand Power Tools
6. Stationary Machines
7. Shop Rules, OSHA Regulation

Standards:

Wisconsin Technology and Engineering Standards

BB1.b: Analyze and use tools and materials.
BB1.b.1.e: Explain that tools are used to design, make, use, assess technology and extend human capabilities such as holding, lifting, carrying, fastening, separating and computing.
BB1.b.2.e: Recognize that materials have many different properties that are leveraged in making things.
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).
AC1.d: Demonstrate the safe and appropriate use of portable power tools that are common to the residential construction industry and are appropriate to the individual student's level.
AC1.d.1.e: Discuss that all tools must be properly cared for.
AC1.d.2.m: Demonstrate the safe and proper use of power tools.
AC1.d.3.m: Demonstrate the safe and proper use of pneumatic tools.
AC1.d.4.m: Demonstrate proficiency in the proper care of all tools used in a class or lab.
AC1.d.5.h: Demonstrate the use of portable power tools, such as circular saws, table saws, saber saws, drills, planers and sanders, safely and properly.
AC1.d.6.h: Demonstrate the use of portable pneumatic tools, such as rough framing nail guns, interior finishing and brad nail guns, hammers, impact wrenches, drills and compressors, safely and appropriately.
AC1.d.7.h: Maintain and care for portable power tools and portable pneumatic tools.
AC1.f: Demonstrate the value and necessity of practicing occupational safety in the construction industry facility and job site.
AC1.f.1.e: Discuss how electricity is useful but dangerous.
AC1.f.2.e: Recognize that all work environments are places where accidents and injuries can occur.
AC1.f.3.m: Explain electrical safety standards and proper wiring methods.
AC1.f.4.m: Recognize the potential accidents and injuries that may occur in a given work environment.
AC1.f.5.h: Demonstrate the safe use of electrical connection methods and electrical wiring procedures.
AC1.f.6.h: Demonstrate the safety procedures and practices in various work environment settings pertaining to residential and commercial construction.

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Learning Targets:

I can...

- identify career areas in the manufacturing, construction and carpentry fields.
- demonstrate the safe and proper use of hand, power and stationary tools
- analyze and match the proper tool for the correct procedure
- distinguish and identify electrical, chemical and mechanical hazards in the workplace

Unit #3: Materials and Processes

Major Topics:

1. Applications - Furniture Making, Millwork
    a. Hardwood
    b. Softwood
2. Applications - Cabinet Making
    a. Sheet Stock (plywood)
    b. Man-Made (laminates)
3. Properties and structure
4. Conservation
5. Processes
    a. cutting
    b. boring
    c. planing
    d. turning
    e. sanding
    f. finishing
6. Advanced Joinery

Standards:

Wisconsin Technology and Engineering Standards

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.

AC1.a.10.h: Analyze how structures are constructed using a variety of processes and procedures.

BB1.b.2.e: Recognize that materials have many different properties that are leveraged in making things.

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).

AC1.e.5.e: Explain the importance of communication.

BB1.a.2.e: Identify that systems have parts or components that work together to accomplish a goal.

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.

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Learning Targets:

I can...

- perform a cost analysis to determine the best application of a raw material to mass produce a product based on economics and quality
- identify career areas in the manufacturing, construction and carpentry fields.
- select appropriate resources and explain how trade-offs between competing values, such as availability, cost, desirability and waste influenced my decision.
- distinguish between hardwood, softwood and manufactured sheet goods and correctly select the appropriate material for an intended product.
- apply the correct material for an intended purpose including millwork, furniture making, cabinet construction, etc.
- evaluate the machinability of select wood species and determine suitability for a given process or application.
- evaluate various vendors and make the best selection for the purchase of supplies and raw materials
- correctly identify major wood species and determine best application for each depending on customer desire, machinability, cost, etc.
- safely operate hand and power equipment to perform cutting, boring, planing, sanding and finishing operations with wood.

Unit # 4: Computer Aided Manufacturing

Major Topics:

1. Machine and tool selection
2. Feeds and speeds
3. Machine code
4. Jigs and fixtures
5. CAD/CAM applications
6. Prototyping and simulation

Standards:

Wisconsin Technology and Engineering Standards

AC1.g.10.h: Demonstrate proficiency in the practical application of the processes and materials (e.g., structural, electrical, mechanical, finish) appropriate to architectural design and construction.

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.c.1.e: Identify the types, functions and applications, of simple mechanical components (e.g. levers, linkages, cranks, cams, gears, pulleys & belts, sprockets & chains).

BB1.c.2.m: Explain the relationship between the inputs and outputs of linear, rotary and compound motion mechanisms in terms of direction, distance and force.

MNF.1.b.1.e: Introduce critical thinking skills to make educated decisions and solve problems.

ENG5.b.2.e: Use computers and technology to access and organize information.

ENG5.b.3.e: Discuss following step-by-step directions to assemble a product.

ENG5.b.4.m: Operate and maintain systems in order to achieve a given purpose.

ENG5.b.5.m: Use computers, calculators and technology in various applications.

ENG5.b.6.h: Operate systems so that they function in the way they were designed.

ENG5.b.7.h: Use computers and calculators to access, retrieve organize, process, maintain, interpret and evaluate data and information in order to communicate.

ENG5.b.8.h: Troubleshoot, analyze and maintain systems to ensure proper function, accuracy and precision.

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Learning Targets:

I can:

- Identify machines when given a process and identify the process that a given machine performs.
- Determine the appropriate speed rate for a given material using a tool with a given diameter.

- Determine the feed rate for a given material using a tool with a given diameter. • Read and interpret G & M codes.
- Transfer the drawings made in CAD to a CAM program.
- Create numerical code using a CAM program.
- Verify the creation of a part using a simulation software.
- Create parts using the machines demonstrated by the instructor.
- Create a product on the computer using knowledge of manufacturing processes.

Unit # 5: Mass Production

Major Topics:

1. Lab/Shop Layout
2. Marketing
3. Processes
4. Ergonomics and efficiency

Standards:

Wisconsin Technology and Engineering Standards

ENG2.b.1.e: Expressing ideas to others, verbally and through sketches and models, is an important part of the design process.

MNF.1.b.2.e: Learn basic methods of verbal, written and graphical communication as it relates to manufacturing.

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.

ENG2.b.2.e: Discuss how models are used to communicate and test design ideas and processes.

ENG2.b.3.m: Modeling, testing, evaluating and modifying are used to transform ideas into practical solutions.

ENG2.b.4.h: A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.

ENG4.a.4.m: Demonstrate two-dimensional and three-dimensional representations of the designed solution.

ENG4.c.1.e: Discuss the process of designing involves presenting some possible solutions in visual form and then selecting the best solution(s) from many.

ENG5.a.3.e: Recognize and use everyday symbols such as numbers and symbols to communicate key ideas.

ENG5.a.4.m: Identify information provided in manuals, protocols or by experienced people to identify how things work.

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Learning Targets:

I can:

- identify career areas in the manufacturing, construction and carpentry fields.
- create a plan to mass produce a product made primarily from wood.
- identify the tasks and procedures necessary to mass produce a product.
- conduct market research and marketability of a product.
- produce a prototype of an intended product.
- evaluate the efficiencies of personnel and equipment in order to improve productivity.