

Wilson Area School District Planned Course Guide

Title of planned course: Materials Processing

Subject Area: Technology Education

Grade Level: 9-12

Course Description: Materials Processing is an introductory course that provides students with the opportunity to learn the skills and processes associated with various types of woodworking. Students will also develop skills necessary to incorporate metals, plastics and manufactured materials into their projects through the use of CNC equipment including routers, lasers, 3d printers, & waterjet cutters. Through hands-on projects that use woodworking tools and techniques, students develop competence with woodworking safety, project planning and layout, basic project construction, joinery, manufacturing production, and construction systems. Students plan and construct projects aligned with their interests and abilities.

Time/Credit for this Course: Half Year / 0.5 credit

Curriculum Writing Committee: Erik Everett

Wilson Area School District Planned Course Materials

Course Title: Materials Processing

Textbook:

- *Modern Woodworking*, Willis H. Wagner and Clois E. Kicklighter Ed.D., 2006
- *Furniture and Cabinet Making*, John L. Feirer, 1983

Supplemental Books:

- Fine woodworking magazine
- Popular woodworking magazine

Teacher Resources: (STEELS Standards) pdesas.org

Curriculum Map

Fall Semester

- August:** Introduction to materials processing topics
- September:** Introduction to materials processing topics
- October:** Personal project work & presentation
Woodworking Basics and Joinery
- November:** Personal project work & presentation
Woodworking Basics and Joinery
- December:** Personal project work & presentation
Advanced Woodworking and Project Design
- January:** Personal project work & presentation
Advanced Woodworking and Project Design

Spring Semester

- January:** Introduction to materials processing topics
- February:** Introduction to materials processing topics
Personal project work & presentation
Woodworking Basics and Joinery
- March:** Personal project work & presentation
Woodworking Basics and Joinery
- April:** Personal project work & presentation
Advanced Woodworking and Project Design
- May:** Personal project work & presentation
Advanced Woodworking and Project Design
- June:** Personal project work & presentation

Curriculum Scope & Sequence

Planned Course: Materials Processing

Unit: Introduction to materials processing topics

Time frame: 5 weeks

STEELS Standards:

3.5.9-12.A - Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.B - Critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal.

3.5.9-12. D - Critique whether existing or proposed technologies use resources sustainably.

3.5.9-12.F Evaluate a technological innovation that arose from a specific society's unique need or want.

3.5.9-12.AA - Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.BB - Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

3.5.9-12.DD - Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.

Essential content/objectives: At the end of the unit, students will be able to:

- Understand the course expectations and timeline for instruction.
- Understand the discipline policy that relates to behavior in this class.
- Utilize the Customary system of measurement and present measurements in simplest form.
- Add, Subtract, and divide fractions and present them in simplest form.
- Model and compare values of integers, mixed numbers, fractions, and decimals.
- Describe personal safety measures designed to protect workers.
- Demonstrate effective practice of eliminating hazards, poor decisions, and unsafe conditions that could lead to accidents.
- Safely operate a CNC laser engraver/cutter, CNC router, table saw, planer, jointer, router, band saw, scroll saw, drill press, disk and belt sander, hand drill, etc.
- Safely use hand tools- hammer, screwdriver, hand saw, coping saw, hacksaw, sandpaper
- Evaluate which tools and machines can be used to achieve good results with minimal waste.
- Describe the different processes used in materials processing

Core Activities: Students will complete/participate in the following:

- Course introduction presentation & handouts
 - Course description
 - Class expectations
 - Grading procedures
 - Assignment posting & completion
 - Classroom tour

- o Student storage
- o Bathroom procedures
- Overview of wood, metal, and plastic materials available
 - o Red oak, Basswood, Cherry, Maple, Walnut
 - o Plywood
 - o Stainless Steel
 - o Acrylics
 - o PLA (3D printed)
- Hand tool demonstrations, lessons, & worksheets
 - o Tools names: Square, ruler, tape measure, scraper, nail guns, jig saw, impact drill, standard drill, orbital sander
 - o Storage location
 - o Proper use & techniques
 - o Safety
- Machine safety demonstrations, lessons, & worksheets
 - o Machine: Planer, miter saw, jointer, table saw, drill press, router
 - o Location
 - o Proper use & techniques
 - o Safety
- Safety PPE and personal practices worksheet
 - o Clothing & footwear
 - o Eye protection
 - o Ear protection
 - o Respiratory protection
- Basic measurements worksheet and layout techniques demonstration
 - o Customary System
 - 1/16 Precision
 - Adding, subtracting, dividing fractions
 - o Unit conversions
 - inches to mm
 - o Ruler, tape measure, & square use

Extensions:

- Current events
- Independent study
- Creation of a safety poster to improve lab safety
- Material measurement challenge

Remediation:

- Review
- Unit Terms and Questions
- Homework
- One-on-one re-teaching
- Supplemental reading

Instructional Methods:

- Direct instruction
- Demonstrations
- Labs
- Lecture
- Observation

- Peer-to-peer collaboration
- Group problem-solving

Materials & Resources:

- Google classroom assignments
 - Worksheets
 - Safety Videos
- Supplemental books
- Internet resources
- Video / Projector
- Classroom tools, machines, and Materials

Assessments:

- Machine/tool safety tests
- Measurement test
- Class discussion (Question & Answer)
- Homework/classwork assignments

Curriculum Scope & Sequence

Planned Course: Materials Processing

Unit: Personal project work & presentation

Time frame: Throughout course

STEELS Standards:

3.5.9-12.A - Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.B - Critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal.

3.5.9-12. D - Critique whether existing or proposed technologies use resources sustainably.

3.5.9-12.I (ETS) Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

3.5.9-12.M Develop a device or system for the marketplace.

3.5.9-12.P Apply a broad range of design skills to a design thinking process.

3.5.9-12.Q Implement and critique principles, elements, and factors of design.

3.5.9-12.U Evaluate and define the purpose of a design.

3.5.9-12.W Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs.

3.5.9-12.AA - Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.BB - Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

3.5.9-12.DD - Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.

Essential content/objectives: At the end of the unit, students will be able to:

- Develop safe working habits
- Calculate material costs for a project
- Breakdown a list of materials and classify them in their proper headings
- Communicate ideas through drawing or sketching
- Effectively manage time to meet deadlines
- Utilize feedback to correct material defects
- Create a visually appealing presentation highlighting key project steps
- Select materials based on characteristics, quantity needed, and availability

Core Activities: Students will complete/participate in the following:

- Project design & management skills lesson
 - Planning
 - Material selection
 - 2D & 3D drawings
 - Design thinking process
 - Budgeting
 - Material list & board foot calculations
 - Time management
- Testing and refining projects based on feedback
 - Fixing defects
- Project presentation
 - Portfolio development
 - Google slide templates
 - Project steps & pictures
 - Reflection

Extensions:

- Current events
- Independent study
- Advanced hands-on application
- Creation of a project guide

Remediation:

- Review
- Unit Terms and Questions
- Homework
- One-on-one re-teaching
- Supplemental reading
- Direct feedback

Instructional Methods:

- Direct instruction
- Demonstrations
- Labs
- Lecture
- Observation
- Peer-to-peer collaboration
- Group problem-solving

Materials & Resources:

- Google classroom assignments
 - Worksheets
 - Project templates
- Supplemental books
- Internet resources
- Video / Projector
- Classroom tools, machines, and Materials

Assessments:

- Weekly reflection
- Class discussion (Question & Answer)
- Homework/classwork assignments
- Project rubric

Curriculum Scope & Sequence

Planned Course: Materials Processing

Unit: Woodworking Basics & Joinery

Time frame: 8 weeks

STEELS Standards:

3.5.9-12.A - Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.B - Critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal.

3.5.9-12. D - Critique whether existing or proposed technologies use resources sustainably.

3.5.9-12.AA - Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.BB - Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

3.5.9-12.DD - Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.

Essential content/objectives: At the end of the unit, students will be able to:

- Classify forested materials by hardwood, softwood, geographic location and the characteristics which determine the classification
- Select materials for different applications according to their properties
- Identify laminated construction materials and their uses
- Describe the different processes used in materials processing
- Demonstrate different styles of separating, forming, conditioning and combining techniques
- Consider material characteristics when selecting materials to use
- Select an appropriate woodworking based on the specific project & purpose
- Identify and use the correct combining tools and materials
- Apply finishing techniques to a project based on specific materials used and project specifications
- Understand and put into practice basic finishing and polishing techniques such as spray-coating and wipe on.

Core Activities: Students will complete/participate in the following:

- Worksheet on types of wood and their characteristics
 - Hardwoods
 - Softwoods
 - Manufactured panels
 - Material Characteristics
 - Checking
 - Cupping
 - Shake
 - Snipe
 - Open grain

- Closed grain
- Demonstration on measuring, marking, and cutting techniques
 - Rough material layout
 - Final layout and alignment
- Lesson on common woodworking joints
 - Butt joint
 - Dovetail
 - Bow tie
 - Miter
 - Lap
- Demonstration on use of clamps, adhesives, and fasteners
 - Bar clamp
 - Edge joining
 - Quick clamp
 - Wood glue
 - Interior & exterior applications
 - Brad nails
 - Pin nails
 - Pocket holes
- Introduction to finishing techniques (sanding, staining, sealing)
 - Hand sanding
 - Sanding blocks
 - Orbital sanding
 - Sanding grits
 - 80,120,220
 - Stains
 - Oil stain
 - Gel stain
 - Pre stain conditioner
 - Sealing finishes
 - Polyurethane
 - Acrylic Urethane
 - Butcher block Conditioner (mineral oil & wax)

Extensions:

- Current events
- Independent study
- Advanced hands-on application
 - bow tie inlays
 - Raising the grain

Remediation:

- Review
- Unit Terms and Questions
- Homework
- One-on-one re-teaching
- Supplemental reading

Instructional Methods:

- Direct instruction
- Demonstrations

- Labs
- Lecture
- Observation
- Peer-to-peer collaboration
- Group problem-solving

Materials & Resources:

- Google classroom assignments
 - Worksheets
 - Project templates
- Supplemental books
- Internet resources
- Video / Projector
- Classroom tools, machines, and Materials

Assessments:

- Weekly Reflection
- Class discussion (Question & Answer)
- Homework/classwork assignments

Curriculum Scope & Sequence

Planned Course: Materials Processing

Unit: Advanced Woodworking and Project Design

Time frame: 4 weeks

STEELS Standards:

3.5.9-12.A - Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

3.5.9-12.B - Critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal.

3.5.9-12. D - Critique whether existing or proposed technologies use resources sustainably.

3.5.9-12.K (ETS) Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

3.5.9-12.M Develop a device or system for the marketplace.

3.5.9-12.P Apply a broad range of design skills to a design thinking process.

3.5.9-12.Q Implement and critique principles, elements, and factors of design.

3.5.9-12.W Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs.

3.5.9-12.AA - Safely apply an appropriate range of making skills to a design thinking process.

3.5.9-12.BB - Assess how similarities and differences among scientific, technological, engineering, and mathematical knowledge and skills contributed to the design of a product or system.

3.5.9-12.DD - Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.

3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

Essential content/objectives: At the end of the unit, students will be able to:

- Convert hand drawings into digital designs using CAD software
- Demonstrate appropriate setup techniques required for each CNC machine
- Identify machine axes specific to the coordinate system
- Use the CNC router to create a juice groove and profile cutout
- Use the CNC laser to scan engrave a custom design
- Assess the design is correctly programmed through simulated cuts

Core Activities: Students will complete/participate in the following:

- Introduction to CAD software for woodworking designs
 - AutoCAD
 - 2D drawing
 - RDworks
 - Laser programming
 - VCarve
 - CNC router programming
- Precision measurement and tool setup
 - Squaring up with machine axes
 - Zeroing axes (X,Y, & Z)
 - Laser (Focus z axis, Framing outline)
- Introduction to CNC machinery and digital fabrication in woodworking
 - CNC Router
 - Juice Groove
 - Profile Toolpath
 - Tabs
 - CNC Laser
 - Scan engraving

Extensions:

- Current events
- Independent study
- Advanced hands-on application
- Laser engraved inlays

Remediation:

- Review
- Unit Terms and Questions
- Homework
- One-on-one re-teaching
- Supplemental reading

Instructional Methods:

- Direct instruction
- Demonstrations
- Labs
- Lecture
- Observation
- Peer-to-peer collaboration
- Group problem-solving

Materials & Resources:

- Google classroom assignments
 - Worksheets
 - Project templates
- Supplemental books
- Internet resources
- Video / Projector
- Classroom tools, machines, and Materials

- Machine guides (Power settings)

Assessments:

- Weekly reflection
- Class discussion (Question & Answer)
- Homework/classwork assignments