Construction Technologies

Cochranton Junior Senior High School

Applied Engineering and Technology

Course Description: This course will focus on the everyday tools, techniques, and skills used in everyday construction and manufacturing. The first semester of the class will focus on the proper operation of power and hand tools such as the portable drill, circular saw, planer, jointer, table saw, miter saw, and others. Students will be guided through units on foundation construction, floor framing, wall framing, shingling, A/C wiring, and others. From the skills and knowledge achieved during the first semester, the class will design an outdoor shed in Solidworks which they will build for a fundraiser and auction during the following school year. The last twelve weeks of class will be spent outside building the outdoor shed.

Unit Title: Introduction and Orientation

Suggested time frame: 1 weeks

Sept 1-Sept 8

Standards: 3.4.10.D3

Big Idea: Technology is created, used and modified by humans.

Essential Questions:

-How are rehearsing, speaking and listening techniques valuable in preparing for a job interview?

-What are your expectations for this course?

-Do you have any experience working with hand and power tools?
-When was the first time you used a computer? Do you think that technology will be a benefit throughout this course?

Competency	Vocabulary	Strategy	Resource
• Describe local program and expectations, policies, and procedures. • Describe local program and vocational center policies and procedures including dress code, attendance, academic requirements, discipline, shop/lab rules and regulations. • Give a brief overview of the course. Explain to students what Construction Technology is, why it is important, and how it will be delivered. • Compare and contrast local program and school policies to expectations of employers. • Preview course objectives, program policy, and the industry standards	-Policies -Employment -Assessment -Objectives	-Assess student orientation, policy, and procedure knowledge through instructor observations and a written unit test. File the completed test to document student mastery of the school and program policies and procedures. -Have students evaluate themselves weekly using the Workplace Skills Weekly Checklist. -Have students peer review work and make corrections.	-Student and Safety In Technology Education Contract - Orientation Test -Various Bellringers/Anticipatory Sets

Unit Title: Basic Math

Suggested time frame: 3-4 Class Periods

Standards: CC.2.1.HS.F.5, 3.4.10E4

Big Idea: Basic mathematic concepts are used in everyday life and no more importantly than in construction technologies.

Essential Questions:
-How does individual construction and architectural prints tell you information properly?
-Why do you think basic measuring skills are important to this trade and skill-set?
-How can using a simple calculation such as area relate directly to construction technologies?

Competency	Vocabulary	Strategy	Resource
• a. Define terms related to construction math. • Add, subtract, multiply, and divide whole numbers, decimals, and fractions. • Convert whole numbers to fractions, and convert fractions to whole numbers. • Convert decimals to percents, and convert percents to decimals. • Convert fractions to decimals. • Convert fractions to percents. • Demonstrate reading a tape measure to the nearest 16th.	-Denominator -Numerator -Fractions -Improper Fractions -Proper Fractions -Reciprocate -Conversion -Match -Blueprint -Equivalent	- Have students define, illustrate, and give examples of terms related to construction math. Examples should include how to use these terms in basic math principles as well as real-world situations. The terms can include but are not limited to acute angle, adjacent angles, angle, area, bisect, borrow, carry, circle, circumference, convert, cubic, decimal, degree, denominator, diagonal, diameter, difference, digit, English ruler, equilateral triangle, equivalent fractions, formula, fraction, improper fraction, invert, isosceles	-Card Stock -Measuring pre-test -Measuring Test -Various Bellringers -Sample Blueprints -Access to various rooms within the school setting to compare blueprint difference.

		triangle, long division, machinist's ruler, meter, metric ruler, mixed number, negative numbers, numerator, obtuse angle, opposite angles, percent, perimeter, pi, place value, positive numbers, radius, rectangle, remainder, right angle, right triangle, square. -Have students estimate their own height and the height of a partner in centimeters. Then have them pair up and measure their heights with a tape measure to see how closely they estimated. - Have students use sample blueprints to calculate the square footage of a house plan. As an extension, have students work as a team to use measurement tools to determine the square 52 footage of the classroom, building, cafeteria, and so forth	

Unit Title: Hand and Power Tools

Suggested time frame: 3-4 weeks

Standards: 3.7.10.A, 3.6.12.B, OSHA and NIOSH Standards and Regulations

Big Idea: Understanding and demonstrating workplace skills and knowledge is paramount.

Essential Questions: -How can mastery of basic construction tools and equipment make you a better employee?
-What is the essential difference between a miter, crosscut, rip, bevel and compound bevel?

Competency	Vocabulary	Strategy	Resource
• Identify basic hand and power tools (e.g., hammer, screwdriver, saw, wrench, pliers, and drill) used in the field and how they have advanced through time. Have students use the Inspiration program to illustrate a timeline of the evolution of hand and power tools. • Discuss safety factors, proper use, and maintenance. Describe accidents that can occur while using tools. Divide students into groups, and give each group a scenario or case study (written or on video) involving an accident. Have each group identify safety mistakes in each situation; determine correct procedures; and present the scenario, mistakes found, and procedures that should have been used.	-Miter Saw -Circular Saw -Jig Saw -Table Saw -Portable Drill -Corded Drill -Miter -Cross cut -Bevel -Rip -Compound Miter -Framing Hammer -Finishing Hammer -Tape Measurer -Speed Square -Framing Square	Have each student complete a test to identify specific tools. - Utilize Content written and performance assessments - Evaluate the scenario through teacher assessment of appropriateness. -Evaluate the selection of the proper tool for the assigned project and demonstration of its use	--Student Safety Guides for all machines to be used -Student Safety Tests -Miter Saw, Circular Saw, Jig Saw, Planer, Jointer, Table Saw, etc…

• Given a scenario, students will choose the correct tool and explain why that tool is the correct one for the scenario. • Have students compare and contrast the benefit of working with a contractor or going into business for themselves			

Unit Title: Introduction to Blueprints and Foundations

Suggested time frame: 3 weeks

Standards: 3.4.10.E7 & 3.4.10.E4

Big Idea: Geometric relationships can be described, analyzed, and extended

Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

Essential Questions: -When developing or interpreting a blueprint, which individual plans are generally included in a site plan?

-How can you use basis math concepts such as the Pythagorean Theorem in order to determine if a structure is square?

-How does a footer within a foundation dissipate load?

Competency	Vocabulary	Strategy	Resource
• Identify terms and symbols commonly used on blueprints. • Interpret various symbols to locate various elements. • Interpret a plan to determine layout. • Interpret electrical drawings, including site plans, floor plans, and detail drawings. • Read an equipment schedule. • Explain the basic layout of a blueprint. • Describe the information in a title block. • Identify the lines used on blueprints.	-Site Plan -Foundation Plan -HVAC -Electrical -Plot Plan -Blueprint -Schematic -Pythagorean Theorem -Pier -Footer -Anchor Bolt	- Using a blueprint, explain all terms, symbols, and abbreviations on the blueprint and how they are used to locate various elements. Terms may include but are not limited to architect, architect's scale, architectural plans, beam, blueprints, civil plans, computer aided drafting (CAD), contour lines, detail drawings, dimension line, dimensions, electrical plans, elevation (EL) drawing, engineer, engineer's	-Website (www.floorplans.com) -Modern Carpentry Book -Various Bellringers/Anticipatory Sets -Guided Review Sheets -Scaled Model Pieces constructed by students -Cardboard (18x24") -Site Plan -Hot Glue Guns -Wood Snips/Cutters -Safety Glasses

• Explain the architect's and engineer's scales. • Sketch a project to scale. • Construct a structure based on a sketch. • Calculate using the Pythagorean Theorem and determine its use for squaring an object such as a foundation. • Create a scaled model (3/4" =1')		scale, floor plan, foundation plan, HVAC (heating, ventilation, and air-conditioning), hidden line, isometric drawing, leader, legend, mechanical plans, metric scale, not to scale (NTS), piping and instrumentation drawing (P&IDs), plumbing, plumbing plans, request for information (RFI), roof plan, scale, schematic, section drawing, specifications, structural plans, symbol, and title block. -Students will develop and construct a scaled ¾" = 1' model demonstrating their knowledge of foundation blueprint reading as well as scaling.	-Scaled Model Construction Rubrics

Unit Title: Introduction to Floor Framing and Subflooring

Suggested time frame: 1-2 Weeks

Standards: CC.2.3.HS.A.11, CC.2.3.HS.A.14

Big Idea: Apply geometric concepts to model and solve real world problems.

Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

Essential Questions: -In which ways can area calculations better assist you in determining the proper amount of subflooring needed to cover a flooring system?
-How can you use basis math concepts such as the Pythagorean Therom in order to determine if a structure is square?

Competency	Vocabulary	Strategy	Resource
• Exhibit the skills, attitudes, abilities, personal responsibilities, and responsibilities a person needs to work as a successful carpenter. • Identify the different types of framing systems. • Describe floor system requirements from drawings and specifications. • Identify floor and sill framing support members. • Describe the methods used to fasten sills and floor framing systems to the foundation. • Select the correct girder/beam size using specific floor load and span data. • Describe different types of floor joists. • Identify different types of bridging. h.	-Girder (Glu-Lam) -Floor Joist -Joist Header/Rim Joist -Sill -Sill Sealer -Anchor Bolt -Level -Plumb -Plumb Bob -	- Using a blueprint, explain all terms, symbols, and abbreviations on the blueprint in relation to a floor framing system consisting of sills, sill sealers, Joist Headers, Floor Joists and subflooring -Students will develop and construct a scaled ¾" = 1' model demonstrating their knowledge of foundation blueprint reading as well as scaling. -Students will work in cooperative learning groups in order to generate a scaled model of a flooring system.	-Website (www.floorplans.com) -Modern Carpentry Book -Various Bellringers/Anticipatory Sets -Guided Review Sheets -Scaled Model Pieces constructed by students -Cardboard (18x24") -Site Plan -Hot Glue Guns -Wood Snips/Cutters -Safety Glasses -Various Bell ringers -Self Assessment -Scaled Model Construction Rubrics

• Describe and explain different types of sub-flooring materials. • Estimate the amount of material needed to frame a floor assembly. • Create a scaled model (3/4” =1’) floor framing system • Estimate the amount of subflooring needed to cover a constructed flooring system • Design a sill system for a ¾” =1’ Scaled model using material provided.			

Unit Title: Introduction to Wall, Ceiling and Roof Framing

Suggested time frame: 5-6 Weeks

Standards: CC.2.3.HS.A.11, CC.2.3.HS.A.14

Big Idea: Apply knowledge and skills to determine proper safety and construction methods used in modern technological construction.

Essential Questions: -In which ways can area calculations better assist you in determining the proper amount of subflooring needed to cover a flooring system?
-How can you use basis math concepts such as the Pythagorean Therom in order to determine the length of a rafter from plumb cut to ridge cut?

Competency	Vocabulary	Strategy	Resource
• Describe the different components of a wall layout. • Explain the procedures for layout and assembly of interior and exterior wall frames (laying out a wood frame wall, including plates, corner posts, door and window openings, partition T's, bracing, and firestops). • Perform the proper procedure for assembling and erecting an exterior wall. • Classify the appropriate materials and methods used for installing sheathing on walls. • Perform layout and assembly of a given size wall. • Calculate framing and sheathing materials needed for a wall assembly	-Partition -Bracing -Stud -Sole Plate -Top Plate -Double Top Plate -Rafter -Common Rafter -Hip Rafter -Jack Rafter -Header -16D -8D -Corner Post/Construction -Fire Stops -Balloon Framing -Platform Framing -On Center	- Demonstrate procedures for assembling and erecting an exterior wall. Describe the common materials and methods used for installing sheathing on walls. Demonstrate how to lay out, assemble, erect, and brace exterior walls for a frame building. Divide students into groups, and have the students lay out and assemble a wall according to specifications provided. -Students will work in cooperative learning groups in order to generate a scaled model of a wall/ceiling/roofing system.	-Scale Models up to this point -Scaled Model wall Framing Pieces proceed by groups - Pythagorean Theorem handout -2x4 framing materials -2x6 framing materials -Speed Squares -3.5" screws -Cordless Drills -Measuring Tapes -Performance Assessment Rubrics -Scaled Model Construction Rubrics

• Design a sill system for a ¾” =1’ Scaled model using material provided.		- Have students estimate the materials required to frame walls as an individual exercise.	

Unit Title: Introduction to AC Wiring

Suggested time frame: 6-8 Weeks

Standards: CC.2.3.HS.A.11, CC.2.3.HS.A.14

Big Idea: Demonstrate safety in and around electrical circuits and equipment while analyzing and creating individual circuits for testing.

Essential Questions:
-Why is OSHA such an important association when referring to the electrical occupation industry?
- What is the formula for calculating resistance in an electrical system?
-What causes resistance in an electrical system?
-Why does a wire get hot when current flows through it?

Competency	Vocabulary	Strategy	Resource
• a. Define terms related to electrical safety. b. • Demonstrate safe working procedures in a construction and shop/lab environment. c. • Explain the purpose of OSHA and how it promotes safety on the job. d. • Identify electrical hazards and how to avoid or minimize them in the workplace. e. • Explain safety issues concerning lock-out/tag-out procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems	-Receptacle -GFCI -Single Pole -Double Pole -3 Way Switch -Continuality -Resistance -Current -Voltage -Circuit -Linesman -Combination Strippers -Sheathing -Romex -Residential	-Have students research the electrical industry. Research can include information from traditional classroom resources, the Internet, and industry mentors. Invite a guest speaker to visit the class and discuss electrical safety issues and give an overview of the electrical industry. - Have students perform basic safety techniques. Observe student performance to ensure mastery of safety skills. If students are not performing to mastery, guide students through the proper procedure	-AC Wiring Handouts • Wires • Switches • GFCI's • Receptacles • Service panels -Various Bellringers -Receptacles -Single Pole Switches -Double Pole Switches -Three Way Switches -Romex Wire (14g and 12G) -New Construction Boxes -1/2" Knockouts -Sheathing Strippers -Linesman Pliers -Wire Nuts

• Individually analyze and create individual circuits such as single pole switch circuits, three-way switch circuits, receptacle circuits and 4 way circuits.		and have students perform the techniques again. - Observe the student simulated experience, and provide verbal feedback. Have students continue to complete safety techniques until mastery. -Define terms related to electrical theory. -State how electrical power is generated and distributed. I -Identify voltage, and identify the ways in which it can be produced. -Compare the difference between conductors and insulators. -Describe how voltage, current, resistance, and power are related. - Explain the different types of meters used to measure voltage, current, and resistance. -Use Ohm's law to calculate the current, voltage, and resistance in a circuit. -Calculate how much power is consumed by a circuit using the power formula. - Describe the differences between series and parallel circuits. -Calculate the amount of power used by a circuit using the power formula.	

Unit Title: Shed Design and Construction

Suggested time frame: 12 Weeks

Standards: CC.2.3.HS.A.11, CC.2.3.HS.A.14, 3.7.10.A, 3.6.12.B, CC.2.1.HS.F.5, 3.4.10E4

Big Idea: Technological Design is a creative process that anyone can do which may result in new inventions and innovations.

Essential Questions:
-Analyze and interpret various different storage structures and determine common themes from one to another?
- In which ways can you as a job site foreman maximize efficiency on your job or within the workplace?
-What attributes do you feel make you a great and worthwhile employee?
-How might you go about determining the best course of action to brainstorm, plan, design, and produce a basic storage shed within the remainder of time in this class.

Competency	Vocabulary	Strategy	Resource
• This unit will reflect on all other competencies throughout the prior lessons taught within the classroom setting • Over the course of the reminder of the class, students will design and construct a shed no larger than 10' x 10' using skills taught over the course of the year. • This project will integrate all aspects of job site safety, tool usage, floor framing, wall, ceiling, roof framing, AC Wiring, Roofing, and finishing woks.	-Shingles - Fascia -Soffit -J-Channel -F-Channel -Ridge Vent -Ridge Cap -Brake	-Students will be split up into various different crews with differing job assignments. • Skid System • Walls (Front,Left,Right,Rear) • Roof/Rafters • Shingling • Siding • Soffit • Fasica • Doors/Windows -All students will work on all parts of the construction but	-Hammers -Corded and Cordless Drills -16d and 8d Nails -3.5" Deck Screws - 1.5" Aluminum Siding Nails -2x4 Lumber -2x6 Lumber -4x4 Lumber -SolidWorks Schematics and Plans -Miscellaneous Tools and Equipment mentioned throughout previous lessons.

		with direction from the crews members of that particular crew. - Students will be assessed daily/weekly based upon the supplied Performance Assessment Rubric. -Daily Crew meetings will occur with students leading the discussion and tasks.	