

## UC Course Submission Form

**Course Title:**           **MultiCraft Core Curriculum: Building Scaled Structures**

**Academic Subject and Discipline (Building & Trades with English & Math)**

**CTE Sector and Pathway:**   **(“g”) Interdisciplinary**

### **Course Overview**

**A brief summary of the purpose of the course and the topics and skills learned overall.**

This course has been developed to integrate skills and concepts from the Building and Construction Trades with applied mathematics and English. As a natural progression, students will apply the craft skills required to design and build a variety of scaled structures that meet current code requirements. In addition, students will make real-world connections between construction, math, and English using written projects, construction documents that include creating blueprints, project packets, and student-centered construction projects. This course provides students the opportunity to apply academic knowledge and technical skills through a hands-on curriculum that meets pre-apprenticeship requirements for the National Building Trades Council.

### **Course Content:**

**For each unit please provide the following information:**

- 1) Unit Overview: describe the topics and skills students learn in the unit. Focus on describing the actual work of the course and not the content standards the course aligns with.**
- 2) Assignment summaries: Describe each major assignment that makes up the “identity” of the unit: What do students produce to demonstrate learning? What are the major parameters of that work and what purpose does it serve?**

### **Unit One:**

#### **Orientation and Safety**

Students receive instruction and extended practice in the orientation and industry awareness of the construction industry. Students understand and use the vocabulary of the construction trades, as well as the the vocabulary of various math concepts as they apply to the construction industry. They study math and building sequences related to measurements, geometry, and practical building applications that are related to the construction industry. Learners will receive instruction in measurement and marking/layout, the fundamental skills which will be needed to complete all of the

applied mathematics, English, and Construction units and assignments that follow in this course. This will include -- review of fractions and decimals: converting fractions to higher or lower terms, improper fractions and mixed numbers, common denominators, and adding, subtracting, multiplying, and dividing with decimals and fractions; reading a ruler and a tape measure while incorporating fractional measurements to 1/16 of an inch in a building project; reading a fractional caliper to measure material to desired thicknesses. Students practice the key concepts of general shop safety, learning the specific safety rules for the tooling that is applicable to the task at hand and acquiring the knowledge and skills required to work in a safe environment. Shop safety procedures will include; transporting sharp woodworking tools to prevent injury, shop etiquette as it applies to cleanliness and safety, safe and appropriate use of basic, non-powered hand tools including cross-cut saws, rip saws, pull-saws, coping saws, hammers and chisels, hand planes, sand paper of various grits, etc. Students will take written and practical safety tests that are applicable to each tool demonstrated as well as general shop safety procedures. Part of this unit's requirements are for students to attend an OSHA 10-Hour Safety Course. Through the successful completion of this course, the students will receive an OSHA 10 certification.

**Unit Project: Create a Skill Block**

After instruction on specific tool safety for each shop tool, students create a skill block in order to demonstrate safe operation of shop tools. To prepare them for this, they are given an orthographic drawing that they must interpret to create the skill block. Students are given a 3 in x 14 in block of wood and, using the tools of instruction, they demonstrate proper tool safety to the teacher. In order to demonstrate understanding of applied math concepts, students also use geometry tools (i.e., protractor, compass) in order to create shapes in the wood. Ultimately the shapes need to match the given orthographic drawing. While demonstrating, students should also communicate with their instructor, using the vocabulary of the instruction trades, their understanding of how the tools should be used.

**Unit Two:**

**Intermediate/Advanced Construction Techniques:**

In this unit students will explore numerous building and construction trades and discover their unique aptitudes and specific skill sets as they build wall sections using varied materials, i.e., dimension lumber products, steel stud framing for use by various

trades including but not limited to, plumbing, electrical, HVAC, finish carpentry, lath plaster and drywall, framing, glazing, veneers, waterproofing, roofing, sheet metal, concrete etc. Students will use these skills to complete the capstone project. Math skills used will include applied geometry related to the angles of roof pitches, wall angles, finish trim, etc. They will also understand the connection between fractions and decimals and how they relate to the construction process.

### **Create Pony Walls**

Using teacher provided construction drawings, students will construct interior/exterior pony wall sections to practice various trade skills by installing necessary components of a structure including but not limited to: electrical circuits, simple plumbing system, typical 3-coat stucco system, roofing materials, finish carpentry, rough framing, glazing/windows, concrete, HVAC, drywall and paint. This work allows students to apply geometric concepts such as the reading of an angle necessary for pipe bending or the measuring and cutting of angles necessary for roofing and finished carpentry. This work ultimately prepares students for the work of the culminating project in which they design and build their own small sustainable structure. The complete project should be plumb, square and level.

### **CAD Drawing**

Continuing to develop their skills in design, students will create their own design plan that includes a material list, cost estimate, and project schedule. Students will read existing construction drawings (which includes interpreting lines, symbols and abbreviations) to further understand how they are “put together.” They then use architectural drafting software or hand tools to design their own new simple structure. This work gives students a chance to apply geometric concepts to create the drawing such as the Pythagorean theorem to design (and eventually construct) square walls.

### **Historical Analysis of Architectural Styles:**

Using different sets of historical plans, students will compare and contrast changes in architectural styles and engineering/structural requirements. In addition, students will perform a cost analysis regarding plans from different historical eras and submit revised estimates and opinions in the form of a brief report that explains why the costs have increased so significantly from one era to another (increases in materials, labor, new building codes, inflation, etc.). This work allows students to make connections between historical and current trends in architecture and construction in order to aid in decision making.

## **Unit Three: Animal Structure**

The students will design a structure and develop construction documents for a structure made to house one or multiple animals. Examples would include a birdhouse, doghouse, cat tree, chicken coop, or other structure, as long as it is

designed for an animal. The design should include a variety of geometric shapes and should require applied mathematical skills and concepts in order to complete construction. To complete their design, students review specific geometric concepts including understanding the definitions of point, line, line segment, ray, plane, angle, vertex, diameter, radius, and circumference including circular shapes and where other circular shapes fit inside of them. Students apply the area formulas for circles and cylinders and use knowledge of precise measurement of angles using a protractor and angle bisectors using a compass to complete their construction project.

**Create Construction Documents:**

Building on what they learned creating pony walls and using CAD, students create a set of construction documents for their animal housing structure that should include a front view, side view, top view, materials list and cost, and a written proposal (see below) that identifies the advantages of their design. The drawings must have dimensions in both standard and metric, calculated angles, an accurate and labeled scale, and any other pertinent information. Students should include a variety of geometric shapes in order to challenge their design and layout skills. The final project drawings should have detailed labels and dimensions, stressing the importance of accuracy in design and mathematical calculations. After the documents have been approved by the instructor, the structure will be built.

**Written proposal for client:**

The audience for the proposal should be a potential client. In the proposal, students should highlight the advantages of their design and persuade the reader that their particular structure is going to meet the specific needs of their pet. The document should include justification for the types of materials used and estimate the amount of hours of labor required for assembly.

**Unit Four:**

**American Labor History:**

Students will work collaboratively in teams and respond to a given prompt related to the political, economic, and social conditions that have influenced American labor history and current labor laws. Students will write a research essay, write blog posts and comment on those of peers, and make in-class presentations. Students will learn

research, organization, and presentation skills as those skills apply to students showcasing their knowledge of American labor history as well as current labor laws.

### **Key Assignments:**

#### **Research Essay:**

In order to gain a deeper understanding of the historical situations and issues that have led to the creation of current labor laws, students will research a given era to identify key leaders and major movements, focusing on their influence throughout history. Topics include the significance of apprenticeships, heritage of craft unions and symbols, the progression of working conditions, collective bargaining and economic and social justice.

Blog: Students will post their research papers on a blog and comment on each other's papers to enrich the discussion of current labor law and make contemporary application of relevant topics including work conditions, past practices, or social issues like women in the trades.

#### **Presentation:**

Students will present the key findings of their research essay in a 3-5 minute multi-media format (PowerPoints, prezis, posters, videos, or other platform) and provide an overview of evidence collected including the identification of key leaders and their impact on major labor movements for the given era, a description of the political, economic and social implications of the leaders and movements, and labor law and contemporary application. Presentations are intended to demonstrate a deeper understanding of the labor history movement, demonstrate mastery of research, organizational, and presentation skills, and the effective use of academic language in the oral presentation. Students will present to classmates and a panel of advisors including teachers, peers, building trade's professionals and other community partners as appropriate.

## **Unit Five**

### **Capstone Project**

Students will design and build a scaled sustainable structure that encompasses the multiple facets of the building and construction trades. Examples of a capstone project may include a "tiny" home, structure on a trailer, shed, or office space. The interior of the sustainable structure could be a work area or living habitat with finished walls, flooring system, and cabinetry. The sustainable capstone structure requires that a broad variety of the trades be represented and may include skills for rough framing, roofing, doors and windows, insulation, electrical systems, finish carpentry, plumbing systems, roofing, sheet metal, glazing, concrete, painting, solar power system, and HVAC. Design parameters will meet current building code and Title 24 requirements per the local municipality. Students will follow a "Critical Path" schedule for completion of the project and will maintain daily logs and workplace documentation.

**Design and Build a Scaled Sustainable Structure:**

To begin, students will create a packet of construction drawings for approval, similar to what may be submitted before construction can begin. The construction drawings will include a floor plan, framing plan, roof framing plan, elevations, an electrical plan, a plumbing plan, a window and door schedule, and a materials list. These may be produced either by hand or by Computer Aided Drawing (CAD). After teacher approval, students build the structure.

In both the design and build of the structure, students use applied geometry to determine square footages of buildings, rooms, lots, parcels, etc. Estimation skills utilize multiplication, addition, subtraction, division, etc. After instruction, students apply skills in determining quantities of cubic yards, square yards, cubic feet, volume, etc. Conversion techniques are utilized in the creation of a plan for a constructed project when using dimensional measurements and when transferring plans and calculations to a physical project. One must also be able to calculate the area of triangles and quadrilaterals to ensure everything is plumb, level and square. The Pythagorean Theorem must be used in theory and application through construction of woodworking projects, such as right triangle shelf-supports. The students must also be able to use calculating concepts of measuring volume in woodworking and construction, such as when using the volumetric unit "board foot."

**Technical writing:**

Students will use their knowledge of OSHA requirements (unit 1) and labor law (unit 4) to create documents within the project package that include a bill of materials, vendor list, estimates, purchase orders, and labor costs. They will also be responsible for researching and listing the components in a project package such as contract documents, payment schedules, scopes of work, material safety data sheets (MSDS) licensing documentation, proper insurance documents, workers' compensation, liability, job safety analysis worksheets, etc. All written components of the package must be written to technical industry standards, which stress clarity and organization.

**Course Materials**

In the space below, list all course materials, including primary and secondary texts and supplemental materials.

**Building and Construction Trades Department, AFL-CIO. *Building Trades: Multi-Craft Core Curriculum*. Print. 2009**

**Uniform Building Code (UBC) current standard  
National Electrical Code (NEC) current standard  
Uniform Plumbing Code (UPC) current standard**

**International Council of Building Officials (ICBO)**  
**American National Standards Institute (ANSI)**

**Khan Academy** <http://khanacademy.org>

**National Building Trades:** <http://www.bctd.org/Index.aspx>

**California Department of Education:** [www.ca.cde.gov](http://www.ca.cde.gov)

**OSHA-10 certification website** <http://www.careersafeonline.com>

**MC3-Multi-Craft core Curriculum, CA Labor Federation, 2013**

**Construction for the 21st Century: Blueprint Reading Skills, Paxton-Patterson, Inc., 2010**

**How stuff Works website** <http://www.howstuffworks.com/>

**Make: Electronics, Charles Platt, O'Reilly Media, 2009**

**Modern Carpentry, 12 Ed., Wagner, Smith, Huth, 2016**

**Popular Construction Practical Shop Math, by Tom Bernal, 2006. F & W Publications, Cincinnati, Ohio**

**Real World Math Estimation Sheets (realworlded.com) by Real World Educational Products**

**Tiny House Nation. Online Videos.** <http://www.fyi.tv/shows/tiny-house-nation>

**The Woodworker's Complete Shop Reference (Popular Woodworking), by Jennifer Churchill (Chapter 4: Dimensions: Furniture Design and Measuring Devices)**

**Wood Technology & Processes, (Text and Workbook), by Mark D. Feirer and John L. Feirer, 2011.**

**Khan Academy: Geometry:** <http://www.khanacademy.org/math/geometry> (Basic Geometry Section & Pythagorean Theorem)

**How to read a ruler:** <http://www.rickyspears.com/rulergame/>

**Safety Videos:** <http://video.wvgoa.com/tips>; <http://powertoolinstitute.com>