

Course Title:	Construction Technology II
Department:	CTE
Course Number:	7962
Grade Level/s:	11 - 12
Length of course:	One Year
Prerequisite/s:	Construction Technology I (Required)
UC/CSU (A-G) Req:	G (Pending UC Submission)

Brief Course Description: This course has been developed to integrate skills and concepts from the building and construction trades with applied mathematics. This course is the second in a pathway series, students must have completed Construction Technology I. 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, and math using construction documents that include creating construction drawings, detailed project plans, and student-centered construction assignments. 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.

The textbook chosen for this course is Construction Technology NCCER Trainee Guide 4th edition by Pearson Publishing. This allows students to utilize previously completed coursework as reference material. These textbooks cover career connections, stem connections, and current green construction practices. The course will provide necessary course nomenclature and real-world situations with examples and questions that test student's knowledge for understanding. Students will be able to apply for a "Concentrator Certificate" issued by NCCER. At the end of the course, students will research and evaluate apprenticeship, employment and secondary schooling opportunities in the building trades, engineering, and utilities employment.

Construction techniques will span the greatest length of the school year to keep skills developing in safety, math, teamwork, understanding the nature of construction and building products. Through these units, multiple projects will be constructed, used, reprised, or given to those needing the products; for example - build a shed-- school could use it as a storage facility. The construction programs provide many community service products, and these units will include these needed projects.

I. OUTLINE OF CONTENT FOR MAJOR AREAS OF STUDY

A. Unit 1 – Orientation and Safety

1. Description: 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 and create a safe work environment. Shop safety procedures will include, transporting sharp woodworking tools to prevent injury, shop etiquette as it applies to cleanliness and good housekeeping, safe and appropriate use of basic non-powered hand tools, including crosscut saws, rip saws, pull-saws, coping saws, hammers and chisels, hand planes, various grit sandpaper and its appropriate uses etc. Students will take a written safety test and practical hands-on demonstration proving they can recall how to use the tools for this class safely.
2. Key Assignments: Safety and Workplace Behavior
 - a. Assignment 1: Safety Presentation - Using what they have learned about safety in the shop, students will create a safety poster on a safety regulation directly related to the building and construction trades pathway. Students will need to research industry standard safety practices and how they relate to a classroom shop environment. Students will discuss their safety regulation in class with feedback provided by other students.
 - b. Assignment 2: Safety Exam - Students will obtain OSHA industry safety standards knowledge of advanced safety procedures that will continue to be integrated through the rest of the course. Students must pass a safety exam based on all components of acceptable safety within the industry with a score of 100% to be able to operate classroom machinery. The safety exam will include multiple choice questions on classroom procedure questions. This exam will also include questions on the tools that are specific to this class level. Additionally, the student will be required to demonstrate safety procedures throughout the course.
3. Standards Addressed:
 - a. Academic: LS: 11/12.6
 - b. CTE Anchor: Communications: 2.1
 - c. CTE Pathway: D1.1

B. Unit 2 – Mathematical Review of Core Content

1. Description: After instruction on tool safety, students will build a project based on a set of detailed plans to demonstrate mathematical reasoning and formulation of industry standard construction calculations. The students will be provided with a detailed construction drawing that they must interpret to build each project. Students will continue to demonstrate and build upon their understanding of applied math concepts, building sequences related to measurements, geometry and practical building applications that are related to the construction industry. Students will receive instruction in measurement and marking/layout, the fundamental skills which will be needed to complete all the applied mathematics, and construction math units and assignments that follow in this course. This will include, review of fractions, converting fractions to higher or lower terms, mixed numbers, common denominators and adding, subtracting,

multiplying, and dividing with decimals and fractions; reading a ruler and tape measure while incorporating fractional measurements to $1/16^{\text{th}}$ of an inch in a building project; reading a tape measure to measure material of nominal thickness and board footage. Students also use geometry tools (i.e., protractor, compass, architectural ruler) to create shapes in the material. Ultimately the shapes need to match the provided construction drawings. While demonstrating, students should also continue to build upon their ability to communicate with the instructor, using the vocabulary of the construction trades (flush, plumb, square, level) and proving their understanding of how to properly use the tools as intended, with safety as a paramount goal.

2. Key Assignments: Students will use construction plans, tape measures and the worksheets from Construction Math Manual.
 - a. Assignment 1: Units 1-6 from Construction Math Manual will be used for instruction with the completion of activities and quizzes at the end of each unit for a review of checking for understanding math concepts.
 - Unit 1 – Basic Calculating
 - Unit 2 – Rounding
 - Unit 3 – Symbols, Squares, Cubes, Equations and Formulas
 - Unit 4 – Units of Measurement
 - Unit 5 – Averages, Percents, Ratios and Proportions
 - Unit 6 – Calculating Area
 - b. Assignment 2: Chalk It Out - Using some basic construction plans, students will measure out in chalk the lines and markings represented in the blueprints and have other students check the work. The next part of the assignment will be to chalk out twice the size of a blueprint room. Taking a plan for a 20 ft. room and making it a 40 ft. room. The chalk exercise will be held out in the yard of the construction classroom. The students will have to show the work of how they calculated the area for square footage.
 - c. Assignment 3: 16th on Center – Each student will have to mark out a basic drawing, showing where the support beams and wall structures go using the 16th on center constructions file. This will have students using tape measures and calculating fractions in real time.
 3. Standards Addressed:
 - a. Academic: LS: 11-12.6
 - b. CTE Anchor: Communications: 2.1
 - c. CTE Pathway: D5.9
- C. Unit 3 - Measurement, Lay-Out Marking, Reading and Footage
1. Description: Students will learn how to identify the elements and symbols commonly included in a set of plans. Students will also be able to demonstrate the use of scale, square footage, and linear measurement in architectural drawings. Students will design basic plans for a future project they would like to construct.
 2. Key Assignments:
 - a. Assignment 1: Reading Plans – Students will continue to build upon previous blueprint reading knowledge to deepen their learning of building codes and specifications demonstrate their knowledge of the foundations of construction math by using appropriate vocabulary and tools to modify a

- blueprint for construction. Using scale drawings and plans, students demonstrate an understanding of the rules of similarity and proportions. Students calculate area and calculate the volume of excavation from materials and concrete. Students calculate framing materials needed from plans and prepare budgets. Students will be able to identify the commonly used elements in a full set of house plans including building codes, architectural drawing scale, and building specifications. Students will create the site plan to be used in the following units.
- b. Assignment 2: Create a Basic Scaled Plan Drawing – Students interpret and use blueprint dimensions and transfer scale drawings to full scale build. Create blueprints using standard mechanical techniques. Create a reference tool for unfamiliar symbols, notes, and abbreviations for quick reference. Students will be able to identify the commonly used elements in a full set of house plans including building codes, architectural drawing scale, and building specifications. Students will be able, through the building, to scale, and building specifications. Students will be able, through the building, to interpret blueprint dimensions to a full-scale build. Students will show, through both hand drawing and computer use, how to build a basic blueprint. Students will create a blueprint of a single room structure like a shed, classroom, or woodshop from which they do mathematical calculations for linear foot/trim, square footage for a concrete foundation. They will also identify the appropriate architectural symbols for electrical, plumbing, and mechanical aspects of the plan.
 - c. Assignment 3: Concrete, Framing, and Roofing – Students will learn and apply skills needed to properly measure and calculate concrete volume, measure board feet, and area for roofing material. Students will also learn basic skills necessary to form concrete pads and footings including laying rebar and finishing the concrete. The framing aspect will address the skills needed to properly frame a wall, door, window, and ceiling joists. The roofing section will cover the fundamental needs of roofing a residential home and applying flashing and a drip edge.
 - d. Assignment 4: Develop the Plans – Students will create a scaled detailed set of drawings. Each set of drawings will be used to reinforce industry standard vocabulary construction math. All students will be required to complete mathematical processes in measurement, decimal conversions, fractions, geometry, and algebraic fundamentals when creating their plans. Students will create their own legend for the set of plans they are creating. Students will be required to research the different building codes that they will be required to build to. Students will be required to build the “trainer system” that they are designing. All drawings must include the scale legend as well as any notes and code requirements that must be included in the build. A detailed notes page and call outs page must be included in this set of plans.
 - e. Culminating Assignment: Build from the Blueprint – Given a set of plans, students will frame a “Trainer System” with a door, window, and calculate rafters with a ridge board. One wall of the house will have metal studs and the remaining wooden 2 by 4’s or 2 by 6’s. The project will be graded on the accuracy of the layout, accuracy of cuts, and the overall completion of house project. A written method of completion with a sequence of steps taken will be included with the completed project. Students should be able

to show their math and explain their rationale for the sequence of steps taken at the completion of the assignment.

3. Standards Addressed:
 - a. Academic: LS: 11-12.6
 - b. CTE Anchor: Career Planning and Management 3.6
 - c. CTE Pathway: D2.6

D. Unit 4 – Intermediate/Advanced Construction Techniques

1. Description: 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 studs etc. for use with 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 angle 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.

2. Key Assignments:

- a. Assignment 1: Pony Walls - Using instructor provided construction drawings, students will construct interior/exterior pony wall sections to practice various trade skills by installing the necessary components of a structure including but not limited to; electrical circuits, simple plumbing systems, typical three-coat stucco finish, roofing applications, finish carpentry, rough framing, glazing/windows, HVAC, drywall, and paint. This work allows students to apply geometric concepts such as reading the angle necessary for pipe bending or the measuring and cutting of angles necessary for roof framing and finish carpentry. This work ultimately prepares students for the work of the culminating project in which they design and build a small structure. The completed project should be plumb, square, and level. Project quality is necessary for proper completion.

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, abbreviations etc.) to further understand how a construction document is “put together.” They then use architectural drafting software or hand tools for their own sustainable structure. Students will continue to expand their understanding of math concepts such as addition, subtraction, multiplication, division, place value, fractions, decimals, word problems, and measurement. As the student’s understanding of these concepts grows, the rigor increases. 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 and roof angles.

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 the physical project. One must also be able to calculate the area of triangles and quadrilaterals to ensure that everything is plumb, level, and square. The Pythagorean Theorem must be used in theory and application through the construction of woodworking projects, such as right-angle 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.”

- b. Assignment 2: Technical Writing - Students will use their knowledge of safety requirements for the class to create a purposed list of materials, the estimated cost of materials, vendor lists, 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) job safety procedure worksheets etc. All written components of the package must be written in technical industry standards, which stress clarity and organization. Students will present their group project to the class. Other students will provide feedback, and constructive criticism regarding the presented project.
3. Standards Addressed:
 - a. Academic: RLST: 11-12/2
 - b. CTE Anchor: Career Planning and Management: 3.4
 - c. CTE Pathway: D11.13

F. Unit 6 – Post High School Planning

1. Description: This unit is designed to have students gain sustained information on how to continue their training or go into a specialized trade. Students will re-examine the employment documents developed in Construction I and make any additions or changes needed. The students will research construction firms to see what employment requirements are available and the required education and skill sets. Students will explore apprenticeship programs. Students will research institutions for post-high school training, education for entrance requirements, types of degrees earned, and the cost of the program. This may include trade schools and 4-year programs.
2. Key Assignments:
 - a. Assignment 1: Required research on labor market on fastest growing jobs in the building trades, engineering, and utility companies for their local area. This research will be transferred into a slide presentation to share with the class. Each student will choose one of the leading jobs and refine the research to include skill set needed, education, and the pros and cons

of such a job. Photos of the types of projects will be required.

- b. Assignment 2: Review and refine employment documents from Construction I, adding and changing needed information to be prepared to apply for the positions in building trades. A mock interview date will be set, and each student must go through a practice interview; providing employment portfolio, correct answers to questions and use the techniques from the MCA Job Search Program.
- c. Assignment 3: Students will research five post-high school learning and training intuitions. The research will be transferred to a slide presentation to present in the classroom to other students. The research and presentation must include cost, length of the program, if financial aid can be used, possible scholarships, application and entrance requirements for each institution. Programs will be described in detail as to if it is an architecture program, an engineering program, welding, etc. Students must also include certifications and degrees that can be earned.
- d. Assignment 4: Each student will choose a post high school training program or college and apply for entrance into the program. Students can apply to more than one. Documentation will be developed by the student on the process, what they learned, and the requirements that are needed to complete the application. This information will be shared in an oral discussion with instructor and fellow students. The notes and information from this assignment can be held in the employment portfolio.

3. Standards Addressed:
 - a. Academic: LS: 11-12.6
 - b. CTE Anchor: Communications: 2.4
 - c. CTE Pathway: D1.1, D11/13

G. Unit 7 – Course Notes

1. Standards Addressed:
 - a. Academic: LS: 11-12.6
 - b. CTE Anchor: Communications: 2.1
 - c. CTE Pathway: D1.1

II. ACCOUNTABILITY DETERMINANTS

A. Methods of Instruction:

1. Direct instruction
2. Group and individual applied projects
3. Multimedia
4. Demonstration
5. Field trips
6. Guest speakers

B. Student Evaluation:

1. Student projects
2. Written work
3. Exams
4. Observation record of student performance
5. Completion of assignment

C. Industry Certification:

1. NCCER

III. INSTRUCTIONAL MATERIALS AND METHODOLOGIES

A. Required Textbook(s)

Title: Construction Technology Trainee Guide (4th ed)

ISBN: 9780134130392

Format: Print

Author(s): N/A

Publisher: NCCER

Year: 2017