DATE: April 2014
PROPOSED GRADE LEVEL(S): 9th - 12th
GRADING: A-F
PREREQUISITES: C or better in Algebra 1

COURSE DESCRIPTION:

Students are introduced to construction and home building technology and its use in industry through a variety of experiences. Age-appropriate activities are designed for students to construct a residential building using a variety of materials, equipment, and constructive processes. Design, planning, and manipulative activities will be an integral part of the course. Safety is emphasized throughout the course in the use of hand tools and power equipment. All students will benefit from this course regardless of their respective learning styles, learning rates, or gender.

In integrated and fully contextualized construction students will:
- Learn safety, problem solving, machine and tool use, and drawing interpretation. Safety is emphasized throughout the course in the use of hand tools and power equipment.
- Have minimal or no previous construction experience.
- Design, planning, and manipulative activities will be an integral part of the course.
- Be exposed to practical skills in building and carpentry trades by constructing a home.
- Utilize technology in an effort to further study energy conservation and green building techniques.
- Understand and exploit the interdependence between algebra and geometry.
- Learn common core set of geometry skills that are utilized in construction on an ongoing basis.

GENERAL GOALS/PURPOSES:

Students will have the opportunity to experience skill-building activities that are related to construction and various construction occupations.

Students will select procedures, tools, and/or equipment including computer and related technologies in constructing a residential structure including framing, siding, roofing, drywall, electrical, plumbing, HVAC and finish carpentry commonly used in the construction fields.

Students will work safely and be able to recognize potential hazards.

Students will develop interpersonal skills, work habits, and acquire information that will lead to employment in the fields of construction, architecture and engineering.

Students will identify, organize, plan, and allocate resources in the development of products constructed by the industrial world.

Students will know how social, organizational, and technological systems work, and operate effectively with them in performing tasks in a joint effort.
Class will also emphasize safety and career exploration through industry guest speakers and field trips.
CCSS READING COMPONENT:

Students will locate, understand, and interpret written information in documents such as manuals, graphs, safety instruction and textbooks. Construction will place a heavy emphasis on vocabulary and its role in developing an axiomatic system. As students develop their ability to create a formal logical argument, they will also be developing their ability to read analytically.

CCSS WRITING COMPONENT:

Students will communicate thoughts, ideas, information, and messages in writing through letters, directions, reports, graphs, and flowcharts. Students will have opportunities to express their understanding of a variety of construction concepts in writing as well as orally presenting work to the class. All written work will follow standard rules of English.

CCSS SPEAKING AND LISTENING COMPONENTS:

Students will acquire and accurately use Building and Construction Trades sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

In addition, students will:

- Recognize the elements of communication using a sender–receiver model.
- Identify barriers to accurate and appropriate communication.
- Interpret verbal and nonverbal communications and respond appropriately.
- Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
- Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.

DETAILED UNITS OF INSTRUCTION:

Unit 1: Construction Planning
Construction planning is a fundamental part of building anything. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. Construction students will explore the variety of choices in regards to planning.

Unit 2: Introduction to the Shop and this Year’s Building
Construction students will be introduced to the classroom, location of tools, safety issues and instruction and the design of our structure. They will learn and follow all safety rules.

Unit 3: Framing the Walls
The Construction Students will utilize key concepts in Geometry to layout and construct the walls of the structure. They will use Pythagorean Theorem often to ensure walls are “square.”

Unit 4: Laying the Foundation (Floor)
Students will layout and construct the floor of our building. Depending on the construction, this will involve installing drainage, plumbing, ductwork and electrical. They will explore the requirements for plumbing and electricity as well as necessary rules to follow to ensure everything is up to “code.”

Unit 5: The Business of Construction
The students will look at cost analysis in areas of materials, HVAC, short-term versus long-term savings, marketing, liability, deadlines, inspections and depending on the construction, this will involve installing drainage, plumbing, ductwork and electrical.

Unit 6: Decision Making with Green Technologies
Construction students will investigate the pros and cons of green buildings. Students will use a project to see the real-life advantages and disadvantages of going green in 2011. Students will see as green technology improves, costs decrease.

Unit 7: Designing the Archway for the House
Here students will construct the archway for the bedroom and kitchen. Construction students will use parabolas to design and build an archway of their choice.

Unit 8: Surveying
In this unit, Construction students will learn basic surveying techniques that will prove valuable in the construction profession. They will investigate and explore the use of transits, levels, prisms, lasers and clinometers. Many of these skills are based on Geometry fundamentals, such as slope, parallel lines, altitudes, quadrilaterals, triangles and trigonometry.

TEXTBOOKS AND RESOURCE MATERIALS:
Geometry, McDougal Littel 2004; Geometry in Construction, Contextual Concepts, LLC 2010

COMMON CORE STANDARDS TO BE ADDRESSED:

Language Standards – LS – (Standard Area, Grade Level, Standard )

1-12.6. Acquire and accurately use general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Reading Standards for Informational Text – RSIT – (Standard Area, Grade Level, Standard #)

11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

11-12.10 By the end of grade 11, read and comprehend literary nonfiction in the grades 11-CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11-CCR text complexity band independently and proficiently.

Writing Standards – WS – (Standard Area, Grade Level, Standard #)

11-12.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

11-12.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

11-12.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

11-12.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

11-12.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Geometry – G-C – Circles

Understand and apply theorems about circles
1. Prove that all circles are similar.

Find arc lengths and areas of sectors of circles
5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius,
and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

*Explain volume formulas and use them to solve problems*

1. Give an informal argument for the formulas for the circumference of a Circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri’s principle, and informal limit arguments.

*Visualize relationships between two-dimensional and three-dimensional objects*

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three dimensional objects generated by rotations of two-dimensional objects.

5. Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.

**Geometry – G-GPE – Expressing Geometric Properties with Equations**

*Use coordinates to prove simple geometric theorems algebraically*

4. Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, \sqrt{3}) lies on the circle centered at the origin and containing the point (0, 2).

5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

**Geometry – G-MG – Modeling with Geometry**

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

**Geometry – G-SRT – Similarity, Right Triangles, and Trigonometry**

*Define trigonometric ratios and solve problems involving right triangles*

8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

8.1 Know and use angle and side relationships in problems with special right triangles such as, 30°, 60°, and 90° triangles and 45°, 45°, and 90° triangles. (CA Standard Geometry - 20.0)

**DISTRICT ESLR’S TO BE ADDRESSED:**

When students complete the Construction 1 course, they will be:

- **Self-directed Learners** who will be able to solve problems;
- **Effective Communicators** who can express technology concepts to others effectively;
- **Quality Producers** who can solve technology problems in a neat and organized manner;
- **Constructive Thinkers** who are able to approach complex technology problems in an organized, logical, and systematic fashion;
- **Collaborative Workers** who can work in teams to accomplish a task; and
- **Responsible Citizens** who accept responsibility for their actions.
Appendix

CTE CONTENT STANDARDS TO BE ADDRESSED:

D. Residential and Commercial Construction Pathway

The Residential and Commercial Construction pathway provides learning opportunities for students interested in preparing for careers in construction and building design, performance, and sustainability. The standards focus on the manner in which residential and commercial structures are designed and built. The pathway includes instruction in the way in which these structures are built (Class B California License).

Sample occupations associated with this pathway:
Plumber
Electrician
Building Inspector
Estimator
Carpenter

D1.0 Recognize the impact of financial, technical, environmental, and labor trends on the past and future of the construction industry.
   D1.1 Understand significant historical trends in the construction industry.
   D1.2 Understand the environmental regulations that influence residential and commercial design.
   D1.3 Demonstrate knowledge of the California Environmental Quality Act (CEQA) and Environmental Impact Review (EIRs) impacts on residential and commercial construction.

D2.0 Apply the appropriate mathematical calculations used in the construction trades.
   D2.1 Apply formulas to determine area, volume, lineal, board, and square feet.
   D2.2 Apply the Pythagorean Theorem to calculate pipe offsets, roof slope, and check for square.
   D2.3 Estimate the materials needed to complete a specific task.
   D2.4 Determine the total developed length of the water supply piping system.
   D2.5 Calculate the residual pressure at the highest outlet per the requirements of the Plumbing Code.
   D2.6 Calculate the total fixture unit demand from the fixtures indicated on the construction drawings using the tables of the plumbing code.
   D2.7 Calculate the proper slope for drain, waste and vent (DWV) piping.
   D2.8 Apply Ohm’s Law to calculate resistance, current flow, and voltage in series, parallel, and combination circuits.
   D2.9 Calculate the load on an electrical system from general lighting and small and large appliances.

D3.0 Interpret and apply information from technical drawings, schedules, and specifications used in the construction trades.
   D3.1 Identify the elements used in technical drawings, including types of lines, symbols, details, and views.
   D3.2 Identify and interpret the elements of technical drawings, including plan, elevation, section, and detail views.
   D3.3 Interpret technical drawings specifications.
   D3.4 Identify plumbing, electrical, and mechanical symbols and other abbreviations used in construction drawings.
   D3.5 Interpret and scale dimensions from a set of plans using an architect’s scale.
   D3.6 Interpret sectional and detail drawings to determine construction details such as corners, rough openings, stairs, and roof systems.
D3.7 Understand the sequencing and phases of residential and commercial construction projects.

D4.0 Demonstrate techniques for proper site preparation.
  D4.1 Use leveling devices to check for elevation, level, and plumb.
  D4.2 Demonstrate how to establish grades using survey instruments.
  D4.3 Install batter boards.
  D4.4 Check site layout for square using the diagonal method.
  D4.5 Describe excavation and backfill methods.
  D4.6 Identify different methods and equipment used for compaction.
  D4.7 Identify types of backfill materials and how they are used.

D5.0 Demonstrate foundation layout techniques to include setting forms, placing reinforcements, and placing concrete according to construction drawings, specifications, and building codes.
  D5.1 Describe the sequencing procedures for placing large and small slabs.
  D5.2 Demonstrate how to establish elevations for concrete structures.
  D5.3 Lay out location and elevation of concrete/masonry structures based on construction drawings.
  D5.4 Develop a material take-off in accordance with construction drawings and specifications.
  D5.5 Lay out location for reinforcements, expansion joints, openings, and embedded items based on construction drawings, specifications, and building codes.
  D5.6 Construct, place, and brace forms for concrete as detailed in construction drawings for footings, slab, and raised floors.
  D5.7 Place and secure reinforcement as detailed by construction drawings, building codes, and industry standards.
  D5.8 Place secure embedded hardware as detailed on construction drawings.
  D5.9 Demonstrate proper removal and care of concrete forms.
  D5.10 Use appropriate tools and techniques for placing, compacting, screeding, and finishing consolidating concrete in slabs and footings.

D6.0 Demonstrate carpentry techniques for the construction of a single-family residence.
  D6.1 Properly place a moisture barrier and pest control guard on a foundation.
  D6.2 Attach a sill plate at top of concrete foundation.
  D6.3 Lay out, cut, and install joist supports, rim joists, and floor joists as specified on construction plans.
  D6.4 Install a subfloor.
  D6.5 Demonstrate wall and plate layout, including rough openings.
  D6.6 Measure, cut, and assemble wall components using appropriate tools and fasteners.
  D6.7 Demonstrate the ability to square wall systems and install wall bracing and shear panels according to code.
  D6.8 Stand, square, plumb, and brace walls.
  D6.9 Describe the applications and uses of metal stud framing.
  D6.10 Lay out, cut, and install ceiling joists and common and jack rafters.
  D6.11 Frame and erect shed and gable roof systems.
  D6.12 Lay out and install trusses “on-center” with specified hardware.
  D6.13 Install appropriate blocking, bracing, lookouts, fascia, and drip edge.
  D6.14 Frame for roof penetrations and attic access.
  D6.15 Apply roof sheathing and install appropriate flashings.
D6.16 Understand different roofing materials and methods of application.

D7.0 Demonstrate proper installation techniques of interior finish materials and protective finishes.
   D7.1 Identify types and uses of wall finishing materials.
   D7.2 Cut, fit, and install gypsum wallboard onto a framed wall using appropriate fasteners.
   D7.3 Describe the finishes and textures for gypsum wallboard.
   D7.4 Properly prepare walls to receive protective finishes.
   D7.5 Apply finishes according to specifications and industry standards.
   D7.6 Identify types and application of finish flooring materials.
   D7.7 Install pre-hung interior doors.
   D7.8 Install interior trim and case work.

D8.0 Demonstrate the application of exterior finish materials and protective finishes in building construction.
   D8.1 Describe the installation procedures and techniques of masonry siding materials.
   D8.3 Install wood, vinyl, and/or manufactured siding.
   D8.4 Demonstrate preparation techniques for applying exterior paint and stain.
   D8.5 Apply exterior paint and stain according to specifications.
   D8.6 Describe various types and uses of doors and windows used in building construction.
   D8.7 Install pre-hung windows and doors using appropriate flashing and trim.
   D8.8 Caulk and seal joints to prevent air and moisture infiltration and increase energy efficiency.
   D8.9 Install vents for efficient attic and crawl space ventilation.
   D8.10 Install various types of floor, wall, and ceiling thermal insulation.
   D8.11 Describe mold-prevention techniques.

D9.0 Understand, integrate, and employ sustainable construction practices in the building trades.
   D9.1 Identify design and energy solutions for improving building energy efficiency.
   D9.2 Identify materials used in building construction to increase energy efficiency and sustainability.
   D9.3 Calculate energy requirements and loads for buildings and structures.
   D9.4 Demonstrate the application of constructing materials intended to improve building efficiency and sustainability.
   D9.5 Analyze and evaluate buildings for energy efficiency and performance.
   D9.6 Develop solutions to improve building energy performance and efficiency.

D10.0 Demonstrate skills necessary to complete a plumbing system in a single-family residence in accordance with accepted industry standards.
   D10.1 Demonstrate techniques for cutting, deburring, and joining metallic and nonmetallic water piping.
   D10.2 Lay out and install hot and cold water piping to fixture locations as indicated on the construction documents.
   D10.3 Perform pressure test of an installed piping system.
   D10.4 Install fastened in-place fixture valves and shut-off valves as indicated on construction drawings.
   D10.5 Install and secure proper drainage piping to fixture locations.
   D10.6 Determine the proper slope for DWV piping using hand levels, laser levels, and transits.
   D10.7 Install traps and vents as indicated by construction drawings, specifications, and government codes.
D10.8 Install angle stops at water supply stub outs.
D10.9 Install plumbing fixtures.
D10.10 Connect the water supply to faucets and water closets.
D10.11 Connect fixture tailpieces to fixtures and to traps.
D10.12 Check for the proper functioning of fixtures.

D11.0 Demonstrate skills necessary to complete an electrical system in a single-family residence in accordance with accepted industry standards.
D11.1 Determine whether or not an electrical circuit is “live.”
D11.2 Prepare rough framing for the installation of electrical cables and conduit.
D11.3 Lay out components to the tolerances indicated on the construction drawings, specifications, and government codes.
D11.4 Install typical devices, junction boxes, and panels.
D11.5 Install lighting and ceiling fan support boxes according to the National Electrical Code (NEC).
D11.6 Install conduit typical of residential construction and pull conductors through conduit as required by the NEC.
D11.7 Splice and tap conductors for the installation of fixtures and devices.
D11.8 Install low voltage control and communication cables.
D11.9 Demonstrate grounding techniques for all electrical boxes, cabinets, and enclosures.
D11.10 Terminate electrical connections to receptacles, switches, lighting fixtures, large appliances, and other devices.
D11.11 Select receptacles and switches based on load requirements.
D11.12 Terminate equipment grounding and neutral conductor at the electrical service.
D11.13 Terminate communication and control wiring.