Escondido Union High School District

Agricultural Engineering 1
(Revision to Agriculture Mechanics)

EUHSD Board Approval Date: 6/20/17
The EUHSD *Agricultural Engineering 1* curriculum document identifies what students should be able to know by grade level in a comprehensive standards-based course of study. The curriculum document is updated annually based on student academic achievement data, research and best practices, and input from stakeholders. The EUHSD curriculum document contains the following documents and/or information:

A. Course Description  
B. Course Guidelines/Requirements - graduation credit information, transcript information, adopted materials, adopted technology, assessment outline  
C. Instructional Materials References  
D. Scope and Sequence Map with Essential Standards outlined by Unit  
E. References to key essential design and implementation documents

A comprehensive course of study and/or program is designed so that all students have access to the rigorous curriculum necessary to graduate high school demonstrating college and career readiness skills. Student-Centered learning provides opportunity for collaboration, communication, and a robust learning environment and provides opportunities for all students to meet the goals of the district’s Instructional Focus at the time of this writing: “All students communicate their thinking, ideas and understanding by effectively using oral, written and/or non-verbal expression.”

A key design consideration in the transition to the new California State Standards is a focus on changes to pedagogy. The English Language Arts instructional shifts guide classroom teaching and learning and the foundation of curriculum and instructional design. Key considerations of the ELA Instructional shifts can be found by visiting the following URL:[http://www.corestandards.org/other-resources/key-shifts-in-english-language-arts/](http://www.corestandards.org/other-resources/key-shifts-in-english-language-arts/)

The curriculum document is aligned to the California Model Career Technical Education Standards and reflects learning outcomes from both the anchor and pathway standards.[http://www.cde.ca.gov/ci/ct/sf/ctemcstandards.asp](http://www.cde.ca.gov/ci/ct/sf/ctemcstandards.asp) - CTE Model Curriculum Standards
Agricultural Engineering 1 Course Description

Agricultural Engineering 1 is an academically challenging course that integrates mathematics, science, writing and mechanics. Specific units include: Using the Ag Mechanics Shop, Measurement, Project Planning, Electricity and Electronics, Plumbing Systems and Water Use, Concrete and Masonry, Arc Welding, Power Mechanics, and Careers. Students will focus on understanding theory of the preceding areas, as well as mastery of application of these theories. Students will exceed core academic knowledge and demonstrate critical thinking skills as they apply their knowledge to projects, real-life scenarios, and case studies. A variety of resources will be accessed (Internet, professional journals, books, and industry professionals) for the purpose of creating written and oral presentations that demonstrate students’ knowledge and ability. Units covered in this course will build upon existing knowledge where applicable. End of unit projects will incorporate, at minimum, the knowledge acquired from at least one other previously covered unit. Throughout the course, students will be graded on participation in extracurricular FFA activities as well as the development and maintenance of an ongoing Supervised Agricultural Experience (SAE) program.

Course Requirements

<table>
<thead>
<tr>
<th>Course Length:</th>
<th>Year Long</th>
<th>Grade Level:</th>
<th>9-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC/CSU Requirement:</td>
<td>Meets UC/CSU “g” requirements</td>
<td>Graduation Requirement:</td>
<td>EUHS CTE Requirement or Elective Credit</td>
</tr>
<tr>
<td>Course Number (Semester A):</td>
<td>5711</td>
<td>Transcript Abbreviation (Semester A):</td>
<td>AG ENGINEER 1 A (P)</td>
</tr>
<tr>
<td>Course Number (Semester B):</td>
<td>5712</td>
<td>Transcript Abbreviation (Semester B):</td>
<td>AG ENGINEER 1 B (P)</td>
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<tr>
<td>Credits (Semester A):</td>
<td>5 CTE or Elective</td>
<td>Credits (Semester B):</td>
<td>5 CTE or Elective</td>
</tr>
<tr>
<td>Required Prerequisite/s:</td>
<td>Completion or Concurrent Enrollment in Algebra 1 or Math 1 (Integrated) and enrolled in FFA</td>
<td>Recommended Prerequisite/s:</td>
<td>None</td>
</tr>
<tr>
<td>Industry Sector:</td>
<td>Agriculture and Natural Resources</td>
<td>Career Pathway:</td>
<td>Agriculture Mechanics</td>
</tr>
<tr>
<td>Board Approval Date (Curriculum):</td>
<td>6/20/17</td>
<td>Board Approval Date (Materials):</td>
<td></td>
</tr>
<tr>
<td>Core Instructional Material/s:</td>
<td></td>
<td>Supplemental Instructional Material/s:</td>
<td></td>
</tr>
<tr>
<td>*There is no core text for this course. Students will utilize a variety of supplemental resources as outlined in each unit of study.</td>
<td></td>
<td>• Applied Mathematics</td>
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<tr>
<td></td>
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<td>• Math for Welders</td>
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<tr>
<td></td>
<td></td>
<td>• Official FFA Handbook</td>
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<tr>
<td>Technology Resource/s:</td>
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<tr>
<td>• Students will utilize a variety of industry equipment and tools found within the shop/lab setting.</td>
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<tr>
<td>• Students will utilize the WWW to conduct research on specific topics.</td>
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<tr>
<td>Assessment/s:</td>
<td>The course is designed as a project based curriculum. Each unit outlines specific skills and/or long term projects which serve as unit and course assessments.</td>
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</tbody>
</table>
**Scope and Sequence Guide**

The Scope and Sequence Guide is a California standards-based document that delineates the standards-based skills students are expected to know and do in order to meet College and Career Readiness expectations. Each unit of study in the Scope and Sequence document is designed to build upon the previous unit and/or prerequisite coursework in support of student mastery of specific standards-based skills. The Scope and Sequence document provides the framework of understanding for key assignments, key assessments, and instructional resources and strategies that serve to assist students in meeting unit learning objectives. The document will be updated annually with input from all stakeholders.

In coursework requiring reading and writing, the following standards are not specifically stated in any one unit of study, but are the result of implementation throughout the curriculum as students participate in reading, writing, and speaking/listening standards-based activities.

- By the end of grade 11, students will read and comprehend literary nonfiction in the grades 11-CCR text completely and proficiently, with scaffolding as needed at the high range. (Reading Informational Text Standard 10)
- Students will write routinely over extending time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks and purposes. (Writing Standard 10)
- “To be college and career ready, students must have ample opportunities to take part in a variety of rich and structured conversations – as part of a whole class, in small groups, and with a partner – build around important content in various domains. They must be able to contribute appropriately to conversations, make comparisons and contrasts, and analyze and synthesize a multitude of ideas according to the standards of evidence appropriate to a particular discipline.” (Standards for ELA Anchor Standards for Speaking/Listening)
# Agricultural Engineering 1 - Scope and Sequence

## Unit 1 – Using the Ag Engineering Shop

**Length:** 1-2 Weeks

### Unit Description:
In Unit 1, students will participate in hands-on activities designed to build their foundational understanding of participation in a workshop classroom environment. Students will examine specific safety and use policies, procedures, and practices. Students will examine work spaces for safety and/or health concerns. They will be expected to demonstrate a variety of safety practices through various classroom assignments and activities and will demonstrate their understanding through completion of a required safety test. Many of the skills and procedures acquired in Unit 1 will be built upon in subsequent units of study.

### Agriculture and Natural Resources Anchor Standards:
The CTE Anchor standards reflect what students should know and do in a sequential CTE pathway course of study. The Anchor standards may be repeated throughout each unit of study and build upon one another throughout a series of courses.

#### Communications:
2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.

#### Technology:
4.5 Research past, present, and projected technological advances as they impact a particular pathway.

#### Problem Solving and Critical Thinking:
5.1 Identify and ask significant questions that clarify various points of view to solve problems.
5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.

#### Health and Safety:
6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.
6.4 Practice personal safety when lifting, bending, or moving equipment and supplies.

### Learning Objectives:
Students will be able to...

- Communicate both orally and in writing.
- Conduct research, both small and on a larger scale, on specific assigned topics such as safety and machine tool use.
- Ask and answer questions using industry terminology.
- Participate in small and large group discussions and clarify points of view when needed.
- Interpret information from a variety of documents. (informational text, charts, graphs, etc.)
- Follow specific policies and procedures for safety and equipment use.
- Demonstrate health and safety practices when working in the shop.
- Maintain tools and equipment according to industry specifications.
- Set up and maintain shop to avoid health concerns or safety hazards.
- Practice personal safety when handling materials or machinery.
- Report hazards in the shop.
- Locate and adhere to MSDS instructions.

### Unit Assignments:
- Throughout the course, students will be expected to properly identify, use, and maintain a variety of shop tools and equipment according to industry specifications. The teacher will demonstrate each piece of equipment and its safety features for each specific unit of study. Students will complete a series of unit quizzes and an overall safety test in order to demonstrate understanding of key rules and procedures. For all tasks involving specific equipment use, students will conduct demonstrations of the equipment, showcasing the safety features and maintenance features. This will be repeated in each unit of study or when a new piece of equipment and/or tool is introduced.
- All students will be required to keep a notebook that outlines key equipment/tools and their use, function, and maintenance requirements and any specific industry related vocabulary terminology. This includes identifying any safety features of the specific tool or piece of equipment. As a demonstration of safety requirements for learning, students will complete the following activities:
  - Students will work in groups of 2-3 to create a poster diagramming and outlining key components of workshop safety. Students will present their posters to two other groups and...
6. Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.

6.6 Maintain a safe and healthful working environment.

6.7 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).

Responsibility and Flexibility:
7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.

7.3 Understand the need to adapt to changing and varied roles and responsibilities.

7.4 Practice time management and efficiency to fulfill responsibilities.

Leadership and Teamwork:
9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.

9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.

Technical Knowledge and Skills:
10.1 Interpret and explain terminology and practices specific to the Agriculture and Natural Resources sector.

10.5 Interpret and explain the aims, purposes, history, and structure of the FFA student organization and know the opportunities it makes available.

Demonstration and Application:
11.1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Building and Construction Trades sector program of study.

Agriculture Mechanics Pathway Standards:
B1.0 Implement personal and group safety practices.

- Demonstrate teamwork approach to learning.
- Utilize WWW and other sources of technology to retrieve information.
- Cite evidence from text using appropriate citation manual.
- Follow complex multi-step instructions.
- Determine meaning of words and symbols as they pertain to industry standards.

- Students will evaluate their posters according to industry standards reviewed in class.
  - Students will take a multiple choice safety test and will pass with at least 90% accuracy prior to utilizing equipment and/or working in the shop area. Students who do not get 100% accuracy will write out the incorrect questions, research the correct answer, respond with the correct answer, and will note the specific rationale for why they may have selected the incorrect answer.
  - Students will develop a housekeeping or clean-up plan for each shop based on photographs and videos of the workshops as they appear during actual work. The plan will be in a spreadsheet format, identifying potential hazards and ways to mitigate those hazards so they do not result in injuries.

- Throughout the course, students will explore a variety of careers related to the Agriculture pathway. This may include visits from guest speakers and/or conducting short research on various careers and adding to their notebook throughout the course. As a culminating activity at the end of the year, students will create a resume and cover letter and a 1-2-page paper that showcases specific ag related careers and the educational requirements in order to attain those careers. Students will continue to use this throughout their enrollment in the Agriculture pathway.

Teacher Note: National FFA Association is a student professional organization. The teacher will review membership and activities to the class. FFA - Professional Student Organization for Industry. Students will be introduced to the FFA organization and may participate, at their choosing. Students participate in a variety of competitions and Career Development Events. The events may be held at the local, regional or state level as conducted by the FFA organization. Students may also move on to National competitions.
B1.1 Practice the rules for personal and group safety while working in an agricultural mechanic’s environment.
B1.2 Integrate accepted shop management procedures and a safe working environment.
B1.3 Safely secure loads on a variety of vehicles.

**Reading Standards for CTE Grade 9/10:**
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
3. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

**Writing Standards for CTE grade 9/10:**
2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.
8. Gather relevant information from multiple authoritative print and digital sources (primary and secondary), using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. CA
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<td>• <a href="https://www.ffa.org/home">https://www.ffa.org/home</a> - (teacher and student resource for FFA)</td>
</tr>
<tr>
<td>• In 2012, the CA Department of Education adopted new language level proficiency descriptors and new EL state standards. Visit the following website to learn more about those new descriptors and corresponding standards: <a href="http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf">http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf</a></td>
<td>• <a href="https://www.bae.ncsu.edu/programs/extension/farm_safety">https://www.bae.ncsu.edu/programs/extension/farm_safety</a></td>
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Agricultural Engineering 1 - Scope and Sequence
Unit 2 – Materials, Measurement, and Project Implementation Background

Length: 4-6 Weeks

**Unit Description:** The students will learn how to select and use appropriate layout tools and procedures for woodworking and metalworking. This knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test. Concepts and practices learned in Unit 2 will be used throughout this course. The students will learn how to use drawing techniques to create plans for personal projects. The students will be able to use and format a bill of materials and to make all calculations needed to develop a bill of materials. The student will be able to select and plan projects that develop the woodworking and metalworking skills needed in agricultural jobs. This knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test. Information obtained through the unit will be utilized throughout this course as students learn theory, and then experience project development and construction.

### Agriculture Mechanics Pathway Standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2.0</td>
<td>Apply the principles of basic woodworking.</td>
</tr>
<tr>
<td>B2.1</td>
<td>Identify common wood products, lumber types, and sizes.</td>
</tr>
<tr>
<td>B2.2</td>
<td>Measure and lay out lumber, calculating board feet and square feet.</td>
</tr>
<tr>
<td>B2.3</td>
<td>Identify, select, and implement basic fastening systems.</td>
</tr>
<tr>
<td>B2.4</td>
<td>Complete a woodworking project, including interpreting a plan, developing a bill of materials and cutting list, selecting materials, shaping, joining, and finishing.</td>
</tr>
<tr>
<td>B5.0</td>
<td>Understand agricultural cold metal processes.</td>
</tr>
<tr>
<td>B5.1</td>
<td>Identify common metals, sizes, and shapes.</td>
</tr>
<tr>
<td>B5.2</td>
<td>Demonstrate basic tool-fitting skills.</td>
</tr>
<tr>
<td>B5.3</td>
<td>Properly lay out materials for a given project.</td>
</tr>
<tr>
<td>B5.4</td>
<td>Demonstrate basic cold metal processes (e.g., shearing, cutting, drilling, threading, bending).</td>
</tr>
<tr>
<td>B5.5</td>
<td>Complete a cold metal project, including interpreting a plan, developing a bill of materials, selecting materials, shaping, fastening, and finishing.</td>
</tr>
<tr>
<td>B9.0</td>
<td>Assimilate metallurgy principles and fabrication techniques.</td>
</tr>
<tr>
<td>B9.1</td>
<td>Define metallurgy principles, including distortion, hardening, tempering, and annealing.</td>
</tr>
<tr>
<td>B9.2</td>
<td>Operate and maintain various arc welding and cutting systems safely and appropriately.</td>
</tr>
<tr>
<td>B9.3</td>
<td>Operate and maintain fabrication tools and equipment safely and appropriately.</td>
</tr>
<tr>
<td>B9.4</td>
<td>Design project plans by using mechanical drawing techniques.</td>
</tr>
<tr>
<td>B9.5</td>
<td>Finish a metal project by implementing proper sequencing.</td>
</tr>
</tbody>
</table>

### Learning Objectives:

**Students will be able to:**

- Communicate both orally and in writing.
- Conduct research, both small and on a larger scale, on specific assigned topics such as safety and machine tool use.
- Ask and answer questions using industry terminology.
- Participate in small and large group discussions and clarify points of view when needed.
- Interpret information from a variety of documents. (informational text, charts, graphs, etc.)
- Follow specific policies and procedures for safety and equipment use.
- Demonstrate health and safety practices when working in the shop.
- Maintain tools and equipment according to industry specifications.
- Set up and maintain shop to avoid health concerns or safety hazards.
- Basic Principles of Woodworking Performance Task – In order to develop a foundational understanding of the basic principles of woodworking and measurement, students will complete a variety of hands-on tasks that include developing an understanding of the term SCALE and its dual meaning in project design and drawings. Students will complete a series of problem based worksheets designed to build background knowledge and understanding of the concept of scale factors and define ratio of a model size relative to the actual object that the model represents. Students will utilize prior knowledge in measurement to understanding that models and toys have different scales in relation to the real object being modeled. Students will use a variety of tools and participate in class discussions that illustrate their understanding that key parts to every scale drawing are the scale factor and the degree to which scale models have been reduced in size, compared to the original. Students will demonstrate their understanding of scale by completing a table showing real life sizes of various objects as provided by their teacher, and illustrate their scaled size in inches. Students must complete both 1/2" and 1/4" scale. They will complete a scale layout of the shop and will submit their drawings to the instructor. Students will add their drawing to their portfolio and will write a 1-page reflection of the task utilizing

### Unit Assignments:

- Measurement Skills Test
- Notebook Checks
- Scale Drawing and Reflection utilizing industry standard rubric
- Sketch designs
- Project Plan Presentation
- Unit test
B9.6 Manipulate and finish metal by using a variety of tools, machines, and techniques (e.g., lathe, mill, CNC plasma, shears, press break, grinders, and sanders).
B9.7 Construct a welding project using any electric welding process, appropriate products, joints, and positions, which will include interpreting a plan, determining proper assembly sequence, developing a bill of materials and cutting list, selecting and acquiring materials, and developing a clear and concise fabrication contract.

Reading Standards for CTE Grade 9/10:
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Writing Standards for CTE grade 9/10:
2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.
8. Gather relevant information from multiple authoritative print and digital sources (primary and secondary), using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. CA

- Practice personal safety when handling materials or machinery.
- Report hazards in the shop.
- Locate and adhere to MSDS instructions.
- Demonstrate teamwork approach to learning.
- Utilize WWW and other sources of technology to retrieve information.
- Cite evidence from text using appropriate citation manual.
- Follow complex multi-step instructions.
- Determine meaning of words and symbols as they pertain to industry standards.
- Produce clear writing that conveys specific ideas and concepts.
- Use technology appropriately.
- Identify common wood types used for specific projects.
- Use measurement tools appropriately and according to scale.
- Complete a project according to specific time limits.
- Interpret basic industry plans.
- Select appropriate tools for specific task.
- Operate machinery according to specifications.
- Design project plans using mechanical drawing techniques.

industry standards and identifying their areas of strength and growth based upon their shop plan design.

- Technical Drawing Performance Task - Technical sketching is a necessary skill used by Architects, Engineers, & Contractors to communicate basic ideas in design and construction project work. This task starts with the very elementary practice of drawing straight lines without the aid of a straight edge. As we progress with our straight practice, the task will progress into geometric shapes such as triangles and also drawing lines at general angles such as 45 degrees. Proficiency in freehand technical sketching is communicating the idea without the use of words including elements of shading, perspective and detail. Students will sketch a variety of classroom objectives. Proficiency is communicating! Try to understand that straight line practice in this lesson evolves into basic geometric shapes and then those basic straight line shapes are used to develop circles and arcs. Example - a square is used to develop a circle. Students will use these basic skills to complete a sketch and scaled drawing of a show box from their Agricultural Mechanics textbook. After students demonstrate their proficiency in sketch and design, students are given 3 project blueprints. Students must then complete a bill of materials for each project. Projects include a workbench, a welding table, and a farrowing crate. Students must correctly list all materials needed to complete each project in their bill of materials. Students will then need to compute the total materials cost for the project. Upon completion of materials cost, students will calculate estimated time needed to complete the project as well as cost of labor to determine an appropriate product cost to a consumer. Students will be assessed on their ability to read a materials plan, create a materials costs list, and create an organizational plan for completion of the materials. Students will be assessed on their ability to interpret
the plans according to industry standards and will submit a 1-page reflection of the task. Note: Students will begin work on these projects in the first semester and continue throughout the year. Student projects will be assessed throughout the year during various stages of development. All students will present their project – along with their cover letter and resume at the end of the course.

- Vocabulary Activity - Students will utilize a variety of industry related terms and will demonstrate their understanding through use of the vocabulary while in the shop and will be provided unit quiz assessments on the industry vocabulary. The vocabulary section will be part of the student’s final exam.

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<td>• <a href="https://owl.english.purdue.edu/owl/">https://owl.english.purdue.edu/owl/</a></td>
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<td>• <a href="http://www.constructionknowledge.net/general_technical_knowledge/general_tech_measurement_conversions.php">http://www.constructionknowledge.net/general_technical_knowledge/general_tech_measurement_conversions.php</a></td>
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### Unit Description:
In Unit 3, students will learn to use principles of electricity and safety for planning simple wiring systems. Electricity is the major power source for stationary equipment in houses, farm, and ranch buildings, and agribusiness. It is the energy source commonly used for driving machinery, and for lighting, heating, and cooling. Some knowledge of electricity is essential for the safe use of electrical equipment. Understanding how to wire simple circuits and make minor electrical repairs is also useful. It is important to maintain electrical circuits and equipment properly to ensure their long life and safe operation. Major areas of instruction include; Electrical Principles and Wiring, Installing Branch Circuits, and Electronics in Agriculture. Knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test.

### Agricultural Mechanics Pathway Standards:

| B3.0 | Demonstrate basic electricity principles and wiring practices commonly used in agriculture. |
| B3.1 | Explain the relationship between voltage, amperage, resistance, and power in single-phase alternating current (AC) circuits. |
| B3.2 | Use proper electrical test equipment for AC and direct current (DC) circuits. |
| B3.3 | Analyze and correct basic circuit problems (e.g., open circuits, short circuits, incorrect grounding). |
| B3.4 | Implement proper basic electrical circuit and wiring techniques using nonmetallic cable and conduit as defined by the National Electric Code (NEC). |
| B3.5 | Interpret basic agricultural electrical plans. |
| B3.6 | Complete an electrical project, including interpreting a plan, following NEC code, selecting materials and components, and completing a circuit. |
| B11.6 | Understand the theory and operation of 12-volt DC electronic and electrical systems (e.g., circuit design, starting, charging, and safety circuits). |

### Reading Standards for CTE Grade 9/10:

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

### Learning Objectives:

**Students will be able to…**

- Communicate both orally and in writing.
- Conduct research, both small and on a larger scale, on specific assigned topics such as safety and machine tool use.
- Ask and answer questions using industry terminology.
- Participate in small and large group discussions and clarify points of view when needed.
- Interpret information from a variety of documents (informational text, charts, graphs, etc.).
- Follow specific policies and procedures for safety and equipment use.
- Demonstrate health and safety practices when working in the shop.
- Maintain tools and equipment according to industry specifications.
- Set up and maintain shop to avoid health concerns or safety hazards.
- Practice personal safety when handling materials or machinery.
- Report hazards in the shop.

### Unit Assignments:

- **Tool Identification Activity** - Students will identify tools of the electrical and electronics industry as well as their correct usage. Information obtained will be included in their interactive notebooks. Pictures of the tools along with a scenario detailing proper use will also be present.
- **Introduction to Conductivity Performance Task** - A conductor is anything that allows an electrical current to flow easily through it. An electric current consists of moving particles called electrons or ions. Solids that conduct electricity have mobile electrons that are loosely held by their atoms. On the other hand, solids that obstruct or prevent the flow of electric current are called insulators or non-conductors. These particular solids have electrons that are closely bound to their atoms nucleus and are generally not free to move. In this activity students learn basic concepts about conductivity of electric current through solids and some liquids and solutions. Students will use a conductivity indicator to determine whether certain solid materials have electrons that are closely bound to their atoms nucleus and are generally not free to move. In this activity students learn basic concepts about conductivity of electric current through solids and some liquids and solutions. Students will use a conductivity indicator to determine whether certain solid materials are conductors or insulators as well as some liquids. Student findings will be included in their class notebook as well as their original predictions on the items conductivity.
- **Circuit Wiring Performance Task** - Students will be given free selection of various supplies including various size batteries and light bulbs, as well as conductors and non-
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Writing Standards for CTE grade 9/10:
2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.
8. Gather relevant information from multiple authoritative print and digital sources (primary and secondary), using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. CA

- Locate and adhere to MSDS instructions.
- Demonstrate teamwork approach to learning.
- Utilize WWW and other sources of technology to retrieve information.
- Cite evidence from text using appropriate citation manual.
- Follow complex multi-step instructions.
- Determine meaning of words and symbols as they pertain to industry standards.
- Produce clear writing that conveys specific ideas and concepts.
- Use technology appropriately.
- Identify common wood types used for specific projects.
- Use measurement tools appropriately and according to scale.
- Complete a project according to specific time limits.
- Interpret basic industry plans.
- Select appropriate tools for specific task.
- Operate machinery according to specifications.
- Design project plans using mechanical drawing techniques.
- Demonstrate understanding of basic electric principles through oral and hands-on demonstrations.
- Implement proper electrical circuit and writing techniques according to National Electric Code.
- Demonstrate understanding of theory and operation of 12 volt DC electronic and electrical systems.
- Conductors. Students will work in teams to demonstrate their understanding of simple and parallel circuits. Students will diagram every attempt they make at creating a circuit. Once they are able to get their light bulb lit, they will explain why this method worked, and specify why each previous attempt failed. Students must use electrical terminology in their justification. Students will then use knowledge learned in lecture and lab to construct a simple circuit. Students must incorporate a duplex receptacle, switch, and fixture in their circuit. Assignment will be evaluated based on proper use of tools and supplies, safety of wire connections, and workability of the circuit.
- Saving Energy Performance Task - Energy is more than numbers on a utility bill; it is the foundation of everything we do. All of us use energy every day – for transportation, cooking, heating and cooling rooms, manufacturing, lighting, water use, and entertainment. We rely on energy to make our lives comfortable, productive, and enjoyable. Sustaining this quality of life requires that we use our energy resources wisely. The careful management of resources includes reducing total energy use and using energy more efficiently. Students will complete a variety of tasks and projects related to identifying energy use and determining how energy can be saved. Examples are highlighted below.
- Electrical Nameplates Activity – Students will use the electrical plates found on machinery in the Ag Mechanic’s shop to provide the amperage and volts of the machines. They will then use that information to calculate how many watts each machine uses. Once students have calculated watts, they will then determine the cost to operate the machine for the duration of a year.
- Environmental Impacts Activity – Students will build upon the previous activity by determining the environmental impact of operating the shop
equipment. The general rule is that on average every kilowatt hour of electricity produces 1.6 pounds of carbon dioxide.

- **Energy Guide Labels / Comparing Appliances Activity** - Students will use Energy Guide labels from 2 similar machines. Their task is to choose the machine that is most economical considering purchase price as well as cost of operating the machine for expected life.

- **Hydraulic Energy Project - This project will focus on increasing students’ knowledge of existing hydroelectric power plants in the U.S. Each student will research a different hydroelectric site and design a presentation containing a description of the site, how it generates energy, amount of power generated, and how energy is stored and distributed. Students will also include environmental effects of creating dams and its potential impact on surrounding and downstream agriculture. In small groups, students will make presentations to each other.

- **Renewable Energies Research Activity - Students** will create a chart comparing all types of energies studied so far (solar, wind, geothermal, hydroelectric, hydrogen cell, natural gas, nuclear energy). They will collect information about the amount of energy created in a year, cost, environmental impacts, emissions, and waste. In groups students will then create an informational website which will include all the students’ information and present it to the class.

- **Math in Electricity Performance Task - Math in Electricity** - Students will use mathematical formulas throughout the electrical unit. Students will learn how to manipulate the formula Watts = Volts x Amperes to calculate watts, amperes and volts. Students will also calculate load capacity for various branch circuits. Students will also troubleshoot if a
40 ampere circuit has enough power to operate specified equipment/machinery.

- **Extension Activity** - Exploring Energy Efficiency
  Lab Aids Kit - Energy comes in many forms, such as electricity, light, magnetism and heat. Regardless of their purpose, most appliances that use electricity transform some of the electrical energy into heat energy. If you’ve ever touched a glowing light bulb or one that just went out, you know this – it’s hot! When the purpose of the appliance is to produce something other than heat, the energy that becomes heat is considered “lost” or wasted. Efficiency is a measurement of how much energy is wasted. A fan with an efficiency of 90% converts 90% of the electricity used into kinetic energy of the moving fan blades and transforms 10% into wasted heat energy. In this activity, students will calculate how efficiently an incandescent flashlight bulb produces light energy. The greater the efficiency of a light bulb, the less heat it produces. Students will conduct an experiment to explore the energy efficiency of an incandescent light bulb. Students will submerge the bulb in water to determine the amount of “heat waste” that the bulb gives off.

- **Extension Activity** - School Energy Audit - Students will conduct an energy audit of the school. Students will collect data on classroom light usage during the day, including bathrooms, offices, outside lights and the gym. They will look at light bulbs and calculate how much energy is being used per room. We will take a look at the school’s electricity bill, provided by the Energy Department at the district office. They will research to find the source of energy being provided to our school. And finally they will create a plan and share it with the administration and teachers on how we can all conserve our energy.
### Meeting the Needs of ELs:

- Utilize the student information system to acquire the language levels of EUHSD English Learners.
- In 2012, the CA Department of Education adopted new language level proficiency descriptors and new EL state standards. Visit the following website to learn more about those new descriptors and corresponding standards: [http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf](http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf)
- In 2014, the CA Department of Education adopted new ELA-ELD Framework, with specific strategies designed to meet the needs of EL students. Visit the following URL to learn more about the new frameworks: [http://www.cde.ca.gov/ci/rl/cf/documents/elaeldfwchapter11.pdf](http://www.cde.ca.gov/ci/rl/cf/documents/elaeldfwchapter11.pdf)

### Unit Resources:

- Textbook
- Various tools and equipment
- [https://owl.english.purdue.edu/owl/](https://owl.english.purdue.edu/owl/)
- [http://www.hse.gov.uk/electricity/standards.htm](http://www.hse.gov.uk/electricity/standards.htm)
Agricultural Engineering 1 Scope and Sequence
Unit 4 – Plumbing Systems & Water Use
Length: 4 Weeks

Unit Description: The students will learn to identify plumbing materials and perform basic plumbing procedures. Students will learn how to select, install, and maintain a soil irrigation system. Students will learn how to maintain and use fluid and robotic power in agricultural applications. Students will identify methods of water conservation. Major areas of instruction include Plumbing and Irrigation Technology. This knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test.

Agricultural Mechanics Pathway Standards:

B4.0 Select and apply plumbing system practices commonly used in agriculture.
B4.1 Match appropriate basic plumbing fitting skills with a variety of materials, such as copper, polyvinyl chloride (PVC), steel, polyethylene, and acrylonitrile butadiene styrene (ABS).
B4.2 Explain the environmental influences on plumbing and irrigation system choices (e.g., filter systems, water disposal, drip vs. flood).
B4.3 Research and communicate how various plumbing and irrigation systems are used in agriculture.
B4.4 Complete a plumbing project, including interpreting a plan, developing a bill of materials and cutting list, selecting materials, joining, and testing.

Reading Standards for CTE Grade 9/10:
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
3. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Writing Standards for CTE grade 9/10:
2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style

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<td>• Communicate both orally and in writing.</td>
<td>• Plumbing Exercise in Pipe Fitting Performance Task - The purpose of the pipe fitting exercise is to obtain experience in assembling a watertight unit using different types of plumbing materials. Skills to learn include using various types of adaptors and fittings, cutting pipe materials to length, reaming and cleaning pipe ends, threading and making galvanized connections, making cemented plastic connections, soldering copper connections, and making polyethylene connections using clamps. Students will be provided blueprints, and must assemble the device according to the plan provided. Once the student has the device assembled, the project will be graded based on ability to follow plans, correct joining method of various materials, and ability of device to hold water without leaking.</td>
<td>• Unit quizzes</td>
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<td>• Conduct research, both small and on a larger scale, on specific assigned topics such as safety and machine tool use.</td>
<td>• Research Task – Students will use a variety of WWW resources to research and write an informational essay on the environmental influences on plumbing and irrigation system choices. They will research and explain how various plumbing and irrigation systems are used in agriculture and will submit their findings in a 2-4-page mini research paper including use of APA citation.</td>
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4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

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| • Select appropriate tools for specific task. |
| • Operate machinery according to specifications. |
| • Design project plans using mechanical drawing techniques. |
| • Explain environmental influences associated with plumbing and irrigation systems. |</p>
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  - [http://www.plumbinghelp.ca/articles_plumbing_symbols/](http://www.plumbinghelp.ca/articles_plumbing_symbols/)  
  - [https://www.qsupply.com/farm-livestock/plumbing-supplies.html](https://www.qsupply.com/farm-livestock/plumbing-supplies.html) |
Agricultural Engineering 1 Scope and Sequence

Unit 5 – Concrete and Masonry

Length: 4 Weeks

**Unit Description:** Students will understand the large role that cement and concrete products play in everyday lives. Students will discuss and understand the difference between cement and concrete. Students will be able to explain how cement and concrete are used. Students will understand how cement is made. Students will be able to identify materials used to make concrete. Students will be able to explain how much energy is used to separate small or large particles. Students will learn about proportioning concrete mixes (Unit 2). Students will be able to identify various types of aggregate. Students will discuss why various sizes of aggregate are needed to create concrete. Students will know the chemistry of cement. Students will understand that concrete hydrates and the difference between hydration and drying. Students will be able to articulate the principle of conservation of mass. Students will demonstrate the ability to mix and place concrete and masonry materials. This knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test.

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<th><strong>Agricultural Mechanics Pathway Standards:</strong></th>
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<td>B6.0 Understand concrete and masonry practices commonly used in agriculture.</td>
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<td>B6.1 Identify and explain the use of concrete and masonry tools and demonstrate proper handling of concrete materials.</td>
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<tr>
<td>B6.2 Practice bed preparation, concrete forms layout, and construction.</td>
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<tr>
<td>B6.3 Complete a concrete or masonry project, including calculating volume, developing a bill of materials, assembling, mixing, placing, and finishing. (Introduced in year 1)</td>
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<td>- Use and Identification Activity - Students will identify tools of the concrete and masonry industry as well as their correct usage. Information obtained will be included in their interactive notebooks. Pictures of the tools along with a scenario detailing proper use will also be present.</td>
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<td>- Concrete Mix Performance Task - When given premixed concrete, students will make predictions regarding what components make concrete. Students will then use sieves to separate out the cement, sand, and gravel particles on the concrete mix. Students will weigh the initial mix, then weigh each component sifted out to determine ratios of sand, cement and gravel in their mix. Give each group of students a 250 ml beaker filled with dry concrete mix. Pour the mixture into the sieve with the largest sized openings with the succeeding smaller sizes below and the collection container at the bottom. Using short brisk motions of the sieves, time how long it takes for each sized particle to be separated. This activity will lead you to a working definition of concrete. The percent of each sized particle can be found by weighing each and comparing that to the total weight of the sample in the 250 ml beaker. Invite the students to identify each group of particles from the sieve. The finest particles contain the cement that makes up the bonding material holding the larger particles together. The students will mix each of the five different sized particles with a small amount of water to see which of the particles actually set. Students will use this knowledge to determine which concrete mix sample, Sample A, Sample B, or Sample C would be best for their project use. (Teacher will have premixed the 3 samples before class, with Sample A containing...</td>
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Demonstrate teamwork approach to learning.
Utilize WWW and other sources of technology to retrieve information.
Cite evidence from text using appropriate citation manual.
Follow complex multi-step instructions.
Determine meaning of words and symbols as they pertain to industry standards.
Produce clear writing that conveys specific ideas and concepts.
Use technology appropriately.
Identify common wood types used for specific projects.
Use measurement tools appropriately and according to scale.
Complete a project according to specific time limits.
Interpret basic industry plans.
Select appropriate tools for specific task.
Operate machinery according to specifications.
Design project plans using mechanical drawing techniques.
Cite specific concrete and masonry practices associated with the agriculture industry.
Identify specific tools associated with concrete and masonry industry and use appropriately and according to plan.

a 5 : 3 : 6 ratio, Sample B containing a 1 : 2 : 3 ratio, and Sample C containing a 3 : 2 : 1 ratio.

Extension Activity (Components of Concrete) - A further look at the components of Concrete - Paste, or mortar, in concrete is composed of Portland cement, water and entrapped air or purposely entrained air. Cement paste ordinarily constitutes about 25 to 40 percent of the total volume of concrete. Students can see proportioning in action by adding 3 to 5 times more water than required to cement and concrete mixes. This will demonstrate how many sizes of particles are needed in a concrete mix. Students will test two mixes: water mixed with concrete mix (cement, small and large aggregate), water, and water mixed with mortar (cement and small aggregate). Place one-part concrete mix to five parts water in a jar. Shake the mixture and let it set for an hour or overnight. Remove larger sized aggregate from a dry concrete mix (or use a mortar mix) and pour one part of the finer mixture into a jar and add five parts water. Shake the contents and let it settle for an hour or overnight. Measure each layer to calculate the percentage of aggregate of each size in both mixes. Compare the two mixes to understand that different particle sizes play a role in quality concrete and see the difference between concrete and mortar.

Extension Activity – (Collection of Aggregate) – May be modified by the instructor: A collection of aggregate - A list of aggregates is provided on the board. A classroom collection is helpful for students to see the varieties of concrete that are possible by varying the aggregates. Two different sized aggregates can be used to show that the total volume of space between aggregates does not change when the size of the aggregate changes. Measure the amount of water that it takes to fill two 1000 ml beakers, each containing a different size of aggregate. The volume of space between particles lessens only when the different sized aggregates are mixed. This can be shown rather dramatically if two different sizes of plastic beads are used. Review your experience with the aggregates from the mortar mix. The aggregates are of such a size to allow the most efficient surface contact between the cement paste and the different sizes of aggregates. The amount of cement paste used must be at minimum equal to the spaces in between the aggregate particles and a small amount more to make the concrete mixture relatively easy to move while pouring concrete and making the surface smooth. This is known as “workability.”
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### Agricultural Engineering 1 Scope and Sequence
#### Unit 6 – Shielded Metal Arc Welding
Length: 4 Weeks

**Unit Description:** Students will learn to select electric arc welders, equipment, and other materials needed for welding in agricultural mechanics. Students will rely heavily upon the knowledge gained from Units 2 & 4 to fully understand the principles of the arc welding process. Students will use arc welding equipment and procedures in welding and cutting. Students will understand measurable attributes of objects and the units, systems, and processes of measurement (Unit 2). Students will recognize and apply mathematics in context, outside of mathematics (Unit 2). Students will understand and explain the interactions of energy and matter (Unit 4). Students will use grammatical and mechanical conventions in written compositions related to processes followed and materials used during projects (Unit 3). Students will understand the characteristics and components of the media allowing them to choose the proper presentation tools for the project and the audience. This knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test. Major areas of instruction include; Selecting and Using Arc Welding Equipment and Arc Welding Mild Steel.

<table>
<thead>
<tr>
<th>Agricultural Mechanics Pathway Standards:</th>
<th>Learning Objectives:</th>
<th>Unit Assignments:</th>
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<tbody>
<tr>
<td>B7.0 Understand oxy-fuel cutting and welding.</td>
<td><strong>Students will be able to…</strong></td>
<td>Use and Identification Activity - Students will identify tools of the metal and welding industry as well as their correct usage. Information obtained will be included in their interactive notebooks. Pictures of the tools along with a scenario detailing proper use will also be present.</td>
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<tr>
<td>B7.1 Explain the role of heat and oxidation in the cutting process.</td>
<td>• Communicate both orally and in writing.</td>
<td>Electrode Identification and Specifications Performance Task - Students will make an information sheet in which they identify commonly used electrodes with the correct numbering system. Students must then determine the chemical makeup of the flux coating for each electrode and correlate their findings to the electrodes ability to protect a newly formed bead while it solidifies from a molten to a hardened state.</td>
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<tr>
<td>B7.2 Properly set up, adjust, shut down, and maintain an oxy-fuel system.</td>
<td>• Conduct research, both small and on a larger scale, on specific assigned topics such as safety and machine tool use.</td>
<td>Let There Be Light Performance Task - Students will strike and maintain an arc by building up a small boss on each center punch mark on coupon. After experimenting with various arc lengths in the welding booth, students will explain what happens when an arc is being maintained. Students must refer back to the electrical unit and use appropriate terminology in their explanation. This explanation should be included in their classroom notebook.</td>
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<tr>
<td>B7.3 Flame-cut metal with an oxy-fuel cutting torch.</td>
<td>• Ask and answer questions using industry terminology.</td>
<td>Defective Weld Conditions and Their Main Causes Research Task - Students will research common defects in welds. Students must then create an interactive chart that describes the weld defect, a visual representation of the defect, and explanation of the defect, a minimum of 3 reasons for the defect, and finally a way that the defect can be corrected in future welds.</td>
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<tr>
<td>B7.4 Fusion-weld mild steel with and without filler rod by using oxy-fuel equipment. (Introduced)</td>
<td>• Participate in small and large group discussions and clarify points of view when needed.</td>
<td>Arc Welding Skills Task - Students will learn to manipulate 2 variables of arc welding: arc length, travel angle, or travel speed. Students will run beads using 6013 welding rod. As student’s</td>
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<td>B7.5 Repair metal objects using a variety of techniques, such as brazing or hard surfacing.</td>
<td>• Interpret information from a variety of documents (informational text, charts, graphs, etc.).</td>
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<td>B8.0 Understand electric arc welding processes.</td>
<td>• Follow specific policies and procedures for safety and equipment use.</td>
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<tr>
<td>B8.1 Select, properly adjust, safely employ, and maintain appropriate welding equipment (e.g., gas metal arc welding, shielded metal arc welding, gas tungsten arc welding).</td>
<td>• Demonstrate health and safety practices when working in the shop.</td>
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<td>B8.2 Read welding symbols and plans, select electrodes, fit-up joints, and control heat and distortion.</td>
<td>• Maintain tools and equipment according to industry specifications.</td>
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<tr>
<td>B8.3 Apply gas metal arc welding, shielded metal arc welding, or flux core arc welding processes to fusion-weld mild steel with appropriate welding electrodes and related equipment.</td>
<td>• Set up and maintain shop to avoid health concerns or safety hazards.</td>
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<tr>
<td>B8.4 Weld a variety of joints in various positions.</td>
<td>• Practice personal safety when handling materials or machinery.</td>
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**Unit Assessments:**
- Unit test
- Unit quizzes
- Tool Identification assessment
- Notebook Check
- Performance Task lab reports
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<th>Reading Standards for CTE Grade 9/10:</th>
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<td>2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.</td>
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<td>4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.</td>
<td>6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.</td>
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<td>complete beads on weld coupons, they must adjust variables to appropriate and inappropriate values. Students will then evaluate their own and their peers’ beads. Students must write justifications for why the beads run are either good or bad. Students must address the variables of arc length, travel angle, and travel speed in their written justifications.</td>
<td>8. Gather relevant information from multiple authoritative print and digital sources (primary and secondary), using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. CA</td>
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<p>| Metal Properties Task - Testing Properties - Professionals who work with metals are concerned about the reliability of those metals. Welders and welding engineers for example, need to know how welding materials will perform under various stresses and loads. These characteristics are determined by the properties of the materials used and by the welding techniques used to join pieces. Welding technicians perform various tests on materials and on welding structures to discover this information. Three kinds of tests used by welding technicians are the impact test, the tensile test, and the guided bend test. Based on the information covered in class regarding testing properties, students will label various testing processes. Students will draw conclusions and infer the types of tests various products would have had to undergo. Items include industrial chain, automobile bumper, and file drawer handle. Students must explain their reasoning and thinking through the writing of an essay. |
| Non-Destructive Testing Lesson - Students will learn about the opportunities in the field of Non-Destructive Weld Testing from a Certified Weld Inspector (CWI) Level III. The CWI will come in and walk the students through the process that they would use in evaluation of a weld. The CWI will also discuss education and training required to enter the field. |</p>
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<th><strong>Instructional Resources:</strong></th>
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Agricultural Engineering 1 Scope and Sequence
Unit 7 – Power Engineering
Length: 4 Weeks

**Unit Description:** Students will learn to identify and explain the principles of operation and the systems of small gas engines. Students will be able to maintain and perform repairs on small engines. Students will explain how diesel engines work and explain how tractors are maintained. This knowledge will be demonstrated by completion of assignments, experiential learning, and a unit test. Major areas of instruction include: Fundamentals of Small Engines, Small Engine Maintenance and Repair & Diesel Engines and Tractor Maintenance.

### Agricultural Mechanics Pathway Standards:

- **B10.0** Understand small and compact engines.
- **B10.1** Understand and explain engine theory, including the application of mathematical and/or physical science laws for both two- and four-stroke cycle engines.
- **B10.2** Differentiate among types of small engines and their applications.
- **B10.3** Identify small-engine parts and explain the various systems (e.g., fuel, ignition, compression, cooling, and lubrication systems).
- **B10.4** Troubleshoot and solve problems with small engines.
- **B10.5** Disassemble, inspect, adjust, and reassemble a small engine.
- **B10.6** Look up and order parts, apply repair and maintenance recommendations from a repair manual, and complete appropriate forms, including work orders.
- **B11.0** Understand the principles and applications of various engines and machinery used in agriculture.
- **B11.1** Identify common agricultural machinery and implements.
- **B11.2** Calibrate, operate, and maintain equipment safely and efficiently.
- **B11.3** Summarize the theory, operation, and troubleshooting of various types of engines found on agricultural machinery, including cooling, fuel, and lubrication systems.
- **B11.4** Explain the theory, operation, and troubleshooting of hydraulic systems.
- **B11.5** Explain the theory, operation, and troubleshooting of power train and power take-off systems.

### Learning Objectives:

**Students will be able to…**

- Communicate both orally and in writing.
- Conduct research, both small and on a larger scale, on specific assigned topics such as safety and machine tool use.
- Ask and answer questions using industry terminology.
- Participate in small and large group discussions and clarify points of view when needed.
- Interpret information from a variety of documents (informational text, charts, graphs, etc.).
- Follow specific policies and procedures for safety and equipment use.
- Demonstrate health and safety practices when working in the shop.
- Maintain tools and equipment according to industry specifications.
- Set up and maintain shop to avoid health concerns or safety hazards.
- Practice personal safety when handling materials or machinery.
- Locate and adhere to MSDS instructions.
- Demonstrate teamwork approach to learning.
- Utilize WWW and other sources of technology to retrieve information.

### Unit Assignments:

- **Use and Identification Activity - Students will identify tools of the industry as well as their correct usage. Information obtained will be included in their interactive notebooks. Pictures of the tools along with a scenario detailing proper use will also be present.**
- **Engine Research Task - Students write a research paper including history, development, an introductory exploration of the physics involved in the operation of the engine and how it has evolved to the current design stage, reporting orally to the full class their findings. Students research types of machines (device that transmits or modifies force or motion): simple, internal combustion, external combustion, turbine, electronic, hydraulics, and ones using alternative energy sources.**
- **Mini Systems Research Project - Students will choose an engine system to become a master of; they may choose the Compression System, the Fuel System, the Ignition System, the Cooling System or the Lubrication System. Students will then compile a Know Book detailing what comprises the system and how it works.**

### Unit Assessments:

- Unit test
- Unit quizzes
- Tool Identification assessment
- Notebook Check
- Performance Task lab reports
Reading Standards for CTE Grade 9/10:
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
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Writing Standards for CTE grade 9/10:
2d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
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- Cite evidence from text using appropriate citation manual.
- Follow complex multi-step instructions.
- Determine meaning of words and symbols as they pertain to industry standards.
- Produce clear writing that conveys specific ideas and concepts.
- Use technology appropriately.
- Identify common wood types used for specific projects.
- Use measurement tools appropriately and according to scale.
- Complete a project according to specific time limits.
- Interpret basic industry plans.
- Select appropriate tools for specific task.
- Operate machinery according to specifications.
- Design project plans using mechanical drawing techniques.
- Explain the components of small and compact engines.
- Explain engine theory.
- Identify small engine parts.
- Identify parts of various engine components/systems – cooling system, compression, ignition, etc.
- Identify common agricultural machinery and implements.
- Troubleshoot various engine problems.
- Explain the workings of a hydraulic system; including troubleshooting and basic repair.

- Developing a Service and Maintenance Plan Activity
  - Students will develop a service and maintenance schedule for a tractor. Students must consider engine type and use in determining schedule.
- Compression Ratios Activity - The students will estimate the compression ratio of an engine from measurements, compare the estimate with the engine specifications, determine how the ratio would change if the cylinder head were milled, and consider the effect on other engine parameters.
- Extension Activity It’s Not Magic by Thomas Dougherty CTE Online - How does a carburetor work, is it physics or magic. The teacher will set-up a “carburetor” system using water bottles and tubing. Students will correlate their bottle set-up with that of an actual carburetor diagram. We then identify those parts on the different carburetors on their handouts as well as the idle circuit, main circuit and metering screws. When the pressure at the end of the tube is lowered, atmospheric pressure will push the fuel into the airstream. The teacher explains that on an actual engine the pressure drop is caused by the vacuum created by the piston travelling down with the intake valve open (the intake stroke). The teacher then allows the students to fill water bottles, insert tubes and blow compressed air across the end of the tube with a blowgun. Students witness the water being sucked from the bottle and atomized in the air stream. By varying the diameter of the tubing and the amount of air being blown across it, they will simulate jetting and fuel flow.
Meeting the Needs of ELs:

- Utilize the student information system to acquire the language levels of EUHSD English Learners.
- In 2012, the CA Department of Education adopted new language level proficiency descriptors and new EL state standards. Visit the following website to learn more about those new descriptors and corresponding standards: http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf
- In 2014, the CA Department of Education adopted new ELA-ELD Framework, with specific strategies designed to meet the needs of EL students. Visit the following URL to learn more about the new frameworks: http://www.cde.ca.gov/ci/rl/cf/documents/elaeldfwchapter11.pdf

Instructional Resources:

- https://owl.english.purdue.edu/owl/
- https://www.thoughtco.com/car-how-tos-4132714
### Agriculture and Natural Resources Anchor Standards:

**Career Planning and Management**
- 3.1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.
- 3.2 Evaluate personal character traits, such as trust, respect, and responsibility, and understand the impact they can have on career success.
- 3.3 Explore how information and communication technologies are used in career planning and decision making.
- 3.4 Research the scope of career opportunities.

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- Cite evidence from text using appropriate citation manual.
- Follow complex multi-step instructions.
- Determine meaning of words and symbols as they pertain to industry standards.
- Produce clear writing that conveys specific ideas and concepts.
- Use technology appropriately.

### Unit Assignments:

- **Career Research Paper & Presentation** - Students will conduct research on a variety of careers within the Agricultural Engineering and Mechanics Industry Sector. Students will research at least 4 careers, selecting one of the careers for a more in-depth analysis. Students will first write a career research paper using MLA format. Information in the paper should include industry information, job description, qualifications, education needed, pay range, and projected demand for professionals in their chosen industry. Students will then create a career plan which includes the job description, interests, personal qualifications needed (things they need to know and things they need to know how to do), post-secondary education options, and professional associations. They should use information from a variety of sources. Students will cite sources and write up their findings using APA formatting. The paper should be 3-5 pages in length and include specific references to each area cited in the research project. Students will upload their research paper as part of their final course project.
- **Job Application Performance Task** – Students will research at least 2 job openings within the local region and will complete the job application. Students will print the application and submit it to their portfolio and will be assessed for completion and correctness.
- **Resume and Cover Letter Performance Task** - Students will create a cover letter and resume detailing the competencies and skills attained while enrolled in the Agricultural Engineering course. Students will assume to be preparing this information for potential employment at a local fabrication, electrical, plumbing, concrete or power systems company. Students will submit their resume and cover letter along with their job applications from the previous task and their career research project as part of their overall career exploration unit of study.

### Unit Assessments:

- Unit test
- Unit quizzes
- Tool Identification assessment
- Notebook Check
- Resume and Cover Letter
- Project Presentation
convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
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**Instructional Resources:**

- [https://owl.english.purdue.edu/owl/](https://owl.english.purdue.edu/owl/)
- [https://collegegrad.com/careers/agricultural-engineers](https://collegegrad.com/careers/agricultural-engineers)
- [http://www.engineering.com/jobs/agricultural-engineering/california](http://www.engineering.com/jobs/agricultural-engineering/california)