

# Course Outline

Energy, Environment, and Utilities

REVISED: August/2020

**Job Title**

Electronics Technician

**72-55-60**

**Career Pathway:**

Telecommunications

**Electronics/2**

**Industry Sector:**

Energy, Environment, and Utilities

**Credits:** 5

**Hours:** 90

**O\*NET-SOC CODE:**

17-3023.01

**Course Description:**

This competency-based course is the second in a sequence of three designed for electronics. It provides students with project-based experiences in electromechanical installation and maintenance. Instruction includes an introduction and reviews of workplace safety policies and procedures, trade mathematics, and employability skills. Emphasis is placed on advanced soldering techniques, principles and designs of alternating current (AC) circuits, principles and applications of capacitance, inductance, advanced alternating current (AC) electronics, and solid electronics, and the construction and testing techniques for semiconductors. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

**CBEDS Title:**

Introduction to Electronics Technology

**Prerequisites:**

Enrollment requires successful completion of the Electronics/1 (72-55-50) course.

**CBEDS No.:**

5551

**NOTE:** For Perkins purposes this course has been designated as a **concentrator** course.

This course cannot be repeated once a student receives a Certificate of Completion.



## **COURSE OUTLINE COMPETENCY-BASED COMPONENTS**

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

### **COURSE OUTLINE COMPONENTS**

### **LOCATION**

#### **GOALS AND PURPOSES**

Cover

The educational goals or purposes of every course are clearly stated, and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course and are written to be understandable by a prospective student.

#### **PERFORMANCE OBJECTIVES OR COMPETENCIES**

pp. 7-13

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and in competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction, and assessment in competency-based education are explicit, known, agreed upon, integrated, performance oriented, and adaptive.

**COURSE OUTLINE COMPETENCY-BASED COMPONENTS**  
**(continued)**

<b>COURSE OUTLINE COMPONENTS</b>	<b>LOCATION</b>
<b>INSTRUCTIONAL STRATEGIES</b>	p. 15
<p>Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.</p> <p>Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.</p>	
<b>UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT</b>	Cover
<p>The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.</p> <p>Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.</p>	
<b>EVALUATION PROCEDURES</b>	pp. 15-16
<p>The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.</p> <p>Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.</p>	
<b>REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT</b>	Cover
<p>After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.</p>	

## **ACKNOWLEDGMENTS**

Thanks to LUZ GRANADOS for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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# **CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS**

## ***Energy, Environment and Utilities Industry Sector***

### ***Knowledge and Performance Anchor Standards***

#### **1.0 Academics**

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Energy, Environment, and Utilities academic alignment matrix for identification of standards.

#### **2.0 Communications**

Acquire, and accurately use Energy, Environment, and Utilities sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

#### **3.0 Career Planning and Management**

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

#### **4.0 Technology**

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Energy, Environment, and Utilities sector workplace environment.

#### **5.0 Problem Solving and Critical Thinking**

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Energy, Environment, and Utilities sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

#### **6.0 Health and Safety**

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Energy, Environment, and Utilities sector workplace environment.

#### **7.0 Responsibility and Flexibility**

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Energy, Environment, and Utilities sector workplace environment and community settings.

#### **8.0 Ethics and Legal Responsibilities**

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

#### **9.0 Leadership and Teamwork**

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization.

#### **10.0 Technical Knowledge and Skills**

Apply essential technical knowledge and skills common to all pathways in the Energy, Environment, and Utilities sector.

#### **11.0 Demonstration and Application**

Demonstrate and apply the knowledge and skills contained in the Energy, Environment, and Utilities anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

## ***Energy, Environment, and Utilities Sector Pathway Standards***

### **C. Telecommunications Pathway**

The Telecommunications pathway prepares students for employment and postsecondary education and training in the wireless and fixed-line communications industries. The sharing of information is essential for personal, commercial, educational, government, and military functions. Information is stored, sent, and accessed primarily via the telecommunications industries.

Sample occupations associated with this pathway:

- ◆ Cable/Telecommunications Installation and Maintenance Technicians
- ◆ Line Workers
- ◆ Network Operators, Technicians, Designers, and Managers
- ◆ Network Security Administrator
- ◆ Satellite Systems Installation/Engineers

- C1.0 Understand the basic principles and concepts that impact the telecommunications industry, including systems, concepts, and regulations.
- C2.0 Demonstrate understanding and use of the basic and emerging technologies that impact the telecommunications industry.
- C3.0 Examine the role and functions of satellites in telecommunications.
- C4.0 Research the components, interaction, and operations of wireless telecommunications systems.
- C5.0 Research the components, interaction, and operations of fixed-wire telecommunications systems.
- C6.0 Consider privacy and security issues of the telecommunications systems.

**CBE**  
**Competency-Based Education**

**COMPETENCY-BASED COMPONENTS**  
**for the Electronics/2 Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. INTRODUCTION AND SAFETY</p> <p>Review, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p> <p>(2 hours)</p>	<ol style="list-style-type: none"> <li>1. Review the scope and purpose of the course.</li> <li>2. Review the overall course content as a part of the Linked Learning Initiative.</li> <li>3. Review classroom policies and procedures.</li> <li>4. Review the different occupations in the Energy and Utilities Industry Sector which have an impact on the role of electronics technicians.</li> <li>5. Review the opportunities available for promoting gender equity and the representation of non-traditional populations in electronics.</li> <li>6. Review the impact of Environmental Protection Agency (EPA) legislation on the Energy and Utilities Industry Sector practices.</li> <li>7. Review and demonstrate the procedures for contacting proper authorities for the removal of hazardous materials based on the EPA standards.</li> <li>8. Review the purpose of the California Occupational Safety and Health Administration (Cal/OSHA) and its laws governing electronics technicians.</li> <li>9. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the electronics industry.</li> <li>10. Review classroom and workplace first aid and emergency procedures according to American Red Cross (ARC) standards.</li> <li>11. Review how each of the following insures a safe workplace:               <ol style="list-style-type: none"> <li>a. employees' rights as they apply to job safety</li> <li>b. employers' obligations as they apply to safety</li> <li>c. safety laws applying to electrical tools</li> </ol> </li> <li>12. Pass the safety test with 100% accuracy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 6, 7</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Career Planning and Management: 3.1, 3.3, 3.4, 3.5 Technology: 4.5 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.11, 6.12, 6.13, 6.14, 6.16 Leadership and Teamwork: 9.6 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C6.4, C7.1</p>
<p>B. TRADE MATHEMATICS REVIEW</p> <p>Review, apply, and evaluate the mathematical requirements in electronics work.</p>	<ol style="list-style-type: none"> <li>1. Review the practical applications of math in electronics work.</li> <li>2. Review and demonstrate problem-solving techniques involving whole number problems, using arithmetic operations (addition, subtraction, multiplication, and division).</li> <li>3. Review and demonstrate problem-solving techniques involving various fraction problems using arithmetic operations.</li> <li>4. Review and demonstrate problem-solving techniques involving various decimal problems using addition, subtraction, multiplication, and division.</li> <li>5. Review and demonstrate techniques for changing fractions to decimals.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 5</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Problem Solving and Critical Thinking: 5.1, 5.3, 5.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hour)	<ol style="list-style-type: none"> <li>6. Review and demonstrate techniques for changing decimals to fractions.</li> <li>7. Review the English system of measuring length.</li> <li>8. Review the English system of measuring weight.</li> <li>9. Review the English system of measuring volume or capacity.</li> <li>10. Review and demonstrate problem-solving techniques for various English system measuring problems using arithmetic operations.</li> <li>11. Review and demonstrate measuring techniques for objects by using the English system measuring tools common to the trade.</li> <li>12. Review the conversion of metric units in ascending and descending powers of ten.</li> <li>13. Review the conversion of the English numbering system to metric system.</li> <li>14. Review the conversion of the metric system to the English numbering system.</li> <li>15. Review the calculation of square roots of regular numbers.</li> <li>16. Review and demonstrate problem-solving techniques for geometric problems.</li> <li>17. Review and demonstrate problem-solving techniques for algebraic problems.</li> <li>18. Review and demonstrate problem-solving techniques using percentages.</li> <li>19. Review and demonstrate techniques for reading and interpreting graphs.</li> <li>20. Review and demonstrate the conversion of decimal numbers to binary numbers.</li> <li>21. Review and demonstrate the conversion of binary numbers to decimal numbers.</li> </ol>	<p>Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> C1.5, C3.7</p>
<p>C. <b>ADVANCED SOLDERING</b></p> <p>Understand, apply, and evaluate the techniques of advanced soldering.</p>	<ol style="list-style-type: none"> <li>1. Describe and demonstrate the proper use, maintenance, and storage techniques for the following basic electronic tools and equipment: <ol style="list-style-type: none"> <li>a. matching soldering tools and materials with their uses</li> <li>b. soldering and desoldering various components and connectors</li> <li>c. protecting temperature sensitive components and static sensitive devices (ESD), using protective devices</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 4</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Health and Safety: 6.1, 6.3, 6.6, 6.7, 6.8, 6.9, 6.11, 6.13, 6.14, 6.15, 6.16 Responsibility and Flexibility: 7.5, 7.7 Ethics and Legal Responsibilities: 8.4</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)		Technical Knowledge and Skills: 10.1, 10.2, 10.3  <b>CTE Pathway:</b> C5.2, C5.5, C5.7, C5.8, C5.9
<p>D. ALTERNATING CURRENT (AC) CIRCUITS</p> <p>Understand, apply, and evaluate the principles of AC circuits.</p>	<ol style="list-style-type: none"> <li>1. Define the following:             <ol style="list-style-type: none"> <li>a. alternating current (AC)</li> <li>b. waveform</li> <li>c. sine waves</li> <li>d. triangular waves</li> <li>e. square waves</li> <li>f. power ratio</li> <li>g. transformer</li> <li>h. resistive circuit</li> <li>i. phase relationships</li> </ol> </li> <li>2. Describe the following:             <ol style="list-style-type: none"> <li>a. difference between AC and Direct Current (DC)</li> <li>b. operation of a basic alternating current signal</li> <li>c. values of sine waves                 <ol style="list-style-type: none"> <li>i. instantaneous value</li> <li>ii. average value</li> <li>iii. effective value</li> <li>iv. frequency</li> </ol> </li> <li>d. phase relationships of alternating current                 <ol style="list-style-type: none"> <li>i. single-phase electricity</li> <li>ii. two-phase electricity</li> <li>iii. three-phase electricity</li> </ol> </li> <li>e. relationship between current and voltage</li> <li>f. concept of non-sinusoidal waveforms</li> <li>g. fluctuating DC and AC waveforms</li> <li>h. properties and characteristics of transformers</li> <li>i. reasons for transformer power loss application of fixed, variable, multi-tapped, and auto transformers</li> <li>j. common failures of transformers</li> </ol> </li> <li>3. Describe and demonstrate the following:             <ol style="list-style-type: none"> <li>a. computation of the period of AC waveforms</li> <li>b. computation of the frequency of AC waveforms</li> <li>c. peak value of an alternating current signal</li> <li>d. average value of an alternating current signal</li> <li>e. root-mean-square (RMS) value of an alternating current signal</li> <li>f. measurement of AC volts, amps, and resistance calculation of resistance in series and parallel AC circuits, and the amount of current flow</li> <li>g. operation of an oscilloscope</li> <li>h. operation of a function generator</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 4, 5</p> <p><b>CTE Anchor:</b>            Communication: 2.1, 2.2, 2.3, 2.4            Problem Solving and Critical Thinking: 5.1, 5.4            Health and Safety: 6.8, 6.13, 6.15, 6.16            Technical Knowledge and Skills: 10.1, 10.2, 10.3</p> <p><b>CTE Pathway:</b> C5.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(15 hours)	<ul style="list-style-type: none"> <li>i. construction and measurement of basic AC circuits</li> <li>j. illustration and construction of a series resistive circuit, calculating parameters and describing phase relationship</li> <li>k. illustration and construction of a parallel resistive circuit, calculating parameters and describing phase relationship</li> <li>l. measurement of the parameters of basic AC circuits</li> <li>m. construction of a transformer</li> <li>n. troubleshooting techniques in isolating common failures of transformers</li> </ul>	
<p>E. CAPACITANCE</p> <p>Understand, apply, and evaluate the effects of capacitance in direct and alternating current circuits.</p> <p>(15 hours)</p>	<ul style="list-style-type: none"> <li>1. Define the following: <ul style="list-style-type: none"> <li>a. capacitance</li> <li>b. capacitor</li> <li>c. capacitive circuit</li> </ul> </li> <li>2. Describe the following: <ul style="list-style-type: none"> <li>a. three physical factors which determine capacitance</li> <li>b. unit of capacitance</li> <li>c. properties and characteristics of capacitors</li> <li>d. effects of capacitance in DC circuits</li> <li>e. effects of capacitance in AC circuits</li> <li>f. characteristics of various capacitor types</li> <li>g. the effects of a capacitor on series and parallel circuits</li> <li>h. effects of frequency on capacitive reactance</li> <li>i. relationship between phase angle and the values of resistance and capacitance reactance</li> <li>j. impedance</li> <li>k. effect of frequency on impedance</li> <li>l. RC high and low pass filters</li> <li>m. common failures of capacitors</li> </ul> </li> <li>3. Describe and demonstrate the following: <ul style="list-style-type: none"> <li>a. reading the values of a capacitor</li> <li>b. determining the resistance capacitance (RC) time constant for a circuit, given the values of resistance and capacitance</li> <li>c. calculating the value of capacitive reactance given the values of capacitance and frequency</li> <li>d. construction of a capacitor</li> <li>e. illustration and construction of a series capacitive circuit</li> <li>f. illustration and construction of a parallel capacitive circuit</li> <li>g. troubleshooting techniques in isolating the common failures of capacitors</li> </ul> </li> </ul>	<p><b>Career Ready Practice:</b> 1, 3, 5</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Technology: 4.1 Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Health and Safety: 6.1, 6.8, 6.11, 6.15, 6.16 Technical Knowledge and Skills: 10.1, 10.2, 10.5</p> <p><b>CTE Pathway:</b> C5.5, C5.6, C5.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>F. INDUCTANCE</p> <p>Understand, apply, and evaluate the effects of inductance in direct and alternating current circuits.</p> <p>(15 hours)</p>	<ol style="list-style-type: none"> <li>1. Define the following:               <ol style="list-style-type: none"> <li>a. inductance</li> <li>b. inductors</li> <li>c. inductive circuit</li> <li>d. self-induction</li> </ol> </li> <li>2. Describe the following:               <ol style="list-style-type: none"> <li>a. four physical factors which determine inductance</li> <li>b. unit of inductance</li> <li>c. properties and characteristics of inductors</li> <li>d. effects of inductance in DC circuits</li> <li>e. effects of inductance in AC circuits</li> <li>f. effects of inductance on series and parallel circuits</li> <li>g. effects of frequency on inductive reactance</li> <li>h. relationship between phase angle and inductive reactance</li> <li>i. LR high and low pass filters</li> <li>j. common failures of inductors</li> </ol> </li> <li>3. Describe and demonstrate the following:               <ol style="list-style-type: none"> <li>a. illustration of inductance resistance (LR) time constant for a circuit, given the values of resistance and inductance</li> <li>b. calculation of inductive reactance, given the values of inductance and frequency</li> <li>c. basic construction of an inductor</li> <li>d. illustration and construction of a series inductive circuit</li> <li>e. illustration and construction of a parallel inductive circuit</li> <li>f. troubleshooting techniques in isolating common failures of inductors</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 5</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Technology: 4.1 Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Health and Safety: 6.1, 6.8, 6.11, 6.15, 6.16 Technical Knowledge and Skills: 10.1, 10.2, 10.5</p> <p><b>CTE Pathway:</b> C5.5, C5.6, C5.7</p>
<p>G. ADVANCED ALTERNATING CURRENT (AC) ELECTRONICS</p> <p>Understand, apply, and evaluate the principles of advanced alternating current (AC) electronics.</p>	<ol style="list-style-type: none"> <li>1. Define the following:               <ol style="list-style-type: none"> <li>a. Kirchhoff's current law</li> <li>b. vector</li> <li>c. resistor-capacitor (RC) circuit</li> <li>d. series RC circuit</li> <li>e. parallel RC circuit</li> <li>f. resistor-inductor circuit (a.k.a. RL circuit)</li> <li>g. tuned circuit (a.k.a. LC circuit)</li> <li>h. resonant circuit (a.k.a. RLC circuit)</li> </ol> </li> <li>2. Describe the features and functions of the following RC circuits that filter a signal waveform:               <ol style="list-style-type: none"> <li>a. high-pass filter</li> <li>b. low-pass filter</li> <li>c. band-pass filter</li> <li>d. band-reject filter</li> </ol> </li> <li>3. Describe the following:               <ol style="list-style-type: none"> <li>a. Ohm's law for alternating current circuits</li> <li>b. power factor in relationship to RLC circuits</li> <li>c. power factor correction in relationship to impedance</li> <li>d. characteristics of a series resonant circuit</li> <li>e. characteristics of a parallel resonant circuit</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 4, 5</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Health and Safety: 6.8, 6.13, 6.15, 6.16 Ethics and Legal Responsibilities: 8.2, 8.3 Technical Knowledge and Skills: 10.1, 10.2, 10.3, 10.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	<ol style="list-style-type: none"> <li>4. Describe and demonstrate the following:               <ol style="list-style-type: none"> <li>a. illustration and construction of a series RC circuit</li> <li>b. illustration and construction of a parallel RC circuit</li> <li>c. illustration of RC time constraints</li> <li>d. measurement of the parameters of RC circuit illustration and construction of a series RL circuit</li> <li>e. illustration and construction of a parallel RL circuit</li> <li>f. illustration of RL time constants</li> <li>g. measurement of the parameters of RL circuits</li> <li>h. illustration and construction of a series RLC circuit</li> <li>i. illustration and construction of a parallel RLC circuit</li> <li>j. measurement of the parameters of RLC circuits</li> </ol> </li> <li>5. Describe/review and demonstrate the proper use of the following electronic testing equipment:               <ol style="list-style-type: none"> <li>a. an ammeter to measure alternating current</li> <li>b. a voltmeter to measure alternating current voltage</li> <li>c. a wattmeter to measure alternating current wattage</li> <li>d. a frequency counter to measure alternating current frequency</li> <li>e. an oscilloscope in various laboratory experiments, such as measuring voltage, period, and phase values</li> </ol> </li> </ol>	<b>CTE Pathway:</b> C1.1, C2.9, C5.5, C5.6, C5.7, C5.11
<b>H. SOLID STATE ELECTRONICS</b>  Understand, apply, and evaluate the principles of solid-state electronics.  (10 hours)	<ol style="list-style-type: none"> <li>1. Define and describe the features and functions of the following:               <ol style="list-style-type: none"> <li>a. solid state electronics</li> <li>b. crystalline semiconductor</li> <li>c. integrated circuit (IC)</li> <li>d. light-emitting diode (LED)</li> <li>e. liquid-crystal display (LCD)</li> <li>f. P.N. junction diode</li> </ol> </li> <li>2. Describe and demonstrate the following:               <ol style="list-style-type: none"> <li>a. construction of diode rectifier circuits</li> <li>b. construction of basic transistor circuit configurations</li> <li>c. illustration and construction of a single stage transistor amplifier</li> </ol> </li> </ol>	<b>Career Ready Practice:</b> 1, 3, 4, 5, 11  <b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Health and Safety: 6.6, 6.15, 6.16 Technical Knowledge and Skills: 10.1, 10.2  <b>CTE Pathway:</b> C1.1, C5.5, C5.7
<b>I. SEMICONDUCTORS</b>  Understand, apply, and evaluate the construction and testing techniques used for semiconductor devices.	<ol style="list-style-type: none"> <li>1. Define and/or identify the following:               <ol style="list-style-type: none"> <li>a. semiconductor</li> <li>b. diodes</li> <li>c. anode</li> <li>d. cathode</li> <li>e. zener diode</li> <li>f. forward bias</li> <li>g. reverse bias</li> </ol> </li> </ol>	<b>Career Ready Practice:</b> 1, 3, 4, 5, 11  <b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Health and Safety: 6.6, 6.15, 6.16

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	<ol style="list-style-type: none"> <li>2. Describe and demonstrate the following:               <ol style="list-style-type: none"> <li>a. labeling the anode using an Ohmmeter</li> <li>b. labeling the cathode using an Ohmmeter</li> <li>c. labeling non-functional electrodes using an Ohmmeter</li> <li>d. calculating voltage drops through diodes, including Zener diodes</li> </ol> </li> <li>3. Describe how forward and reverse bias voltages affect current flow through a semiconductor diode.</li> </ol>	<p>Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C5.5, C5.7</p>
<p>J. EMPLOYABILITY SKILLS REVIEW</p> <p>Review, apply, and evaluate the employability skills required in electronics work.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> <li>1. Review employer requirements for the following:               <ol style="list-style-type: none"> <li>a. punctuality</li> <li>b. attendance</li> <li>c. attitude toward work</li> <li>d. quality of work</li> <li>e. teamwork</li> <li>f. timeliness</li> <li>g. communication skills</li> <li>h. computer skills and software applications</li> </ol> </li> <li>2. Update list of potential employers through traditional and internet sources.</li> <li>3. Review the role of electronic social networking in job search.</li> <li>4. Update sample résumés.</li> <li>5. Review the importance of filling out a job application legibly, with accurate and complete information.</li> <li>6. Review the common mistakes that are made on job applications.</li> <li>7. Complete sample job application forms correctly.</li> <li>8. Review the importance of enthusiasm in the interview and on a job.</li> <li>9. Review the importance of appropriate appearance in the interview and on a job.</li> <li>10. Review the importance of the continuous upgrading of job skills.</li> <li>11. Review the importance of customer service as a method of building permanent relationships between the organization and the customer.</li> <li>12. Review and demonstrate appropriate interviewing techniques.</li> <li>13. Review the informational materials and resources needed to be successful in an interview.</li> <li>14. Review and demonstrate appropriate follow-up procedures.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 10, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4, 2.5 Career Planning and Management: 3.1, 3.2, 3.4, 3.5, 3.6, 3.8, 3.9 Technology: 4.2, 4.6 Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7 Ethics and Legal Responsibilities: 8.4, 8.5 Leadership and Teamwork: 9.2, 9.3, 9.4, 9.6 Technical Knowledge and Skills: 10.1, 10.2 Demonstration and Application: 11.1, 11.2, 11.5</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C2.9, C6.4, C7.1, C7.2, C7.4</p>

## ***SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES***

### **TEXTS AND SUPPLEMENTAL BOOKS**

Bishop, Owen. Electronics: Circuits and Systems, 3<sup>rd</sup> Edition. Elsevier Science and Technology, 2007.

Grob, Bernard and Mitchell E. Schultz. Basic Electronics, 5<sup>th</sup> Edition. McGraw-Hill Companies, 2002.

Herrick, Clyde. Basic Electronics Math. Elsevier Science, 2007.

Schuler, Charles A. Electronics: Principles and Applications, 6<sup>th</sup> Edition. McGraw-Hill and Companies, 2002.

### **RESOURCES**

Employer Advisory Board members

CTE Model Curriculum Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/energyutilities.pdf>

California Building Standards Commission

[www.bsc.ca.gov/default.htm](http://www.bsc.ca.gov/default.htm)

Green Building Advisor.com

[greenbuildingadvisor.com](http://greenbuildingadvisor.com)

The Daily Green

[thedailygreen.com](http://thedailygreen.com)

### **COMPETENCY CHECKLIST**

## ***TEACHING STRATEGIES and EVALUATION***

### **METHODS AND PROCEDURES**

- A. Lecture and discussion
- B. Multimedia presentations
- C. Demonstrations and participation
- D. Individualized instruction
- E. Peer teaching
- F. Role-playing
- G. Guest speakers
- H. Field trips and field study experiences
- I. Projects

### **EVALUATION**

SECTION A – Introduction and Safety – Pass the safety test with 100% accuracy.

SECTION B – Trade Mathematics Review – Pass all assignments and exams on trade mathematics review with a minimum score of 80% or higher.

SECTION C – Advanced Soldering – Pass all assignments and exams on advanced soldering with a minimum score of 80% or higher.

SECTION D – Alternating Current (AC) Circuits – Pass all assignments and exams on alternating current (AC) circuits with a minimum score of 80% or higher.

SECTION E – Capacitance – Pass all assignments and exams on capacitance with a minimum score of 80% or higher.

SECTION F – Inductance – Pass all assignments and exams on inductance with a minimum score of 80% or higher.

SECTION G – Advanced Alternating Current (AC) Electronics – Pass all assignments and exams on advanced alternating current (AC) electronics with a minimum score of 80% or higher.

SECTION H – Solid State Electronics – Pass all assignments and exams on solid state electronics with a minimum score of 80% or higher.

SECTION I – Semiconductors – Pass all assignments and exams on semiconductors with a minimum score of 80% or higher.

SECTION J – Employability Skills Review – Pass all assignments and exams on employability skills review with a minimum score of 80% or higher.

## ***Standards for Career Ready Practice***

**1. Apply appropriate technical skills and academic knowledge.**

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and performing other work-related practices.

**2. Communicate clearly, effectively, and with reason.**

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others: they are active listeners who speak clearly and with purpose, and they are comfortable with terminology that is common to workplace environments. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.

**3. Develop an education and career plan aligned with personal goals.**

Career-ready individuals take personal ownership of their educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process, and they understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.

**4. Apply technology to enhance productivity.**

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks.

**5. Utilize critical thinking to make sense of problems and persevere in solving them**

Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve a problem and, once agreed upon, follow through to ensure the problem is resolved.

**6. Practice personal health and understand financial literacy.**

Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.

**7. Act as a responsible citizen in the workplace and the community.**

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them, and they think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.



**8. Model integrity, ethical leadership, and effective management.**

Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

**9. Work productively in teams while integrating cultural and global competence.**

Career-ready individuals contribute positively to every team, as both team leaders and team members. To avoid barriers to productive and positive interaction, they apply an awareness of cultural differences. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.

**10. Demonstrate creativity and innovation.**

Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.

**11. Employ valid and reliable research strategies.**

Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.

**12. Understand the environmental, societal, and economic impacts of decisions.**

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.

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## Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.

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