

# Course Outline

Energy, Environment, and Utilities

REVISED: August/2017

**Job Title**  
Electrician

**72-75-55**

**Career Pathway:**  
Energy and Power Technology

## Electrician/2: Wiring and Codes

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

**Credits:** 10

**Hours:** 120

**O\*NET-SOC CODE:**  
47-2111.00

### Course Description:

This competency-based course is the second in a sequence of five designed for electrical technician and electrician trainees. It provides students with technical instruction and practical experience in electrical wiring and codes. It focuses on safety, permit requirements and code compliance, wiring design and protection, wiring materials and methods, equipment for general use, special occupancies, special equipment, special conditions, communication systems sanctioned by the National Electrical Code (NEC), and the interpretation of data found in the NEC tables. It also covers a review of the practical aspects of resource management when wiring. 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 Electrical Power  
Systems

**CBEDS No.:**  
5583

### Prerequisites:

Enrollment requires completion of the Electrician/1: Fundamentals (72-75-50) course.

**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>	p. 15
<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 PAUL PIDOUX and MARCELA BAKER 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***

### **B. Energy and Power Technology Pathway**

The Energy and Power Technology pathway provides learning opportunities for students interested in preparing for careers in the energy and power industries.

Sample occupations associated with this pathway:

- ◆ Energy Efficiency Evaluation Specialist
- ◆ Energy Engineer
- ◆ Energy Generation/Power Distribution, Maintenance, Inspection, and Repair Technicians
- ◆ Energy/Building Retrofit Specialist
- ◆ Plant/Field Weatherization Installer

- B1.0 Explore the basic conventional and emerging principles and concepts of the energy industry, including energy production, energy transmission, and alternative energy technologies.
- B2.0 Identify various conventional electric power generation fuel sources and the cost and efficiency issues associated with each.
- B3.0 Investigate emerging and alternative electric power generation technologies and fuel sources.
- B4.0 Understand nonnuclear power generation plant operations (coal, oil, natural gas, solar, wind, geothermal power, hydroelectric, or biofuel).
- B5.0 Understand and apply basic knowledge and skills necessary for nuclear power generation and nuclear power plant personnel.
- B6.0 Research methods of energy procurement, transmission, distribution, and storage.
- B7.0 Understand the interrelationships among components of systems.

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

**COMPETENCY-BASED COMPONENTS**  
**for the Electrician/2: Wiring and Codes Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. WORKPLACE SAFETY</p> <p>Understand, apply, and evaluate the safety practices and approved materials for the industry.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe class expectations.</li> <li>2. Describe class rules.</li> <li>3. Demonstrate the ability to read and follow instructions.</li> <li>4. Identify standard shop procedures.</li> <li>5. Describe shop safety rules and regulations.</li> <li>6. Describe first aid practices that apply to electrical technicians and electricians.</li> <li>7. Describe and demonstrate Cardio-Pulmonary Resuscitation (CPR).</li> <li>8. Describe the California Occupational Safety and Health Administration (Cal/OSHA) regulations that apply to electrical technicians and electricians.</li> <li>9. Describe the Environmental Protection Agency (EPA) regulations that apply to electrical technicians and electricians.</li> <li>10. Describe the National Electrical Code (NEC) and its role in safeguarding the work conditions of electricians.</li> <li>11. Pass the designated safety test with 100% accuracy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 6, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2 Health and Safety: 6.1, 6.2, 6.4, 6.6, 6.7, 6.8, 6.9, 6.11, 6.16 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.2</p> <p><b>CTE Pathway:</b> B4.1</p>
<p>B. ELECTRICAL WIRING CODES AND PERMITS</p> <p>Understand, apply, and evaluate the electrical wiring codes, permits, and permit requirements.</p>	<ol style="list-style-type: none"> <li>1. Describe the importance of:             <ol style="list-style-type: none"> <li>a. local requirements for electrical wiring</li> <li>b. state requirements for electrical wiring</li> <li>c. National Electrical Code (NEC) requirements for electrical wiring</li> </ol> </li> <li>2. List three to five requirements for each type of permit:             <ol style="list-style-type: none"> <li>a. local permit</li> <li>b. state permit</li> <li>c. NEC permit</li> </ol> </li> <li>3. Identify plans used for electrical wiring.</li> <li>4. Name the items that are inspected.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2 Problem Solving and Critical Thinking: 5.2, 5.4 Health and Safety: 6.11 Ethics and Legal Responsibilities: 8.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(2 hours)		Technical Knowledge and Skills: 10.1, 10.2  <b>CTE Pathway:</b> B1.7
<b>C. WIRING DESIGN AND PROTECTION</b>  Understand, apply, and evaluate the requirements in wiring design and protection.	<ol style="list-style-type: none"> <li>1. Describe the following wiring design considerations:               <ol style="list-style-type: none"> <li>a. general requirements</li> <li>b. overhead services</li> <li>c. underground services</li> <li>d. emergency services</li> <li>e. service switches</li> </ol> </li> <li>2. Define over-current protection.</li> <li>3. Describe the following grounding considerations:               <ol style="list-style-type: none"> <li>a. conductors</li> <li>b. enclosures</li> <li>c. equipment</li> </ol> </li> <li>4. Describe the following metering equipment options and the specific requirements from their serving agencies:               <ol style="list-style-type: none"> <li>a. self-contained</li> <li>b. current transformers</li> <li>c. switchboards</li> </ol> </li> </ol>	<b>Career Ready Practice:</b> 1, 3  <b>CTE Anchor:</b> Communications: 2.1 Problem Solving and Critical Thinking: 5.3 Health and Safety: 6.1, 6.2, 6.5, 6.8, 6.11, 6.16 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1  <b>CTE Pathway:</b> B1.5 B1.7, B1.8
<b>D. WIRING MATERIALS AND METHODS</b>  Understand, apply, and evaluate the proper wiring materials and methods.	<ol style="list-style-type: none"> <li>1. Describe the following requirements for conductors:               <ol style="list-style-type: none"> <li>a. approved types</li> <li>b. capacities</li> <li>c. voltage drop</li> <li>d. cords and cables</li> <li>e. splices and terminal connections</li> <li>f. installation</li> </ol> </li> <li>2. Describe the impact of the wiring enclosures in the following structural members:               <ol style="list-style-type: none"> <li>a. walls</li> <li>b. slabs</li> <li>c. columns</li> <li>d. beams</li> </ol> </li> <li>3. Describe the features and functions of the following conduits and their respective conduit installation methods:               <ol style="list-style-type: none"> <li>a. rigid conduit</li> <li>b. flexible metal conduit</li> </ol> </li> </ol>	<b>Career Ready Practice:</b> 1, 3  <b>CTE Anchor:</b> Communications: 2.1 Problem Solving and Critical Thinking: 5.3 Health and Safety: 6.1, 6.2, 6.5, 6.8, 6.9, 6.11, 6.16 Ethics and Legal Responsibilities: 8.2



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(50 hours)	<ul style="list-style-type: none"> <li>c. fiber and transite conduit</li> <li>d. electrical metallic tubing</li> <li>e. plastic vinyl conduit (PVC)</li> </ul> <p>4. Describe the impact of the following wiring considerations for conductor enclosures:</p> <ul style="list-style-type: none"> <li>a. location of required enclosures</li> <li>b. conduit size vs. number of conductors</li> <li>c. conduit for special conductors</li> </ul> <p>5. Describe the features and functions of the following miscellaneous wiring enclosures:</p> <ul style="list-style-type: none"> <li>a. surface metal raceways</li> <li>b. armored cable</li> <li>c. under-floor raceways</li> <li>d. wire-ways and bus-ways</li> <li>e. auxiliary gutters</li> <li>f. liquid-tight flexible conduit</li> </ul> <p>6. Describe the following areas where open wiring is used:</p> <ul style="list-style-type: none"> <li>a. yard</li> <li>b. temporary</li> <li>c. cleat</li> <li>d. knot</li> <li>e. tube</li> </ul> <p>7. Describe the features and functions of the following branch circuits:</p> <ul style="list-style-type: none"> <li>a. general</li> <li>b. residential</li> <li>c. commercial and industrial</li> <li>d. loads on branch circuits</li> <li>e. demand factors</li> <li>f. overload protection</li> </ul> <p>8. Describe the features and functions of the following types of boxes and cabinets:</p> <ul style="list-style-type: none"> <li>a. outlet boxes</li> <li>b. switch boxes</li> <li>c. pull and junction boxes</li> </ul> <p>9. Explain the mounting procedure.</p> <p>10. Describe the features and functions of the following lighting fixtures:</p> <ul style="list-style-type: none"> <li>a. incandescent</li> <li>b. recessed and flush</li> <li>c. electric discharge lamps</li> <li>d. supports</li> </ul>	<p>Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> B1.1, B1.2, B1.3, B1.7</p>
<p>E. GENERAL-USE EQUIPMENT</p> <p>Understand, apply, and evaluate the installation and wiring techniques of general-use equipment.</p>	<ul style="list-style-type: none"> <li>1. Identify the different types of equipment intended for general use.</li> <li>2. Describe the following considerations in rotating equipment: <ul style="list-style-type: none"> <li>a. conductor selection</li> <li>b. starting protection</li> <li>c. running protection</li> </ul> </li> </ul>	<p><b>Career Ready Practice:</b> 1, 3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)	<ul style="list-style-type: none"> <li>d. switches and controllers</li> <li>3. Describe the following consideration when using transformers:               <ul style="list-style-type: none"> <li>a. types</li> <li>b. protection</li> <li>c. location</li> <li>d. vaults</li> </ul> </li> <li>4. Describe the considerations when using switches:               <ul style="list-style-type: none"> <li>a. general</li> <li>b. types and capacities</li> <li>c. disconnectors</li> </ul> </li> <li>5. Describe the features and functions of the different types of switchboards and panel-boards.</li> <li>6. Describe the proper locations of switchboards and panel-boards.</li> <li>7. Describe the equipment for switchboards and panel-boards</li> <li>8. Describe the importance of the following requirements:               <ul style="list-style-type: none"> <li>a. working space for equipment</li> <li>b. working space for live parts</li> <li>c. guarding live parts</li> </ul> </li> </ul>	<p><b>CTE Anchor:</b>            Communications: 2.1            Problem Solving and Critical Thinking: 5.3            Health and Safety: 6.1, 6.2, 6.6, 6.9, 6.11            Ethics and Legal Responsibility: 8.2            Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b>            B7.1</p>
<p>F. SPECIAL OCCUPANCIES</p> <p>Understand, apply, and evaluate the general code requirements for locations classified as special occupancies.</p> <p>(15 hours)</p>	<ul style="list-style-type: none"> <li>1. Define special occupancies.</li> <li>2. Describe the features and functions of the following special occupancies:               <ul style="list-style-type: none"> <li>a. commercial garages</li> <li>b. aircraft hangers</li> <li>c. gasoline dispensing and service stations</li> <li>d. bulk storage plants</li> <li>e. finishing processes</li> <li>f. health care facilities</li> <li>g. places of assembly</li> <li>h. theaters and similar locations</li> <li>i. motion picture and television studios</li> <li>j. motion picture theaters</li> <li>k. manufacturing buildings</li> <li>l. agricultural buildings</li> <li>m. mobile homes and mobile home parks</li> <li>n. recreational vehicles and RV parks</li> <li>o. marinas and boatyards</li> <li>p. mixed-used occupancies</li> </ul> </li> <li>3. Differentiate between special occupancies and residential occupancies.</li> <li>4. List several precautions needed when working with special occupancies.</li> <li>5. Identify the chemical classifications associated with special occupancies.</li> </ul>	<p><b>Career Ready Practice:</b>            1, 3</p> <p><b>CTE Anchor:</b>            Communications: 2.1            Health and Safety: 6.8, 6.16            Ethics and Legal Responsibility: 8.2            Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b>            B4.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>G. SPECIAL EQUIPMENT</p> <p>Understand, apply, and evaluate the types of items which are classified as special equipment and the codes for specific installation/construction pertaining to special equipment.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> <li>1. Define special equipment.</li> <li>2. Describe the features and functions of electric signs and outside lighting.</li> <li>3. Describe the features and functions of the following:               <ol style="list-style-type: none"> <li>a. elevators</li> <li>b. dumbwaiters</li> <li>c. escalators</li> <li>d. moving walks</li> </ol> </li> <li>4. Describe the features and functions of electric welders.</li> <li>5. Identify the appropriate locations for the following:               <ol style="list-style-type: none"> <li>a. sound recording and similar equipment</li> <li>b. data processing equipment</li> <li>c. organs</li> <li>d. X-ray equipment</li> <li>e. induction and dielectric heating equipment</li> <li>f. electrolytic cells</li> <li>g. metalworking machine tools</li> <li>h. electrically driven/controlled irrigation machines</li> <li>i. swimming pools and fountains</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 3</p> <p><b>CTE Anchor:</b> Communications: 2.1 Health and Safety: 6.8, 6.16 Ethics and Legal Responsibility: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> B5.2</p>
<p>H. SPECIAL CONDITIONS</p> <p>Understand, apply, and evaluate the types of situations which are classified as special conditions, the specific installation and/or construction they require, and the importance of using the NEC to meet these requirements.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> <li>1. Define special conditions.</li> <li>2. Identify and explain the use of these systems:               <ol style="list-style-type: none"> <li>a. emergency systems</li> <li>b. circuits/equipment operated at over 600 volts</li> <li>c. circuits/equipment operated at less than 50 volts</li> <li>d. class 1, 2, and 3 remote control/signaling circuits</li> <li>e. stand-by power generation systems</li> <li>f. fire protective signaling systems</li> </ol> </li> <li>3. Identify the NEC provisions that cover the special conditions triggered by the above systems.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3</p> <p><b>CTE Anchor:</b> Communications: 2.1 Problem Solving and Critical Thinking: 5.3, 5.4 Health and Safety: 6.8, 6.16 Ethics and Legal Responsibility: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> B7.1, B7.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>I. COMMUNICATION SYSTEMS</p> <p>Understand, apply, and evaluate the communications systems sanctioned by the NEC to answer specific electrical questions.</p> <p>(3 hours)</p>	<p>1. Identify and describe the following communications systems:</p> <ol style="list-style-type: none"> <li>a. communications circuits</li> <li>b. radio and television equipment</li> <li>c. community antenna TV/radio distribution systems</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3</p> <p><b>CTE Anchor:</b> Communications: 2.5 Health and Safety: 6.8, 6.16 Ethics and Legal Responsibility: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> B6.4</p>
<p>J. TABLES AND EXAMPLES</p> <p>Understand, apply, and evaluate the communications systems sanctioned by the NEC to answer specific electrical questions.</p> <p>(6 hours)</p>	<ol style="list-style-type: none"> <li>1. Name the types of information available in the NEC tables.</li> <li>2. Interpret the data.</li> <li>3. Give at least three examples of typical electrical problems.</li> <li>4. Explain the application of the data on the problems chosen.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2 Problem Solving and Critical Thinking: 5.3, 5.4 Health and Safety: 6.8, 6.16 Ethics and Legal Responsibility: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> B7.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>K. RESOURCE MANAGEMENT REVIEW</p> <p>Review, apply, and evaluate resource management in the electrical industry.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Review the following:               <ol style="list-style-type: none"> <li>a. resources</li> <li>b. management</li> <li>c. sustainability</li> </ol> </li> <li>2. Review the management of the following resources:               <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>3. List specific examples of effective management of the following in the electrical industry:               <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>4. Review the following benefits of effective resource management in the electrical industry:               <ol style="list-style-type: none"> <li>a. profitability</li> <li>b. company growth</li> <li>c. stability</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 8, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1 Problem Solving and Critical Thinking: 5.1, 5.4 Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.4, 7.6 Ethic and Legal Responsibility: 8.3, 8.4, 8.5</p> <p><b>CTE Pathway:</b> B1.6</p>
<p>L. REVIEW AND EVALUATION</p> <p>Understand, apply, and evaluate the growth of trainees in cognitive, affective, and psychomotor skills by the application of several methods.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Pass the written test following each major course section.</li> <li>2. Pass the oral test following each major course section.</li> <li>3. Pass the final examination.</li> </ol>	<p><b>Career Ready Practice:</b> 1</p> <p><b>CTE Anchor:</b> Communications: 2.1 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> B4.1, B5.1</p>

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

### **TEXTS AND SUPPLEMENTAL BOOKS**

Miller, Charles R. NFPA's Pocket Electrical References. Jones and Bartlett Publishers, 2006.

National Fire Protection Association. User's Guide to the National Electrical Code, 2008 Edition. Jones and Bartlett Publishers, 2009

Stallcup, James G. Stallcup's Electrical Grounding and Bonding Simplified, 2008 Edition. Jones and Bartlett Publishers, 2010

Stauffer, H. Brooke. NFPA's Residential Wiring, 3<sup>rd</sup> Edition. Jones and Bartlett Publishers, 2009.

Trout, Charles M. Essentials of Electric Motors and Controls. Jones and Bartlett Publishers, 2010.

Williams, Noel. NEC Q&A: Questions and Answers on the National Electrical Code. Jones and Bartlett Publishers, 2007.

### **RESOURCES**

Employer Advisory Board members

CTE Model Curriculum Standards

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

Local representatives of the IBEW

Representatives/members of the International Association of Electrical Inspectors

[www.americangreenjobs.net](http://www.americangreenjobs.net)

### **COMPETENCY CHECKLIST**

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

### **METHODS AND PROCEDURES**

- A. Lecture and discussion
- B. Multi-media presentations
- C. Visual aids
- D. Reference reading and study
- E. Individualized instruction

### **EVALUATION**

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

SECTION B – Electrical Wiring Codes and Permits – Pass all assignments and exams on electrical wiring codes and permits with a minimum score of 80% or higher.

SECTION C – Wiring Design and Protection – Pass all assignments and exams on wiring design and protection with a minimum score of 80% or higher.

SECTION D – Wiring Materials and Methods – Pass all assignments and exams on wiring materials and methods with a minimum score of 80% or higher.

SECTION E – General-Use Equipment – Pass all assignments and exams on general-use equipment with a minimum score of 80% or higher.

SECTION F – Special Occupancies – Pass all assignments and exams on special occupancies with a minimum score of 80% or higher.

SECTION G – Special Equipment – Pass all assignments and exams on special equipment with a minimum score of 80% or higher.

SECTION H – Special Conditions – Pass all assignments and exams on special conditions with a minimum score of 80% or higher.

SECTION I – Communications Systems – Pass all assignments and exams on communications systems with a minimum score of 80% or higher.

SECTION J – Tables and Examples – Pass all assignments and exams on tables and examples with a minimum score of 80% or higher.

SECTION K – Resource Management Review – Pass all assignments and exams on resource management review with a minimum score of 80% or higher.

SECTION L – Review and Evaluation – Pass all assignments and exams on review and evaluation with a minimum score of 80% or higher.

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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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