

# Course Outline

Energy, Environment, and Utilities

REVISED: August/2017

**Job Title**

Home Technology Integrator

**Career Pathway:**

Telecommunications

**Industry Sector:**

Energy, Environment, and Utilities

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

49-2097.00

**CBEDS Title:**

Telecommunications

**CBEDS No.:**

4618

**72-85-80**

**Technology Integration/1:  
Copper & FIOs Cabling**

**Credits:** 15

**Hours:** 180

**Course Description:**

This competency-based course is the first in a sequence of three designed for home technology integration (HTI). It provides students with project-based experiences in copper and fiber optic cable designs. Technical instruction includes an orientation, workplace safety principles and procedures, resource management, trade mathematics, and employability skills. Emphasis is placed on wiring and "rough-in" tools and equipment, residential AC wiring and lighting, copper low-voltage structured wiring, local area networks (LAN) for home and small offices, LAN administration for copper and FIOs, broadband internet access technologies, and fiber optics communication signal transmission. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

**Prerequisites:**

Enrollment requires a reading level of 6.0 as measured by the TABE D 9/10.

**NOTE:** For Perkins purposes this course has been designated as an **introductory** course.

Sections designated by an asterisk (\*) contain competencies that meet the CEA\_CompTIA DHTI+ requirements. The said competencies are designed to prepare students to configure, integrate, maintain, troubleshoot, and comprehend the basic design concepts of electronic and digital home systems.

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. 7-17

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)**

**COURSE OUTLINE COMPONENTS**

**LOCATION**

**INSTRUCTIONAL STRATEGIES**

p. 19

Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

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.

**UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT**

Cover

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.

pp. 7-17

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.

**EVALUATION PROCEDURES**

pp. 19-20

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.

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.

**REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT**

Cover

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.

## **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***

### **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 TI/1: Copper and FIOs Cabling Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. ORIENTATION AND SAFETY</p> <p>Understand, apply, and evaluate the safety rules, procedures, and acceptable work habits.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe the scope and purpose of the course.</li> <li>2. Describe the overall course content as a part of the Linked Learning Initiative.</li> <li>3. Describe classroom policies and procedures.</li> <li>4. Describe the different occupations in the Energy and Utilities Industry Sector which have an impact on the role of Technology Integration (TI) installers.</li> <li>5. Describe the opportunities available for promoting gender equity and the representation of non-traditional populations in the TI field.</li> <li>6. Describe the purpose of the California Occupational Safety and Health Administration (Cal/OSHA) and its laws governing TI technicians.</li> <li>7. Describe the impact of Environmental Protection Agency (EPA) legislation on the Energy and Utilities Industry Sector practices.</li> <li>8. Describe and demonstrate the procedures for contacting proper authorities for the removal of hazardous materials based on the EPA standards.</li> <li>9. Describe the National Electrical Code (NEC) and its role in safeguarding the work conditions of TI installers.</li> <li>10. Describe and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the TI field.</li> <li>11. Describe the role of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ in increasing the use of clean and renewable technology in California.</li> <li>12. Describe the City of Los Angeles Building and Safety Codes and their applications to the TI field.</li> <li>13. Describe the provisions of the California Title 24 Energy Efficiency Standards (a.k.a. 2008 California Green Building Standards Code) as they relate to the Energy and Utilities Industry Sector.</li> <li>14. Describe classroom and workplace first aid and emergency procedures based on the American Red Cross (ARC) standards.</li> <li>15. Pass the safety test with 100% accuracy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 6, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.4, 3.5 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, 6.15, 6.16 Ethics and Legal Responsibility: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C1.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>B. RESOURCE MANAGEMENT</p> <p>Understand, apply, and evaluate the resource management principles and techniques in the TI field.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> <li>1. Define the following: <ol style="list-style-type: none"> <li>a. resources</li> <li>b. management</li> <li>c. sustainability</li> </ol> </li> <li>2. Describe the management of the following resources in the TI field: <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 resources in the TI field: <ol style="list-style-type: none"> <li>a. time</li> <li>b. materials</li> <li>c. personnel</li> </ol> </li> <li>4. Describe the following benefits of effective resource management in the TI field: <ol style="list-style-type: none"> <li>a. profitability</li> <li>b. sustainability</li> <li>c. company growth</li> </ol> </li> <li>5. Describe the economic benefits and liabilities of managing resources in an environmentally responsible way.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 6, 8, 9, 12</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 Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.4, Health and Safety: 6.11 Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.4, 7.5, 7.7, 7.8 Ethics and Legal Responsibility: 8.1, 8.2, 8.4, 8.5 Leadership and Teamwork: 9.1, 9.2, 9.3, 9.6 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C7.2, C7.3</p>
<p>C. TRADE MATHEMATICS</p> <p>Understand, apply, and evaluate the mathematical requirements in the TI field.</p>	<ol style="list-style-type: none"> <li>1. Describe the practical applications of math in the TI field.</li> <li>2. Describe and demonstrate problem-solving techniques involving whole number problems using arithmetic operations (addition, subtraction, multiplication, and division).</li> <li>3. Describe and demonstrate problem-solving techniques involving various fraction problems using arithmetic operations.</li> <li>4. Describe and demonstrate problem-solving techniques involving various decimal problems using addition, subtraction, multiplication, and division.</li> <li>5. Describe and demonstrate techniques for changing fractions to decimals.</li> <li>6. Describe and demonstrate techniques for changing decimals to fractions.</li> </ol>	<p><b>Career Ready Practice:</b> 1</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.4 Problem Solving and Critical Thinking: 5.1, 5.2, 5.4 Technical Knowledge and Skills: 10.1</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	<ol style="list-style-type: none"> <li>7. Describe the English and metric systems of measuring length.</li> <li>8. Describe the English and metric systems of measuring weight.</li> <li>9. Describe the English and metric systems of measuring volume or capacity.</li> <li>10. Describe and demonstrate English and metric problem-solving techniques for various measuring problems using arithmetic operations.</li> <li>11. Describe and demonstrate English and metric measuring techniques of objects by using tools common to the trade.</li> <li>12. Express metric units in ascending and descending powers of ten.</li> <li>13. Convert the English numbering system to metric system.</li> <li>14. Convert metric system to English numbering system.</li> <li>15. Calculate square roots of numbers.</li> <li>16. Describe and demonstrate problem-solving techniques for geometric problems.</li> <li>17. Describe and demonstrate problem-solving techniques for algebraic problems.</li> <li>18. Describe and demonstrate problem-solving techniques using percentages.</li> <li>19. Describe and demonstrate techniques for reading and interpreting graphs.</li> <li>20. Describe and demonstrate techniques for using a calculator.</li> </ol>	<p>Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> C1.5, C3.7</p>
<p>D. WIRING AND “ROUGH-IN” TOOLS AND EQUIPMENT*</p> <p>Understand, apply, and evaluate the techniques for using, maintaining, and storing standard wiring tools and equipment.</p> <p>(10 hours)</p>	<ol style="list-style-type: none"> <li>1. Describe and demonstrate the proper use, maintenance, and storage techniques for the following basic wiring tools and equipment: <ol style="list-style-type: none"> <li>a. punchdown tool</li> <li>b. CAT5/6 plug crimper</li> <li>c. CAT5/6 stripper</li> <li>d. CAT5/6 Cable Stripper</li> <li>e. RJ11 crimper</li> <li>f. cable cutter</li> <li>g. wire stripper</li> <li>h. coaxial type-F crimp tool</li> <li>i. coaxial stripper</li> <li>j. coaxial connector crimpers for various type-F coaxial connectors</li> <li>k. coaxial connector wrench</li> <li>l. hook and pick set</li> <li>m. PVC cutter</li> </ol> </li> <li>2. Describe and demonstrate the proper use, maintenance, and storage technique for the LAN cable tester.</li> <li>3. Describe and demonstrate the proper use, maintenance, and storage techniques for “rough-in” tools.</li> <li>4. Describe the importance of using the correct tools for the job.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 4</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Health and Safety: 6.6, 6.11, 6.12 Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> C1.1, C5.2, C5.5, C5.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>E. RESIDENTIAL AC WIRING AND LIGHTING*</p> <p>Understand, apply, and evaluate the basic concept and design considerations in residential high-voltage wiring and home lighting.</p>	<ol style="list-style-type: none"> <li>1. Identify and describe the jurisdiction and scope of responsibilities of the following organizations regarding wiring and lighting:               <ol style="list-style-type: none"> <li>a. National Electrical Code (NEC)</li> <li>b. National Fire Protection Association (NFPA)</li> <li>c. National Electrical Contractors Association (NECA)</li> <li>d. Underwriters Laboratories Inc. (UL)</li> <li>e. Electronic Industries Alliance/Telecommunications Industry Association (EIA/TIA)</li> </ol> </li> <li>2. Identify and describe the following:               <ol style="list-style-type: none"> <li>a. federal, state, and local licensing requirements for wiring and lighting</li> <li>b. basic electrical safety procedures</li> </ol> </li> <li>3. Define the following:               <ol style="list-style-type: none"> <li>a. rough-in phase</li> <li>b. electrical prints</li> <li>c. ampacity</li> <li>d. insulation rating</li> <li>e. grounding</li> <li>f. ground fault circuit interrupter (GFCI)</li> <li>g. volt-ampere rating</li> <li>h. watt rating</li> <li>i. real power</li> <li>j. apparent power</li> <li>k. Uninterruptible Power Supply (UPS)</li> <li>l. surge suppressor</li> <li>m. cable</li> </ol> </li> <li>4. Identify and describe different wiring types:               <ol style="list-style-type: none"> <li>a. Romex (Nonmetallic –NM- cable)</li> <li>b. Flex (Metal-clad –MC- cable)</li> <li>c. BX (Armored –AC- cable)</li> <li>d. UF (Underground feeder cable)</li> <li>e. EMT (Electric metallic tubing)</li> </ol> </li> <li>5. Identify and describe the features and functions of different lighting types:               <ol style="list-style-type: none"> <li>a. incandescent</li> <li>b. fluorescent</li> <li>c. LED</li> </ol> </li> <li>6. Identify and describe the features and functions of different types of lighting controls.</li> <li>7. Identify and describe the features and functions of different types of outdoor security lighting.</li> <li>8. Describe the following:               <ol style="list-style-type: none"> <li>a. purpose of insulation ratings for home wiring and cable products</li> <li>b. purpose of grounding</li> <li>c. functions of a GFCI</li> <li>d. difference between volt-ampere and watt ratings for home appliances and computers</li> <li>e. difference between real power and apparent power</li> <li>f. functions of a UPS</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, 2.4 Problem Solving and Critical Thinking: 5.1, 5.3, 5.4 Health and Safety: 6.6, 6.9, 6.11, 6.12, 6.13, 6.15, 6.16</p> <p>Ethics and Legal Responsibilities: 8.2, 8.3 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C5.2, C5.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(30 hours)	<ul style="list-style-type: none"> <li>g. functions of a surge suppressor</li> <li>h. power line protocols for managing home lighting</li> </ul> <p>9. Demonstrate the following:</p> <ul style="list-style-type: none"> <li>a. drawing circuit breaker panel connections for branch circuits</li> <li>b. calculating the load of various electrical fixtures and appliances</li> <li>c. calculating kilowatt-hour costs for various home electrical appliances</li> <li>d. drawing and labeling the proper names and codes for connections to a 120-volt wall outlet</li> <li>e. drawing a light switch and identify its correct wire color codes</li> <li>f. identifying the electrical wiring problems at home and classroom</li> <li>g. performing various wiring methods</li> <li>h. performing electrical installation “rough-in” tasks during construction or remodeling</li> <li>i. performing preventative maintenance procedures</li> </ul>	
<p>F. COPPER LOW-VOLTAGE STRUCTURED WIRING*</p> <p>Understand, apply, and evaluate the basic concept and design considerations in “structured wiring” or “structured cabling systems.”</p>	<ul style="list-style-type: none"> <li>1. Define the following: <ul style="list-style-type: none"> <li>a. structured wiring</li> <li>b. structured cabling systems</li> <li>c. low-voltage power-limited circuits</li> <li>d. low-voltage structured wiring</li> <li>e. home-run wiring</li> <li>f. cabling</li> <li>g. bundled cabling</li> <li>h. wall outlet</li> <li>i. distribution panel</li> <li>j. termination point</li> <li>k. RJ45 UTP connector</li> <li>l. coaxial cable</li> <li>m. coaxial connector</li> <li>n. quad-shield coaxial cable</li> <li>o. conduit</li> <li>p. PVC pipe</li> <li>q. RJ11 cable</li> <li>r. Category 5, 6, 7 cables</li> </ul> </li> <li>2. Identify and describe the industry standards that are associated with residential low-voltage structured wiring design.</li> <li>3. Describe federal, state, and local regulations regarding the installation of structured wiring.</li> <li>4. Describe installation drawings for a structured wiring design.</li> <li>5. Describe the features of home-run (star) wiring.</li> <li>6. Explain the difference between Grade 1 and Grade 2 structured wiring requirements for the following: <ul style="list-style-type: none"> <li>a. cabling</li> <li>b. wall outlets</li> <li>c. distribution panels</li> <li>d. termination points</li> </ul> </li> </ul>	<p><b>Career Ready Practice:</b> 1, 3, 4</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: 6.6, 6.9, 6.11, 6.12, 6.13, 6.15, 6.16 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C5.2, C5.3, C5.4, C5.6, C5.7, C5.8, C5.9, C5.10, C5.11</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(35 hours)	<ol style="list-style-type: none"> <li>7. Describe the composition of bundled cabling.</li> <li>8. Identify the five types of cabling used in residential structured wiring designs.</li> <li>9. Describe the following: <ol style="list-style-type: none"> <li>a. color codes and termination standards for RJ45 UTP connectors</li> <li>b. names and uses for the various types of coaxial cable connectors</li> <li>c. locations required for the use of conduit and PVC pipe</li> <li>d. minimum bending radius and pull strength for UTP and coaxial cable</li> <li>e. physical features of quad-shield coaxial cable</li> <li>f. wiring protection against interference from electromagnetic "noise"</li> <li>g. three types of audio wire that connect sound and equipment in home theater systems</li> <li>h. two types of connectors used for coaxial cable</li> <li>i. maintenance plans for wiring/cabling systems</li> </ol> </li> <li>10. Draw the two telephone line connections for an RJ11 cable termination.</li> <li>11. Describe the advantages of using structured wiring in new residential construction.</li> <li>12. Compare the features of Category 6 and Category 7 cable with Category 5 cable.</li> <li>13. Describe and demonstrate the following: <ol style="list-style-type: none"> <li>a. identifying the cabling wiring problems at home and classroom</li> <li>b. creating installation drawings for a structured wiring design</li> <li>c. identifying the locations for installing low-voltage structured wiring wall outlets</li> <li>d. terminating RJ11 connectors to RJ11 cable</li> <li>e. terminating RJ45 UTP connectors to CAT 5/6 cable</li> <li>f. terminating coaxial cable to various connectors</li> <li>g. installing conduit and PVC pipe</li> <li>h. pulling UTP and coaxial cable</li> <li>i. performing installations with Grade 1 and Grade 2 cabling</li> <li>j. testing different types of terminated cable for bandwidth and continuity</li> <li>k. performing cabling installation "rough-in" tasks</li> <li>l. diagnosing and troubleshooting structured wiring problems</li> <li>m. performing preventative maintenance procedures</li> </ol> </li> </ol>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>G. HOME / SMALL OFFICE LOCAL AREA NETWORKS (LAN)</p> <p>Understand, apply, and evaluate the basic design features and standards used in local area networks (LAN).</p> <p>(20 hours)</p>	<ol style="list-style-type: none"> <li>1. Define the following: <ol style="list-style-type: none"> <li>a. network</li> <li>b. IEEE 802.3 Ethernet</li> <li>c. half-duplex</li> <li>d. full duplex</li> <li>e. gigabit</li> <li>f. Local Area Network (LAN)</li> <li>g. gateway</li> <li>h. hub</li> <li>i. switch</li> <li>j. router</li> <li>k. wireless technology</li> <li>l. Universal Plug and Play (UPnP) Initiative</li> </ol> </li> <li>2. Identify designs for connecting home networks.</li> <li>3. Identify and describe the federal, state, and local requirements for installing a LAN.</li> <li>4. Describe the network protocols of the following organizations: <ol style="list-style-type: none"> <li>a. Home Phoneline Networking Alliance (HomePNA)</li> <li>b. Home Plug Powerline Alliance (HPLA)</li> </ol> </li> <li>5. Describe the jurisdiction of the Institute of Electrical and Electronic Engineers Inc (IEEE).</li> <li>6. Describe the various IEEE 802.3 Ethernet standards: <ol style="list-style-type: none"> <li>a. Half-duplex Ethernet</li> <li>b. Fast Ethernet</li> <li>c. Full-duplex Ethernet</li> <li>d. Gigabit Ethernet</li> </ol> </li> <li>7. Describe the features and benefits of Fast Ethernet.</li> <li>8. Describe the guidelines and distance limitations of Gigabit Ethernet.</li> <li>9. Describe the following components most frequently used in home/small office LAN: <ol style="list-style-type: none"> <li>a. residential gateways</li> <li>b. hubs</li> <li>c. bridges</li> <li>d. switches</li> <li>e. routers</li> </ol> </li> <li>10. Describe the types of network media used in home networks.</li> <li>11. Describe the benefits and key features of wireless technology.</li> <li>12. Describe the benefits and key features of Bluetooth technology.</li> <li>13. Describe the Universal Plug and Play (UPnP) initiative.</li> <li>14. Demonstrate the following: <ol style="list-style-type: none"> <li>a. creating designs for connecting home networks</li> <li>b. configuring a network that consists of two computers</li> <li>c. configuring a network that consists of four computers and a printer</li> <li>d. configuring a wireless network that consists of four computers</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 4, 5,</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Technology: 4.1, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6, 6.16 Ethics and Legal Responsibilities: 8.1, 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C1.3, C1.4, C1.5, C1.6, C1.8, C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C2.7, C2.8, C2.9, C4.1, C4.2, C4.3, C4.4, C4.6, C4.7, C4.9</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>H. LAN ADMINISTRATION FOR COPPER AND FIOS*</p> <p>Understand, apply, and evaluate the administrative tasks associated with a network.</p> <p>(20 hours)</p>	<ol style="list-style-type: none"> <li>1. Define the following: <ol style="list-style-type: none"> <li>a. broadband internet access</li> <li>b. Broadband over Power Line (BPL)</li> <li>c. Digital Subscriber Line (DSL)</li> <li>d. Digital Subscriber Line Access Multiplexer</li> <li>e. cable broadband Internet access</li> <li>f. Integrated Services Digital network (ISDN)</li> <li>g. satellite broadband internet access</li> <li>h. latency</li> <li>i. fixed wireless carrier</li> </ol> </li> <li>2. Describe federal, state, and local regulations regarding the installation of broadband access technologies.</li> <li>3. Describe industry standards that govern broadband technologies.</li> <li>4. Describe the five main types of broadband internet access technologies.</li> <li>5. Describe the advantages and disadvantages of BPL Internet access service.</li> <li>6. List the types of DSL technologies available for home technology designs.</li> <li>7. Describe the location and purpose for installing a DSL splitter.</li> <li>8. Describe the functions performed by a DSLAM.</li> <li>9. Describe the basic operation of a cable broadband internet access system.</li> <li>10. Describe the major system components of a broadband cable system.</li> <li>11. Identify the parameters associated with ISDN broadband service.</li> <li>12. Describe the standards for a cable modem.</li> <li>13. Describe the advantages and disadvantages of satellite broadband internet access.</li> <li>14. Describe the impact that latency has on satellite broadband Internet service.</li> <li>15. Identify the system flow diagram for a satellite broadband network.</li> <li>16. Describe federal, state, and local regulations regarding the installation of satellites.</li> <li>17. Describe the types of broadband internet access that are available from fixed wireless carriers.</li> <li>18. Describe and demonstrate installation, diagnosing and troubleshooting residential broadband access.</li> <li>19. Describe and demonstrate preventative maintenance techniques.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 4</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.4 Technology: 4.1, 4.4 Problem Solving and Critical Thinking: 5.1 Ethics and Legal Responsibilities: 8.1, 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C1.5, C2.3, C2.4, C2.5, C2.7, C2.9, C3.1, C3.2, C3.3, C3.5, C3.9, C3.11</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>I. BROADBAND INTERNET ACCESS TECHNOLOGIES*</p> <p>Understand, apply, and evaluate the additional features and design considerations for telecommunications systems for the automated home.</p> <p>(20 hours)</p>	<ol style="list-style-type: none"> <li>1. Define the following: <ol style="list-style-type: none"> <li>a. broadband internet access</li> <li>b. Broadband over Power Line (BPL)</li> <li>c. Digital Subscriber Line (DSL)</li> <li>d. Digital Subscriber Line Access Multiplexer</li> <li>e. cable broadband Internet access</li> <li>f. Integrated Services Digital network (ISDN)</li> <li>g. satellite broadband internet access</li> <li>h. latency</li> <li>i. fixed wireless carrier</li> </ol> </li> <li>2. Describe federal, state, and local regulations regarding the installation of broadband access technologies.</li> <li>3. Describe industry standards that govern broadband technologies.</li> <li>4. Describe the five main types of broadband internet access technologies.</li> <li>5. Describe the advantages and disadvantages of BPL Internet access service.</li> <li>6. List the types of DSL technologies available for home technology designs.</li> <li>7. Describe the location and purpose for installing a DSL splitter.</li> <li>8. Describe the functions performed by a DSLAM.</li> <li>9. Describe the basic operation of a cable broadband internet access system.</li> <li>10. Describe the major system components of a broadband cable system.</li> <li>11. Identify the parameters associated with ISDN broadband service.</li> <li>12. Describe the standards for a cable modem.</li> <li>13. Describe the advantages and disadvantages of satellite broadband internet access.</li> <li>14. Describe the impact that latency has on satellite broadband Internet service.</li> <li>15. Identify the system flow diagram for a satellite broadband network.</li> <li>16. Describe federal, state, and local regulations regarding the installation of satellites.</li> <li>17. Describe the types of broadband internet access that are available from fixed wireless carriers.</li> <li>18. Describe and demonstrate installation, diagnosing and troubleshooting residential broadband access.</li> <li>19. Describe and demonstrate preventative maintenance techniques.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 3, 4, 5</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.4 Technology: 4.1, 4.4 Problem Solving and Critical Thinking: 5.1 Ethics and Legal Responsibilities: 8.1, 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C1.5, C2.3, C2.4, C2.5, C2.7, C2.9, C3.1, C3.9, C3.11</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>J. FIBER OPTICS*</p> <p>Understand, apply, and evaluate the techniques used in fiber optics communication signal transmission.</p>	<ol style="list-style-type: none"> <li>1. Define the following:               <ol style="list-style-type: none"> <li>a. fiber optics</li> <li>b. light pulses</li> <li>c. transmitter</li> <li>d. light-emitting diode (LED)</li> <li>e. injection-laser diode (ILD)</li> <li>f. infrared (IR) light</li> <li>g. total internal reflection</li> <li>h. attenuation limits</li> </ol> </li> <li>2. Describe the following features as they apply to fiber optic cable:               <ol style="list-style-type: none"> <li>a. materials price</li> <li>b. installation price</li> <li>c. diameter</li> <li>d. weight</li> <li>e. signal degradation</li> <li>f. power voltage requirement</li> <li>g. digital signals</li> <li>h. flammability</li> <li>i. applications</li> <li>j. speed</li> <li>k. bandwidth</li> <li>l. transmission distance</li> <li>m. interference from electromagnetic “noise”</li> <li>n. maintenance</li> </ol> </li> <li>3. Describe the features and functions of the following types of fiber:               <ol style="list-style-type: none"> <li>a. single mode</li> <li>b. multimode</li> <li>c. plastic optical fiber (POF)</li> </ol> </li> <li>4. Describe the features and functions of the following cable designs:               <ol style="list-style-type: none"> <li>a. loose tube cable</li> <li>b. tight buffered cable</li> </ol> </li> <li>5. Describe the features and functions of the different fiber connector types.</li> <li>6. Describe the features and functions of the different types of fiber cable.</li> <li>7. Describe the following components of a fiber-optic relay system:               <ol style="list-style-type: none"> <li>a. transmitter</li> <li>b. optical fiber</li> <li>c. optical regenerator</li> <li>d. optical receiver</li> </ol> </li> <li>8. Describe federal, state, and local regulations regarding the installation of fiber optic systems.</li> <li>9. Describe industry standards that govern fiber optic systems.</li> <li>10. Describe and demonstrate the advantages of fiber optic over copper wire based on the following factors:               <ol style="list-style-type: none"> <li>a. materials price</li> <li>b. installation price</li> <li>c. speed</li> <li>d. bandwidth</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4 Technology: 4.1, 4.3 Problem Solving and Critical Thinking: 5.1 Health and Safety: 6.6, 6.16 Ethics and Legal Responsibilities: 8.1, 8.2 Technical Knowledge and Skills: 10.1, 10.2</p> <p><b>CTE Pathway:</b> C1.1, C1.2, C2.2, C2.3, C2.4, C2.9, C5.7, C5.8</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)	<ul style="list-style-type: none"> <li>e. transmission distance</li> <li>f. interference from electromagnetic “noise”</li> <li>g. maintenance</li> </ul> <ul style="list-style-type: none"> <li>11. Demonstrate the operation of equipment used in the fiber optic industry.</li> <li>12. Demonstrate splicing fiber optic cable.</li> <li>13. Describe and demonstrate installation, diagnosing and troubleshooting fiber optic cable.</li> <li>14. Describe and demonstrate preventative maintenance techniques.</li> </ul>	
<p>K. EMPLOYABILITY SKILLS</p> <p>Understand, apply, and evaluate the employability skills required in the TI field.</p> <p>(5 hours)</p>	<ul style="list-style-type: none"> <li>1. Describe employer requirements for the following: <ul 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> </ul> </li> <li>2. Identify potential employers through traditional and internet sources.</li> <li>3. Describe the role of electronic social networking in job search.</li> <li>4. Design sample résumés and cover letters.</li> <li>5. Describe the importance of filling out a job application legibly, with accurate and complete information.</li> <li>6. Complete sample job application forms correctly.</li> <li>7. Describe the importance of enthusiasm on a job.</li> <li>8. Describe the importance of appropriate appearance on a job.</li> <li>9. Describe the importance of the continuous upgrading of job skills.</li> <li>10. Describe customer service as a method of building permanent relationships between the organization and the customer.</li> <li>11. Describe and demonstrate appropriate interviewing techniques.</li> <li>12. Identify the informational materials and resources needed to be successful in an interview.</li> <li>13. Design sample follow-up letters.</li> <li>14. Describe and demonstrate appropriate follow-up procedures.</li> <li>15. Complete sample job application forms correctly.</li> <li>16. Describe the importance of enthusiasm on a job.</li> <li>17. Describe the importance of appropriate appearance on a job.</li> <li>18. Describe the importance of the continuous upgrading of job skills.</li> <li>19. Describe customer service as a method of building permanent relationships between the organization and the customer.</li> </ul>	<p><b>Career Ready Practice:</b> 1, 2, 3, 7, 8</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, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9 Technology: 4.4 Responsibility and Flexibility: 7.2, 7.4, 7.5, 7.6, 7.7 Ethics and Legal Responsibilities: 8.4 Leadership and Teamwork: 9.2, 9.4, 9.6 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1, 11.2, 11.5</p> <p><b>CTE Pathway:</b> C1.1, C7.1, C7.2, C7.3, C7.4</p>

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

### **TEXTBOOKS**

Caputo, Anthony. Digital Video Surveillance and Security. Elsevier Science, 2010.

Gilster, Ron. HTI+ Home Technology Integrator and CEDIA Installer I Exam Guide/Reference Book. McGraw Hill (Osborn), 2005.

O'Driscoll, Gerard, Stuart C. Palmer, and Whitney G. Freeman. HTI+ Certification Concepts and Practice. Exam Prep. Marcraft International Corporation, 2006.

Vanston, John, Wayne Caswell, Henry Elliott, and Michael Betterworth. Home Technology Integration: A Technology Forecast. Texas State Technical College Publishing, 2007.

Wells, Quentin. Guide to Digital Home Technology Integration. Cengage Learning, 2008.

### **RESOURCES**

Employer Advisory Board members

Subject area advisor

CTE Foundation Standards

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

<http://www.cde.ca.gov/be/st/ss/documents/ctestandards.doc>

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

<http://www.renewableenergyjobs.com/>

<http://careers.pennenergyjobs.com>

<http://www.cleantechrecruits.com>

Digital Home Technology Integrator Certification CEA-CompTIA DTI+ Examination Objectives HT0-201

[http://www.comptia.org/global/Libraries/DE-Docs/DTI\\_2006\\_Objectives\\_HT0-201.sflb.ashx](http://www.comptia.org/global/Libraries/DE-Docs/DTI_2006_Objectives_HT0-201.sflb.ashx)

### **COMPETENCY CHECKLIST**

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

### **METHODS AND PROCEDURES**

- A. Lectures 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 – Orientation and Safety – Pass a written exam on classroom and workplace safety with a score of 100%.

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

SECTION C – Trade Mathematics – Pass all assignments and exams on the mathematical requirements for the TI field with a minimum score of 80% or higher.

SECTION D – Wiring and “Rough-In” Tools and Equipment – Pass all assignments and exams on wiring and “rough-in” tools and equipment with a minimum score of 80% or higher.

SECTION E – Residential AC Wiring and Lighting – Pass all assignments and exams on residential AC wiring and lighting with a minimum score of 80% or higher.

SECTION F – Copper Low-Voltage Structured Wiring – Pass all assignments and exams on copper low-voltage structured wiring with a minimum score of 80% or higher.

SECTION G – Home/Small Office Local Area Networks (LAN) – Pass all assignments and exams on home/small office local area networks (LAN) with a minimum score of 80% or higher.

SECTION H – LAN Administration for Copper and FIOs – Pass all assignments and exams on LAN administration for copper and FIOs with a minimum score of 80% or higher.

SECTION I – Broadband Internet Access Technologies– Pass all assignments and exams on broadband internet access technologies with a minimum score of 80% or higher.

SECTION J – Fiber Optics – Pass all assignments and exams on fiber optics with a minimum score of 80% or higher.

SECTION K – Employability Skills – Pass all assignments and exams on employability skills 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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