

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / Electrical — System Design

Course Code: CONSTRUCTION

### **COURSE INTRODUCTION:** Electrical

This course is designed to introduce students to the workings of electricity and the electrical trade. Topics covered include electrical theory and regulations, residential services and testing, electrical system elements, and electrical system design. Safety is stressed throughout the course.

Units in this course include:

1. Basic Theory and Practice
2. System Elements
3. System Design

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<p><b>UNIT DESCRIPTION:</b> System Design                  This unit builds upon the previous unit, System Elements, providing electrical students with a more holistic idea of electrical systems for residences. Topics covered include circuit breakers and fuses, conductor selections and calculations, overcurrent protection, control systems, and load calculations for services and branch and feeder circuits.</p>	<p><b>SUGGESTED UNIT TIMELINE:</b> 3 lessons                  Lesson 1: Control Circuits                  Lesson 2: Load Calculations                  Lesson 3: Overcurrent Protection  <b>CLASS PERIOD (min.):</b> 90 minutes</p>					
<p><b>ESSENTIAL QUESTIONS:</b></p> <ol style="list-style-type: none"> <li>1. How are control circuits used in residential electrical systems?</li> <li>2. What factors are considered when selecting conductors for specific applications?</li> <li>3. What is the importance of the National Electrical Code® (NEC®) in sizing services, feeders, and branch and feeder circuits?</li> <li>4. How are load calculations performed for services, feeders, and branch and feeder circuits?</li> <li>5. How are overcurrent protection devices used in circuits?</li> <li>6. How do NEC® regulations apply to overcurrent protection?</li> </ol>						
<p style="text-align: center;"><b>ESSENTIAL MEASURABLE LEARNING OBJECTIVES</b>      <b>CCSS LEARNING GOALS (Anchor Standards/Clusters)</b>      <b>CROSSWALK TO STANDARDS</b></p>						
<p>1. Students will select control circuit elements for residential rooms and depict them accurately in wiring diagrams.</p>				N-RN 3 N-Q 1 A-SSE 1 A-SSE 3 A-CED 3 A-CED 4 F-BF 2 S-IC 6 L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2	26211-08	Level 1
<p>2. Students will select and perform calculations for conductors for given scenarios.</p>				N-RN 3 N-Q 1 A-SSE 1	26302-08	Level 3

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			<p>A-SSE 3                  A-CED 3                  A-CED 4                  F-BF 2                  S-IC 6                  L 9-10.1                  L 9-10.2                  L 9-10.4                  L 9-10.6                  L 11-12.1                  L 11-12.2                  L 11-12.4                  L 11-12.6                  WHST 9-10.1                  WHST 9-10.2                  WHST 9-10.4                  WHST 9-10.10                  WHST 11-12.1                  WHST 11-12.2                  WHST 11-12.4                  WHST 11-12.10                  RST 9-10.3                  RST 11-12.3                  RST 11-12.9</p>		
<p>3. Students will use the NEC® to appropriately size services and associated circuit elements for residences.</p>			<p>N-RN 3                  N-Q 1                  A-SSE 1                  A-SSE 3                  A-CED 3                  A-CED 4                  F-BF 2                  S-IC 6                  RI 11-12.1</p>	<p>26301-08                  26401-08</p>	<p>Level 1</p>

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				RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1		
4. Students will explain the importance and application of overcurrent protection devices in circuits.				N-RN 3 N-Q 1 A-SSE 1 A-SSE 3 A-CED 3 A-CED 4 F-BF 2 S-IC 6 L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2	26210-08	Level 1
5. Students will demonstrate their understanding of National Electrical Code® (NEC®) regulations related to overcurrent protection.				L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2 RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1	26305-08	Level 3
<p><b>ASSESSMENT DESCRIPTIONS*:</b> (Write a brief overview here. Identify Formative/Summative. Actual assessments will be accessed by a link to PDF file or Word doc.)</p> <p>Students will demonstrate their understanding of content and ability to apply learned skills by:</p> <ul style="list-style-type: none"> <li>• Depicting control circuit elements in wiring diagrams (Formative)</li> <li>• Creating construction drawings for conductors in service environments (Summative)</li> <li>• Preparing written rationales defending their choices of conductor materials (Summative)</li> <li>• Create a checklist for performing load calculations (Formative)</li> <li>• Perform load calculations for services, feeders, and branch and feeder circuits (Summative)</li> <li>• Completing an online worksheet regarding overcurrent protection (Formative)</li> </ul>						

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	<ul style="list-style-type: none"> <li>• Locating regulations within the National Electrical Code®, translating them into everyday language, and relating them to given situations (Summative)</li> </ul> <p><b>*Attach Unit Summative Assessment, including Scoring Guides/Scoring Keys/Alignment Codes and DOK Levels for all items. Label each assessment according to the unit descriptions above (i.e., Grade Level/Course Title/Course Code, Unit #).</b></p>
<b>Obj. #</b>	<b>INSTRUCTIONAL STRATEGIES (research-based): (Teacher Methods)</b>
1, 2, 3, 4	Direct: Instructor-led demonstrations
3	Interactive: Instructor-led class discussions; Instructor guides students to work in teams.
5	Indirect: Instructor provides materials to guide student learning.
<b>Obj. #</b>	<b>INSTRUCTIONAL ACTIVITIES: (What Students Do)</b>
1, 2, 3, 5	Writing to Inform
2	Worksheets
5	Reading for Meaning
<b>UNIT RESOURCES: (include Internet addresses for linking)</b>	
<p>Support documents:</p> <ul style="list-style-type: none"> <li>• [CONTROL CIRCUIT DIAGRAM CHECKLIST]</li> <li>• [CONDUCTOR SELECTION – CALCULATION RUBRIC]</li> <li>• [REGULATION TRANSLATION – RELATION RUBRIC]</li> <li>• [LOAD CALCULATION RUBRIC]</li> </ul> <p>Internet resources:</p> <ul style="list-style-type: none"> <li>• <a href="http://www.allaboutcircuits.com/worksheets/over_i.html">http://www.allaboutcircuits.com/worksheets/over_i.html</a></li> </ul> <p>Resources available from MCCE free loan library (<a href="http://www.mcce.org">www.mcce.org</a>):</p> <ul style="list-style-type: none"> <li>• Residential Electrical Wiring Shopware, LAWRENCEVILLE, NJ, FILMS MEDIA GROUP, 2000. DVD ROM — This program follows an apprentice electrician through the specific steps of wiring a house as he works with a professional electrician. The video covers wiring diagrams, breaker panels, circuit breakers, switches, and outlet wiring. A quick but instructive look at the basics of wiring. 12 minutes.</li> </ul>	

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- **Inside the Electrician's Toolbox**  
Shopware, HAMILTON, NJ, FILMS MEDIA GROUP, 2008. DVD ROM — This program includes a general introduction of electricity — electrons, current, kilowatts, and the journey of electrical power from utility company to home — and examines the work materials and tools commonly used by an electrician. Wires, cables, conduits, boxes, receptacles, and switches are illustrated, and the tools required to cut and run cable or conduit, detect and test voltage, and wire or connect fixtures are shown in action. Wiring diagrams and blueprints are also considered, and safety is stressed throughout. Recommended for high school, vocational/technical school, and adult education. 26 minutes.
- **Electrical Tools, Safety & Wiring**  
CEV Multimedia, LUBBOCK, TX, CEV MULTIMEDIA, 2003. DVD ROM — This program focuses on basic electrical safety procedures, and discusses a wide variety of topics, such as: Over-current protective devices; Care of insulation on electric power cords; Correct use of tools and following safe and approved working procedures; Proper electrical material identification. In order to provide practical application, electrical demonstration boards provide students with visual demonstration on how to wire three circuits commonly found in most residences— duplex receptacle, lighting fixture controlled by a dimmer, and a three-way lighting circuit. 4 sections, 250 minutes.