

DESE Model Curriculum

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

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>UNIT DESCRIPTION: System Elements These lessons are designed to introduce the electrical student to elements within residential electrical systems, including conductors; cables; device, pull, and junction boxes; raceways, conduit, and fittings; lighting; and motors.</p>		<p>SUGGESTED UNIT TIMELINE: 5 lessons Lesson 1: Conductors and Cables Lesson 2: Boxes Lesson 3: Conduit and Raceways Lesson 4: Lighting Lesson 5: Motors CLASS PERIOD (min.): 90 minutes</p>					
<p>ESSENTIAL QUESTIONS:</p> <ol style="list-style-type: none"> 1. How are conductor and cable installations planned? 2. How are conductors and cables properly installed? 3. How are different kinds of device, pull, and junction boxes selected and installed? 4. How is conduit bent by hand? With power tools? 5. How are raceway systems chosen for given applications? 6. How do the elements of lighting systems (i.e., lighting fixtures, lamps, ballasts, and control devices) work together? 7. How are lighting systems chosen to suit their locations? 8. How are motors used in residential electrical systems? 9. How are motors used in commercial/industrial electrical systems? 							
ESSENTIAL MEASURABLE LEARNING OBJECTIVES		CCSS LEARNING GOALS (Anchor Standards/Clusters)	CROSSWALK TO STANDARDS				
			GLEs/CLEs	PS	CCSS	NCCER	DOK
<ol style="list-style-type: none"> 1. Students will demonstrate their knowledge of conductors and cables (including handling and storage practices). 					WHST 9-10.2 WHST 9-10.4 WHST 9-10.10 WHST 11-12.2 WHST 11-12.4 WHST 11-12.10 L 9-10.1 L 9-10.2 L 9-10.4 L 9-10.6	26109-08	Level 1

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				L 11-12.1 L 11-12.2 L 11-12.4 L 11-12.6 RST 9-10.3 RST 11-12.3 RST 11-12.9		
2. Students will describe the processes related to planning and installing conductors and cables.				N-RN 3 N-Q 1 A-SSE 1 A-SSE 2 A-SSE 3 A-SSE 4 A-CED 1 A-CED 3 A-CED 4 F-TF 1 F-TF 3 F-TF 8 F-TF 9 G-SRT 8 G-MG 3 WHST 9-10.2 WHST 9-10.4 WHST 9-10.10 WHST 11-12.2 WHST 11-12.4 WHST 11-12.10 L 9-10.1 L 9-10.2 L 9-10.4 L 9-10.6	26206-08 26208-08	Level 1

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				L 11-12.1 L 11-12.2 L 11-12.4 L 11-12.6 RST 9-10.3 RST 11-12.3 RST 11-12.9		
3. Students will demonstrate their knowledge of how to select and install device, pull, and junction boxes appropriate to given situations.				N-RN 3 N-Q 1 A-SSE 1 A-SSE 2 A-SSE 3 A-SSE 4 A-CED 1 A-CED 3 A-CED 4 F-TF 1 G-SRT 8 G-MG 3 WHST 9-10.2 WHST 9-10.4 WHST 9-10.10 WHST 11-12.2 WHST 11-12.4 WHST 11-12.10 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	26106-08 26205-08	Level 1

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				L 11-12.6 RST 9-10.3 RST 11-12.3 RST 11-12.9		
4. Students will demonstrate their knowledge of terms associated with conduit bending and raceway systems.				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 RI.9-10.4 RI.11-12.4	26107-08 26108-08 26204-08	Level 1
5. Students will select raceway systems for given applications and justify their selections.				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 9-10.4 WHST 9-10.10 WHST 11-12.1 WHST 11-12.4 WHST 11-12.10	26204-0	Level 3
6. Students will compare methods of conduit bending to select the best method for given applications.				N-RN 3 N-Q 1 A-SSE 1 A-SSE 2	26107-08 26108-08	Level 2

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				A-SSE 3 A-SSE 4 A-CED 1 A-CED 3 A-CED 4 F-TF 1 F-TF 3 F-TF 8 F-TF 9 G-SRT 8 G-MG 3 L 9-10.1 L 9-10.2 L 9-10.6 L 11-12.1 L 11-12.2 L 11-12.6 RST 11-12.9		
7. Students will demonstrate their knowledge of terms associated with lighting.				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 RST 11-12.9	26203-08 26303-08	Level 1
8. Students will identify different kinds of lamps and light fixtures, their advantages and disadvantages, and appropriate settings.				L 9-10.1 L 9-10.2 L 9-10.4 L 9-10.6 L 11-12.1 L 11-12.2	26203-08 26303-08	Level 1

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				L 11-12.4 L 11-12.6 RST 11-12.9		
9. Students will use motor nameplates to make appropriate decisions for installing motors.				N-RN 3 N-Q 1 A-SSE 1 A-SSE 2 A-SSE 3 A-SSE 4 A-CED 1 A-CED 3 A-CED 4 F-TF 1 G-SRT 8 G-MG 3 RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1 L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2	26309-08	Level 1
10. Students will demonstrate their knowledge of motor applications in residential versus commercial/industrial electrical systems.				RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1 L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2	26202-08	Level 1

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<p>ASSESSMENT DESCRIPTIONS*: (Write a brief overview here. Identify Formative/Summative. Actual assessments will be accessed by a link to PDF file or Word doc.) Students will demonstrate their understanding of content and ability to apply learned skills by:</p> <ul style="list-style-type: none"> • Drawing and labeling a typical cable (Formative) • Writing cable planning and installation processes (Summative) • Completing a materials estimation for device, pull, and junction boxes (Summative) • Writing the steps of installation processes for device, pull, or junction boxes (Summative) • Completing crossword puzzles over terms associated with conduit and raceways and lighting (Formative) • Selecting raceway systems for a given application and providing written justifications for their selections (Summative) • Writing comparisons of methods for bending conduit (Summative) • Creating infographics regarding lighting systems (Summative) • Answering Instructor’s questions regarding motor applications (Formative) • Writing motor calculations and application descriptions (Formative) <p>*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 #).</p>	
Obj. #	INSTRUCTIONAL STRATEGIES (research-based): (Teacher Methods)
1, 2, 3, 4, 5, 6, 7, 9, 10	Direct: Instructor-led demonstrations
8, 9	Indirect: Instructor provides materials to guide student learning.
8	Interactive: Instructor guides students to work in teams.
Obj. #	INSTRUCTIONAL ACTIVITIES: (What Students Do)
1, 2, 3, 5, 6, 8, 9	Writing to Inform
4, 7	Crossword puzzle
10	Reflective Discussion
<p>UNIT RESOURCES: (include Internet addresses for linking)</p> <p>Support documents:</p> <ul style="list-style-type: none"> • [CABLE DISSECTION CHECKLIST] 	

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- [CABLE PROCESS RUBRIC]
- [BOX ESTIMATION AND PROCESS RUBRIC]
- [CONDUIT RACEWAY CROSSWORD]
- [CONDUIT RACEWAY CROSSWORD KEY]
- [RACEWAY RATIONALE RUBRIC]
- [BENDING COMPARISON RUBRIC]
- [LIGHTING CROSSWORD]
- [LIGHTING CROSSWORD KEY]
- [LIGHTING INFOGRAPHIC RUBRIC]
- [MOTOR NAMEPLATE WRITE-UP CHECKLIST]

Internet resources:

- <http://www.makeuseof.com/tag/awesome-free-tools-infographics/>
- <http://www.vfds.com/how-to-read-a-motor-nameplate>

Resources available from MCCE free loan library (www.mcce.org):

- 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.
- 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

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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.