



# **Alabama Department of Postsecondary Education**

**Representing the Alabama Community College System**

## **STATEWIDE CAREER/TECHNICAL EDUCATION COURSE ARTICULATION REVIEW MINUTES**

Articulation Agreement Identifier: AUT 110 2011-1 Identifier is the postsecondary course prefix followed by Plan-of-Instruction version number (e.g.; INT 100 (2005-1)).

Applicable CIP code(s): 15.0613

Postsecondary course prefix, number, and title: AUT 110 - DC Fundamentals

Secondary Course(s) of Study: 431509/430058 – Direct Current

Initial Review: October 8, 2009 Annual DPE Review: January 30, 2012

Effective dates: Fall Semester 2011.

Course Content Analysis (all postsecondary course objectives must be sufficiently addressed in the secondary courses):

### **Notes:**

- 1 Skills and knowledge contained in the postsecondary course objectives must be present in the corresponding secondary objectives for a “match” to occur.**
- 2. Postsecondary and Secondary objectives must reflect similar content and performance levels before the course articulation agreement will be recommended to the TEDAC Oversight Committee.**
- 3. More than one Secondary course may be used in order to articulate to a Postsecondary course.**

Postsecondary Course Objectives	Secondary Course(s) and Location(s)	TEDAC Comments
<p><b>MODULE A – Principles of DC Electricity Competencies &amp; Objectives</b></p> <p>A1.0 Perform tasks in a safe manner.</p> <p>A1.1 Given a variety of lab situations, perform assigned tasks in a safe manner.</p> <p>A1.1.1 Explain the use of personal protective equipment.</p> <p>A1.1.2 Explain hazards associated with electrical systems.</p> <p>A1.1.3 Explain lockout/tag out procedures.</p> <p>A2.0 Explain elements of DC electrical theory.</p> <p>A2.1 This competency is measured cognitively.</p> <p>A2.1.1 Define terms associated with DC electricity.</p> <p>A2.1.2 Explain the function of each atomic component structure.</p> <p>A2.1.3 Explain the function of electrical charges.</p> <p>A2.1.4 State whether a potential difference exists between two charges given their magnitude and polarity.</p> <p>A2.1.5 State the direction of electron movement between two charges, given their magnitude and polarity.</p> <p>A2.1.6 Explain the function of conductors.</p> <p>A2.1.7 Explain the function of insulators.</p> <p>A2.1.8 Explain the difference between insulators, and conductors.</p> <p>A2.1.9 Describe the relationship between electrical charge and current.</p> <p>A2.1.10 Explain the principles of magnetism and how they relate to electrical charges.</p> <p>A2.1.11 Explain the various units of electrical</p>	<p><b>Direct Current, Unit 1-3, Sources Content Standards</b></p> <ol style="list-style-type: none"> <li>1. Identify structure and characteristics of the atom.</li> <li>2. Explain the relationship of the atom to an electrical charge, including electrostatic field and law of charges.</li> <li>3. Identify sources of electricity, including chemical, mechanical, and solar. Examples: chemical—battery mechanical—generator</li> </ol> <p><b>Learning Objectives</b></p> <ol style="list-style-type: none"> <li>1. Identify structure and characteristics of the atom. <ul style="list-style-type: none"> <li>• Definition of the atom</li> <li>• Components</li> <li>• Component functions</li> <li>• Atomic shell</li> </ul> </li> <li>2. Explain the relationship of the atom to an electrical charge. <ul style="list-style-type: none"> <li>• Electrostatic field</li> <li>• Law of charges</li> </ul> </li> <li>3. Describe the atomic structure of a given element and including the contribution of each atomic particle to the physical and electrical characteristics of the element. <ul style="list-style-type: none"> <li>• Define metric notation.</li> <li>• State the purpose of metric notation.</li> <li>• Describe the relationship between metric notation and electricity.</li> <li>• State whether a potential difference exists between</li> </ul> </li> </ol>	

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<p>measurement.</p> <p>A2.1.12 Explain Ohm's Law.</p> <p>A2.1.13 Calculate current using Ohm's Law.</p> <p>A2.1.14 Calculate voltage using Ohm's Law.</p> <p>A2.1.15 Calculate resistance using Ohm's Law.</p> <p>A2.1.16 Describe the linear proportion between current and voltage.</p> <p>A2.1.17 Explain electrical power.</p> <p>A2.1.18 Describe power dissipation in resistance.</p> <p>A2.1.19 Identify power formulas.</p> <p>A2.1.20 State the relationship between resistance, voltage, current, and power.</p> <p>A2.1.21 Calculate current flows.</p> <p>A2.1.22 Calculate voltage drops and rises.</p> <p>A2.1.23 Calculate resistance.</p>	<p>two charges given their magnitude and polarity.</p> <ul style="list-style-type: none"> <li>• State the direction of electron movement between two charges, given their magnitude and polarity.</li> </ul> <p>4. Define electricity.</p> <ul style="list-style-type: none"> <li>• Identify the properties of electricity.</li> <li>• Explain the function of electrical properties.</li> <li>• Define the following terms: coulomb, scientific notation, ampere, ammeter, voltmeter</li> </ul> <p>5. Identify sources of electricity.</p> <ul style="list-style-type: none"> <li>• Chemical</li> </ul> <p>Example: cells and batteries of cells                  Explain the purpose of a battery.                  Explain the function of a battery.                  Explain the procedures for testing a battery for serviceability.</p> <p><b>Direct Current, Unit 4-5, Terminology and Symbols Content Standards</b></p> <p>4. Explain electrical terms, including direct current (DC), voltage, resistance, power, conductors, and insulators.</p> <p>5. Interpret electrical symbols.                  Examples: unit symbols, schematic symbols</p> <p><b>Learning Objectives</b></p> <p>4. Explain and define electrical terms.</p> <ul style="list-style-type: none"> <li>• Direct current</li> </ul>	

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<p><b>MODULE B – DC Electrical Circuits Competencies &amp; Objectives</b></p> <p>B1.0 Read and interpret electrical circuits.</p> <p>B1.1 Design and construct a variety of DC circuits.</p> <p>B1.1.1 Explain terms and symbols used for DC electrical circuits.</p> <p>B1.1.2 State the basic components of a DC electrical circuit.</p> <p>B1.1.3 Identify characteristics of conductors and insulators.</p> <p>B1.1.4 Describe the differences between schematic and wiring diagrams.</p> <p>B1.1.5 Differentiate between various resistive circuits such as series, parallel, and series-parallel circuits.</p> <p>B1.1.6 Use Kirchhoff’s law to solve for unknowns in various resistive circuits.</p> <p>B1.1.7 Solve for unknowns within a circuit using various network theorems.</p> <p>B1.1.8 Explain considerations for designing and constructing various DC circuits.</p>	<ul style="list-style-type: none"> <li>• Voltage</li> <li>• Resistance</li> <li>• Power</li> <li>• Conductors</li> <li>• Insulators</li> </ul> <p>5. Interpret electrical symbols.</p> <ul style="list-style-type: none"> <li>• Identify common electrical symbols used in schematics.</li> </ul> <p>Examples: unit symbols, schematic symbols</p> <p><b>Direct Current, Unit 6, Components of a Basic Circuit Content Standards</b></p> <p>6 Explain components of a basic circuit, including source, load, and conductor.</p> <p><b>Learning Objectives</b></p> <ol style="list-style-type: none"> <li>1. Define a variable DC power supply.</li> <li>2. Explain the use of a variable DC power supply.</li> <li>3. Define resistance.</li> <li>4. Define load.</li> <li>5. Explain the function of resistance in electrical circuits.</li> <li>6. Define resistors.</li> <li>7. Explain the purpose of resistors.</li> <li>8. Identify types of conductors.</li> <li>9. Explain the function of insulators.</li> <li>10. Define conductors.</li> <li>11. Explain the function of conductors.</li> <li>12. Define Insulators.</li> <li>13. Identify insulators.</li> <li>14. Describe standard wire gage sizes.</li> </ol>	

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	<p><b>Direct Current, Unit 7-8, Electrical Quantities and Measurements</b></p> <p><b>CoContent Standards</b></p> <p>7. Explain electrical quantities and units of measure, including voltage, current, resistance, and power.</p> <p>8. Determine electrical quantities of volts, ohms, d amperes utilizing appropriate test equipment.</p> <p><b>Learning Objectives</b></p> <p>7. Explain electrical quantities.</p> <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current</li> <li>• Resistance</li> <li>• Power</li> </ul> <p>8. Define electrical units of measure.</p> <ul style="list-style-type: none"> <li>• Volts</li> <li>• Amperes</li> <li>• Ohms</li> <li>• Watts</li> </ul> <p>9. Determine electrical quantities utilizing appropriate test equipment.</p> <ul style="list-style-type: none"> <li>• Volts</li> <li>• Ohms</li> <li>• Amperes</li> </ul> <p>10. Explain the purpose of a multimeter.</p> <p>11. Explain meter movements and scales.</p> <p>12. Describe and demonstrate the correct method for using the following meters: ammeter, voltmeter, ohmmeter</p> <p><b>Direct Current, Unit 9-11, Characteristics of Resistors</b></p>	

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	<p><b>Content Standards</b></p> <p>9. Identify different types of resistors, including fixed and variable resistors.</p> <p>10. Determine resistance values using the standard resistor color code.</p> <p>11. Determine electrical and physical characteristics of resistors. Examples: resistance, power rating, wattage</p> <p><b>Learning Objectives</b></p> <p>1. Identify different types of resistors.</p> <ul style="list-style-type: none"> <li>• Fixed</li> <li>• Variable</li> </ul> <p>2. Determine resistance values using the standard resistor color code.</p> <p>3. Determine electrical and physical characteristics of resistors.</p> <p>4. Identify resistors value and tolerance by color code.</p> <p>5. Determine a resistors power rating by examining its size.</p> <p>6. Define the variable resistors.</p> <p>7. Explain the purpose of variable resistors.</p> <p>8. Explain the purpose of resistor power rating.</p> <p>9. Identify resistor combinations.</p> <p>10. Describe the function of resistor combinations.</p> <p>11. Explain the purpose of a Rheostat.</p> <p>12. Explain the purpose of a Potentiometer.</p> <p>13. Identify common resistor troubles.</p>	

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	<p><b>Direct Current, Unit 12, Ohm's Law Content Standard</b></p> <p>1. Solve problems in electrical series, parallel, and combination circuits using Ohm's law to determine voltage, current, resistance, and power.</p> <p><b>Learning Objective</b></p> <ol style="list-style-type: none"> <li>1. State Ohm's Law.</li> <li>2. Explain Ohm's Law.</li> <li>3. Identify the symbols of Ohm's law.</li> <li>4. Calculate current using Ohm's Law.</li> <li>5. Calculate voltage using Ohm's Law.</li> <li>6. Calculate resistance using Ohm's Law.</li> <li>7. Describe the linear proportion between current and voltage.</li> <li>8. Explain electrical power.</li> <li>9. Describe power dissipation in resistance.</li> <li>10. Select the appropriate resistor for a given circuit.</li> <li>11. Identify power formulas.</li> <li>12. Describe common problems in circuits.</li> <li>13. Identify a series circuit.</li> <li>14. Explain the function of a series circuit.</li> <li>15. Identify a parallel circuit.</li> <li>16. Explain the function of a parallel circuit.</li> <li>17. Identify a series parallel circuit.</li> <li>18. Explain the function of a series parallel circuit.</li> <li>19. Solve problems in electrical circuits using Ohm's law.               <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current</li> </ul> </li> </ol>	

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	<ul style="list-style-type: none"> <li>• Resistance</li> <li>• Power</li> </ul> <p>20. Draw a schematic diagram of a DC series circuit.</p> <p>21. Draw a schematic diagram of a DC parallel circuit.</p> <p>22. Draw a schematic diagram of a DC series-parallel circuit.</p> <p>23. Construct a DC series circuit.</p> <p>24. Construct a DC parallel circuit.</p> <p>25. Construct a DC series-parallel circuit.</p> <p>26. Measure the voltage, current, and resistance in a series circuit.</p> <p>27. Measure the voltage, current, and resistance in a DC parallel circuit.</p> <p>28. Measure the voltage, current, and resistance in a DC series-parallel circuit.</p> <p>29. Measure the voltage across a voltage divider.</p> <p><b>Direct Current, Unit 12, Circuit Construction Content Standard</b></p> <p>13. Demonstrate the fabrication of specified DC circuits, including the use of soldering, breadboards, and wiring techniques.</p> <p><b>Learning Objective</b></p> <ol style="list-style-type: none"> <li>1. Construct DC parallel circuits.</li> <li>2. Construct DC series-parallel circuits.</li> <li>3. Construct DC series circuits.</li> </ol> <ul style="list-style-type: none"> <li>• Identify types of wire connectors.</li> <li>• Describe the purpose of connectors.</li> <li>• Explain the purpose of fuses.</li> </ul>	



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<p><b>MODULE C – DC Circuit Testing Competencies &amp; Objectives</b></p> <p>C1.0 Use electrical test equipment to troubleshoot electrical circuits.</p> <p>C1.1 Given a DC circuit previously developed by the student, use various instruments to test the circuit to determine if the readings are in accordance with specifications.</p> <p>C1.1.1 Explain the characteristics and functions of various instruments used to test DC electrical circuits.</p> <p>C1.1.2 Explain procedures for obtaining readings from various instruments used to test DC electrical circuits.</p> <p>C1.1.3 Calculate power in series circuit, parallel circuit, and a series parallel circuit</p> <p>C1.2 Given various faulty circuits or faulty readings within a circuit, determine the root cause and propose a solution.</p> <p>C1.2.1 Describe the process for determining if a reading is correct or incorrect.</p> <p>C1.2.2 Explain the procedures for determining the cause</p>	<ul style="list-style-type: none"> <li>• Explain the purpose of switches.</li> <li>• Define wire resistance.</li> <li>• Describe the temperature coefficient of resistance.</li> <li>• Explain the difference between insulators, conductors and semiconductors.</li> <li>• Explain the function of soldering.</li> <li>• Describe the process of soldering.</li> <li>• Identify common types of solder.</li> <li>• Identify common types of flux.</li> </ul> <p><b>Direct Current, Unit 14, Troubleshooting Content Standard</b></p> <p>14. Demonstrate troubleshooting techniques for circuits, including opens, shorts, and grounds.</p> <p><b>Learning Objectives</b></p> <ol style="list-style-type: none"> <li>1. Describe and demonstrate the correct method for using the following meters: ammeter, voltmeter, ohmmeter</li> <li>2. Identify and explain common circuit problems</li> <li>3. State Kirchhoff's Law</li> <li>4. Explain and apply Kirchhoff's Law</li> <li>5. State Thevenin's Law</li> <li>6. Explain and apply Thevenin's Law</li> <li>7. Describe open circuits</li> <li>8. Describe short circuits</li> <li>9. Describe series parallel circuits</li> <li>10. Recognize open circuits</li> <li>11. Recognize short circuits</li> <li>12. Recognize series parallel circuits</li> <li>13. Solve problems pertaining to resistance, voltage,</li> </ol>	

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<p>of the malfunction.                      C1.2.3 Explain the procedures for repairing the malfunction.</p>	<p>current and power in DC circuits                      14. Analyze complex DC circuits using Ohm's Law                      15. Analyze complex DC circuits using network theorems                      16. Analyze voltage dividers using both Ohm's Law and network theorems</p>	