Alabama Department of Postsecondary Education

Representing the Alabama Community College System

# STATEWIDE CAREER/TECHNICAL EDUCATION COURSE ARTICULATION REVIEW MINUTES

Articulation Agreement Identifier: AUT 112 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 112 – Alternating Current Fundamentals

Secondary Course(s) of Study: 431510/430059 – Alternating Current

Initial Review: October 8, 2009 DPE Annual 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 |
|---|---|---|
| **Module A Principles of AC Electricity**<br><br>**Competency:**<br>A1.0 Explain elements of AC electrical theory.<br>**Performance Objective**<br>This competency is measured cognitively.<br>**Learning Objectives:**<br>A1.1.1 Identify the particles in an atom.<br>A1.1.2 State the electrical charge of the atomic particles.<br>A1.1.3 Define voltage, current, resistance, and power.<br>A1.1.4 State the units of measurement for voltage, current, resistance, and power.<br>A1.1.5 Describe the relationship between, voltage, current, resistance, and power.<br>A1.1.6 Explain the function of voltage sources.<br>A1.1.7 State Ohm's Law.<br>A1.1.8 State the Power Law.<br>A1.1.9 State Kirchoff's Law as applied to AC theory<br>A1.1.10 Describe the relationship between electricity and magnetism.<br>A1.1.11 Explain the operation of an electromagnet.<br>A1.1.12 Explain how magnetic induction works.<br>A1.1.13 Identify a sine wave.<br>A1.1.14 Describe period, frequency, and amplitude.<br>A1.1.15 State the unit of measurement for frequency.<br>A1.1.16 Describe peak, peak-to-peak, and effective voltage.<br>A1.1.17 Describe phase relationships and phase-shift<br>A1.1.18 Define capacitance.<br>A1.1.19 State the unit of measurement for capacitance.<br>A1.1.20 Define reactance.<br>A1.1.21 Define inductance.<br>A1.1.22 State the unit of measurement for inductance.<br>A1.1.23 Describe the function of an inductor in a circuit. | **Alternating Current, Unit 1-2, Terminology and Symbols Content Standards**<br><br>1. Explain electrical terms, including alternating current, frequency, period, sine wave, capacitance, and inductance.<br>2. Interpret electrical symbols.<br><br>Examples: unit symbols, schematic symbols<br><br>**Learning Objectives**<br><br>1. Define and explain electrical terms.<br>• Alternating current<br>• Frequency<br>• Period<br>• Sine wave<br>• Capacitance<br>• Inductance<br>2. Identify and interpret common electrical symbols.<br>Examples: unit symbols, schematic symbols<br><br>**Alternating Current, Unit 3, Magnetism Content Standards**<br><br>3. Explain terms and principles of electromagnetism, including permeability, retentivity, and inductance.<br>**Learning Objectives** | |

| Postsecondary Course Objectives | Secondary Course(s) and Location(s) | TEDAC Comments |
|---|---|---|
| **Competency:**<br>A2.0 Perform tasks in a safe manner.<br>**Performance Objective**<br>A2.1 Given a variety of lab situations, perform assigned tasks in a safe manner.<br>**Learning Objectives:**<br>A2.1.1 Identify personal protective equipment.<br>A2.1.2 Explain the use of personal protective equipment.<br>A2.1.3 Explain hazards associated with electrical systems.<br>A2.1.4 Explain lockout/tag out procedures.<br><br>**Competency:**<br>A3.0 Value the importance of following safety precautions.<br>**Performance Objective**<br>A3.1 This competency is measured affectively. | 1. Define magnetism.<br>2. Explain the function of magnetism in electricity.<br>3. Define magnetic units.<br>4. Identify magnetic units.<br>5. Explain the function of magnetic units in electricity.<br>6. Define electromagnetic induction.<br>7. Identify electromagnetic units.<br>8. Explain electromagnetic induction.<br>9. Define permeability.<br>10. Explain permeability.<br>11. Define retentivity.<br>12. Explain retentivity.<br>13. Define inductance.<br>14. Explain inductance.<br><br>**Alternating Current, Unit 4-6, Electrical Quantities**<br>**Content Standards**<br><br>4. Explain electrical quantities, including frequency, impedance, power, capacitance, inductance, voltage, current, watts, and periods.<br>5. Measure electrical units, including volts, amperes, ohms, and hertz.<br>6. Determine electrical quantities utilizing test equipment, including volts, frequency and period, amperes, and power.<br><br>**Learning Objectives**<br><br>**Omitted in the POI and should be added The below were taken from the Direct Current POI**<br>7. Explain electrical quantities.<br>• Voltage<br>• Current<br>• Resistance | |

| Postsecondary Course Objectives | Secondary Course(s) and Location(s) | TEDAC Comments |
|---|---|---|
| | • Power<br>8. Define electrical units of measure.<br>• Volts<br>• Amperes<br>• Ohms<br>• Watts<br>9. Determine electrical quantities utilizing appropriate test equipment.<br>• Volts<br>• Ohms<br>• Amperes<br>10.Explain the purpose of a multimeter.<br>11.Explain meter movements and scales.<br>12. Describe and demonstrate the correct method for using the following meters: ammeter, voltmeter, ohmmeter<br><br>**Alternating Current, Unit 7, Ohm's Law in AC Circuits**<br>**Content Standards**<br><br>7. Solve problems in electrical circuits using Ohm's law, including voltage, current, impedance, and power.<br><br>**Learning Objectives**<br><br>1. Draw a schematic diagram of an AC series circuit.<br>2. Draw a schematic diagram of an AC parallel circuit.<br>3. Draw a schematic diagram of an AC Series Parallel Circuit.<br>4. Use common test equipment to analyze an AC series circuit.<br>5. Use common test equipment to analyze a parallel circuit according to specifications.<br>6. Use common equipment to analyze a series-parallel circuit according to specifications.<br>7. Use a function generator to set the required voltage and frequency for a function generator. | |
| **MODULE B – AC Electrical Circuits**<br>**Competency:**<br>B1.0 Read and interpret electrical circuits.<br>**Performance Objectives:**<br>B1.1 Design and construct a variety of AC circuits.<br>**Learning Objectives:**<br>B1.1.1 Explain terms and symbols used for electrical circuits.<br>B1.1.2 State the basic components of an electrical circuit.<br>B1.1.3 Identify characteristics of conductors of different capacities.<br>B1.1.4 Describe the differences between schematic and wiring diagrams.<br>B1.1.5 Differentiate between series, parallel, series-parallel circuits, and RCL circuits.<br>B1.1.6 Explain considerations for using various types of connections when constructing AC circuits. | | |

| Postsecondary Course Objectives | Secondary Course(s) and Location(s) | TEDAC Comments |
|---|---|---|
| **MODULE C – Circuit Testing**<br>**Competency:**<br>C1.0 Use electrical test equipment to troubleshoot electrical circuits.<br>**Performance Objectives**<br>C1.1 Given an AC circuit previously developed by the student, use various instruments to test the circuit to determine if the readings are in accordance with specifications.<br>**Learning Objectives**<br>C1.1.1 Explain the characteristics and functions of various instruments used to test electrical circuits.<br>C1.1.2 Explain procedures for obtaining readings from various instruments used to test electrical circuits.<br><br>**Performance Objectives**<br>C1.2 Given various faulty circuits or faulty readings within a circuit, determine the root cause and propose a solution<br>**Learning Objectives**<br>C1.2.1 Describe the process for determining if a reading is correct or incorrect.<br>C1.2.2 Explain the procedures for determining the cause of the malfunction.<br>C1.2.3 Explain the procedures for repairing the malfunction.<br><br>**Module D Transformers**<br>**Competency:**<br>D1.0 Use transformers in an industrial setting.<br>**Performance Objectives**<br>D1.1 Perform transformer wiring functions for various applications.<br>**Learning Objectives**<br>D1.1.1 Describe the difference between mutual induction and self induction. | 8. Use a digital multimeter and an oscilloscope to perform an operational checkout of an AC circuit.<br>9. Use a digital multimeter to troubleshoot an AC circuit and identify the malfunction.<br>10. Use an oscilloscope to troubleshoot an AC circuit and identify the malfunction.<br>11. Construct an AC Parallel Circuit containing resistors, capacitors, inductors, or combinations thereof, and test for continuity.<br>12. Construct an AC Series-Parallel Circuit containing resistors, capacitors, inductors or combinations thereof, and test for continuity.<br><br>**Alternating Current, Unit 8-12, Reactive Circuits**<br>**Content Standards**<br><br>8. Solve resistive-capacitive circuits.<br>9. Solve resistive-inductive circuits.<br>10. Solve resistive-capacitive-inductive circuits.<br>11. Analyze filter circuits to determine electrical values, including hi-pass, low-pass, band pass, and band stop.<br>12. Demonstrate troubleshooting techniques for evaluating reactive circuits.<br><br>**Learning Objectives**<br><br>1. Explain the function of inductance.<br>2. Define inductive reactance.<br>3. Explain the function of inductive reactance.<br>4. Identify inductive circuits.<br>5. Define capacitive reactance.<br>6. Explain the function of capacitive reactance.<br>7. Identify capacitive circuits.<br>8. Identify open circuits in AC circuits. | |

| Postsecondary Course Objectives | Secondary Course(s) and Location(s) | TEDAC Comments |
|---|---|---|
| D1.1.2 Differentiate between the input side and load side of a transformer.<br>D1.1.3 Define Impedance.<br>D1.1.4 Identify various transformer types such as step up, step down, single phase, auto transformers, and polyphase.<br>D1.1.5 Explain the operation of transformers including action and counter action of the primary and secondary magnetic fields.<br>D1.1.6 Explain the function of a center tap.<br>D1.1.7 Calculate primary and secondary ratios for voltage, current, turns, power, and impedance.<br>D1.1.8 Identify primary leads, secondary leads, and transformer polarity from a schematic diagram.<br>D1.1.9 Differentiate between delta and wye connections.<br>D1.1.10 Explain the relationship of line current to coil current and line voltage in Wye and Delta configurations of polyphase transformers.<br>D1.1.11 Explain the purpose of isolation in a transformer. | 9. Identify short circuits in AC circuits.<br>10. Define RC time constants.<br>11. Explain the function of RC time constants.<br>12. Define LR time constants.<br>13. Explain the function of LR time constants.<br>14. Explain the use of complex numbers for Alternating current circuits.<br>15. State the purpose of transformers.<br>16. Differentiate between transformers.<br>17. Explain the characteristics of transformers.<br>18. Define resonance.<br>19. Explain the function of resonance.<br>20. Define filters.<br>21. Explain the function of filters.<br>22. Describe the voltage and current phase relationship in a resistive AC circuit.<br>23. Describe the voltage and current transients that occur in an inductive circuit.<br><br>24. Define inductive reactance and state how it is affected by frequency.<br>25. Describe the voltage and current transients that occur in a capacitive circuit.<br>26. Define capacitive reactance and state how it is affected by frequency.<br>27. Explain the relationship between voltage and current in the following types of AC circuits: • RL circuit • RC circuit • LC circuit • RLC circuit<br>28. Describe the effect that resonant frequency has on impedance and current flow in a series or parallel Resonant circuit.<br>29. Define bandwidth and describe how it is affected by resistance in a series or parallel resonant circuit.<br>30. Explain the following terms as they relate to AC circuits: • True power • Apparent power | |

| Postsecondary Course Objectives | Secondary Course(s) and Location(s) | TEDAC Comments |
|---|---|---|
| | • Reactive power • Power factor<br>31. Troubleshoot circuits. | |