Articulation Agreement Identifier: **AUT 111 (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 111 – AC 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.
### Module A: Principles of AC Electricity

**Competency:**
A1.0 Explain elements of AC electrical theory.

**Performance Objective**
This competency is measured cognitively.

**Learning Objectives:**
- A1.1.1 Identify the particles in an atom.
- A1.1.2 State the electrical charge of the atomic particles.
- A1.1.3 Define voltage, current, resistance, and power.
- A1.1.4 State the units of measurement for voltage, current, resistance, and power.
- A1.1.5 Describe the relationship between voltage, current, resistance, and power.
- A1.1.6 Explain the function of voltage sources.
- A1.1.7 State Ohm’s Law.
- A1.1.8 State the Power Law.
- A1.1.9 State Kirchoff’s Law as applied to AC theory
- A1.1.10 Describe the relationship between electricity and magnetism.
- A1.1.11 Explain the operation of an electromagnet.
- A1.1.12 Explain how magnetic induction works.
- A1.1.13 Identify a sine wave.
- A1.1.14 Describe period, frequency, and amplitude.
- A1.1.15 State the unit of measurement for frequency.
- A1.1.16 Describe peak, peak-to-peak, and effective voltage.
- A1.1.17 Describe phase relationships and phase-shift.
- A1.1.18 Define capacitance.
- A1.1.19 State the unit of measurement for capacitance.
- A1.1.20 Define reactance.
- A1.1.21 Define inductance.
- A1.1.22 State the unit of measurement for inductance.
- A1.1.23 Describe the function of an inductor in a circuit.

### Alternating Current, Unit 1-2, Terminology and Symbols

**Content Standards**
1. Explain electrical terms, including alternating current, frequency, period, sine wave, capacitance, and inductance.
2. Interpret electrical symbols.

Examples: unit symbols, schematic symbols

**Learning Objectives**
1. Define and explain electrical terms.
   - Alternating current
   - Frequency
   - Period
   - Sine wave
   - Capacitance
   - Inductance
2. Identify and interpret common electrical symbols.
   Examples: unit symbols, schematic symbols

### Alternating Current, Unit 3, Magnetism

**Content Standards**
3. Explain terms and principles of electromagnetism, including permeability, retentivity, and inductance.

**Learning Objectives**
**Competency:**
A2.0  Perform tasks in a safe manner.

**Performance Objective**
A2.1  Given a variety of lab situations, perform assigned tasks in a safe manner.

**Learning Objectives:**
A2.1.1  Explain the use of personal protective equipment.
A2.1.2  Explain hazards associated with electrical systems.
A2.1.3  Explain lockout/tag out procedures.

**Competency:**
A3.0  Value the importance of following safety precautions.

**Performance Objective**
A3.1  This competency is measured affectively.

**Secondary Course(s) and Location(s)**
1. Define magnetism.
2. Explain the function of magnetism in electricity.
3. Define magnetic units.
4. Identify magnetic units.
5. Explain the function of magnetic units in electricity.
7. Identify electromagnetic units.
8. Explain electromagnetic induction.
10. Explain permeability.
11. Define retentivity.
12. Explain retentivity.
13. Define inductance.
14. Explain inductance.

**Alternating Current, Unit 4-6, Electrical Quantities**

**Content Standards**
4. Explain electrical quantities, including frequency, impedance, power, capacitance, inductance, voltage, current, watts, and periods.
5. Measure electrical units, including volts, amperes, ohms, and hertz.
6. Determine electrical quantities utilizing test equipment, including volts, frequency and period, amperes, and power.

**Learning Objectives**

Omitted in the POI and should be added. The below were taken from the Direct Current POI

7. Explain electrical quantities.
   • Voltage
   • Current
   • Resistance
### MODULE B – AC Electrical Circuits

**Competency:**
B1.0 Read and interpret electrical circuits.

**Performance Objectives:**
B1.1 Design and construct a variety of AC circuits.

**Learning Objectives:**
- B1.1.1 Explain terms and symbols used for electrical circuits.
- B1.1.2 State the basic components of an electrical circuit.
- B1.1.3 Identify characteristics of conductors of different capacities.
- B1.1.4 Describe the differences between schematic and wiring diagrams.
- B1.1.5 Differentiate between series, parallel, series-parallel circuits, and RCL circuits.
- B1.1.6 Explain considerations for using various types of connections when constructing AC circuits.

### Secondary Course(s) and Location(s)

- 8. Define electrical units of measure.
  - Volts
  - Amperes
  - Ohms
  - Watts
- 9. Determine electrical quantities utilizing appropriate test equipment.
  - Volts
  - Ohms
  - Amperes
- 10. Explain the purpose of a multimeter.
- 11. Explain meter movements and scales.
- 12. Describe and demonstrate the correct method for using the following meters: ammeter, voltmeter, ohmmeter

### Alternating Current, Unit 7, Ohm’s Law in AC Circuits

**Content Standards**
7. Solve problems in electrical circuits using Ohm’s law, including voltage, current, impedance, and power.

**Learning Objectives**
- 1. Draw a schematic diagram of an AC series circuit.
- 2. Draw a schematic diagram of an AC parallel circuit.
- 4. Use common test equipment to analyze an AC series circuit.
- 5. Use common test equipment to analyze a parallel circuit according to specifications.
- 6. Use common equipment to analyze a series-parallel circuit according to specifications.
- 7. Use a function generator to set the required voltage and frequency for a function generator.
### Module C – Circuit Testing

**Competency:**
- **C1.0** Use electrical test equipment to troubleshoot electrical circuits.

**Performance Objectives**
- **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.

**Learning Objectives**
- **C1.1.1** Explain the characteristics and functions of various instruments used to test electrical circuits.
- **C1.1.2** Explain procedures for obtaining readings from various instruments used to test electrical circuits.

**Performance Objectives**
- **C1.2** Given various faulty circuits or faulty readings within a circuit, determine the root cause and propose a solution

**Learning Objectives**
- **C1.2.1** Describe the process for determining if a reading is correct or incorrect.
- **C1.2.2** Explain the procedures for determining the cause of the malfunction.
- **C1.2.3** Explain the procedures for repairing the malfunction.

### Module D Transformers

**Competency:**
- **D1.0** Use transformers in an industrial setting.

**Performance Objectives**
- **D1.1** Perform transformer wiring functions for various applications.

**Learning Objectives**
- **D1.1.1** Describe the difference between mutual induction and self induction.
- **D1.1.2** Differentiate between the input side and load side of a transformer.
<table>
<thead>
<tr>
<th>Postsecondary Course Objectives</th>
<th>Secondary Course(s) and Location(s)</th>
<th>TEDAC Comments</th>
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<tbody>
<tr>
<td>transformer.</td>
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<tr>
<td>D1.1.3 Define Impedance.</td>
<td>9. Identify short circuits in AC circuits.</td>
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<td>D1.1.4 Identify various transformer types such as step up, step down, single phase, auto transformers, and polyphase.</td>
<td>10. Define RC time constants.</td>
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<tr>
<td>D1.1.5 Explain the operation of transformers including action and counter action of the primary and secondary magnetic fields.</td>
<td>11. Explain the function of RC time constants.</td>
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<td>D1.1.6 Explain the function of a center tap.</td>
<td>12. Define LR time constants.</td>
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<td>D1.1.7 Calculate primary and secondary ratios for voltage, current, turns, power, and impedance.</td>
<td>13. Explain the function of LR time constants.</td>
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<td>D1.1.8 Identify primary leads, secondary leads, and transformer polarity from a schematic diagram.</td>
<td>14. Explain the use of complex numbers for Alternating current circuits.</td>
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<td>15. State the purpose of transformers.</td>
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<td>16. Differentiate between transformers.</td>
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<td>17. Explain the characteristics of transformers.</td>
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<td>18. Define resonance.</td>
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<td>20. Define filters.</td>
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<td>21. Explain the function of filters.</td>
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<td>22. Describe the voltage and current phase relationship in a resistive AC circuit.</td>
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<td>23. Describe the voltage and current transients that occur in an inductive circuit.</td>
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<td>24. Define inductive reactance and state how it is affected by frequency.</td>
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<td>25. Describe the voltage and current transients that occur in a capacitive circuit.</td>
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<td>26. Define capacitive reactance and state how it is affected by frequency.</td>
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<td>27. Explain the relationship between voltage and current in the following types of AC circuits: • RL circuit • RC circuit • LC circuit • RLC circuit</td>
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<td>28. Describe the effect that resonant frequency has on impedance and current flow in a series or parallel Resonant circuit.</td>
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<td>29. Define bandwidth and describe how it is affected by resistance in a series or parallel resonant circuit.</td>
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<td>30. Explain the following terms as they relate to AC circuits: • True power • Apparent power</td>
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<td>• Reactive power • Power factor 31. Troubleshoot circuits.</td>
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