# AC Electronics Course No. 40450 Credit: 1.0

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| **Student name:** |  | **Graduation Date:** |  |

Pathways and CIP Codes:Aviation Maintenance (47.0000) – Avionics

Course Description: An **application level** course that teaches the fundamental concepts of alternating current. **Recommend students have a good grasp of Algebra 2 or Physics.**

Directions:The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.

**RATING SCALE:**

4. Exemplary Achievement: Student possesses outstanding knowledge, skills or professional attitude.

3. Proficient Achievement:Student demonstrates good knowledge, skills or professional attitude. Requires limited supervision.

2. Limited Achievement:Student demonstrates fragmented knowledge, skills or professional attitude. Requires close supervision.

1. Inadequate Achievement:Student lacks knowledge, skills or professional attitude.

0. No Instruction/Training:Student has not received instruction or training in this area.

## Benchmark 1: Sine and Non-Sinusoidal Waveforms

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.1 | Identify properties of an AC signal. |  |
| 1.2 | Define peak, peak-to-peak, average, and RMS voltage and current. |  |
| 1.3 | Define RMS power, apparent power, true power, and reactive power. |  |
| 1.4 | Analyze and measure AC signals using oscilloscope, frequency meter, and generator. |  |

## Benchmark 2: Phasors and Complex Numbers

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.1 | Explain how sine waves are expressed as phasors. |  |
| 2.2 | Express sine waves in rectangular and polar form. |  |
| 2.3 | Describe the complex number plane and use it to perform mathematical operations. |  |
| 2.4 | Convert the polar form of a complex quantity, such as a sine wave, impedance, or admittance, to the rectangular form and vice versa. |  |
| 2.5 | Define resistance, reactance, and impedance. |  |
| 2.6 | Draw a circuit phasor diagram for an RC, RL, and RLC circuit. |  |
| 2.7 | Explain the meaning of total circuit phase angle for an RC and RL circuit. |  |
| 2.8 | Apply and relate Ohm’s Law for complex circuit quantities. |  |
| 2.9 | Calculate power in RC, RL, and RLC circuits. |  |

## Benchmark 3: Capacitors

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 3.1 | Define capacitance in terms of physical & electrical characteristics as well as in terms of stored charge & voltage. |  |
| 3.2 | Calculate capacitive reactance describing changes with applied frequency & capacitor farad rating. |  |
| 3.3 | Explain how capacitors are combined in series and parallel capacitive circuits. |  |
| 3.4 | Solve series and parallel capacitive circuits for voltage division, current flow, and charge distribution. |  |
| 3.5 | Explain how to test a capacitor using an ohmmeter and capacitor analyzer. |  |
| 3.6 | Construct AC capacitive circuits and verify their operation. |  |

## Benchmark 4: Inductors

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 4.1 | Construct AC inductive circuits and verify their operation. |  |
| 4.2 | Define inductance in terms of its physical and electrical characteristics. |  |
| 4.3 | Calculate inductive reactance describing changes in frequency and inductor size. |  |
| 4.4 | Explain how inductors are combined in series and parallel. |  |
| 4.5 | Solve an inductive circuit having AC sources with series and parallel inductors. |  |

## Benchmark 5: Transformers

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 5.1 | Construct AC circuits using transformers and verify their operation. |  |
| 5.2 | Explain the attributes of a transformer and classifications. |  |
| 5.3 | Solve circuits using transformers with loaded secondaries. |  |
| 5.4 | Describe how a transformer acts as an impedance matching device. |  |
| 5.5 | Describe the common attributes of a non-ideal transformer. |  |
| 5.6 | Describe common variations of the basic transformer. |  |

## Benchmark 6: RC Circuit Analysis

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 6.1 | Describe how impedance is used to find circuit current in an RC circuit. |  |
| 6.2 | Describe the meaning of circuit phase lead in an RC circuit. |  |
| 6.3 | Define RC circuits including series, parallel, and time constant components. |  |
| 6.4 | Describe the response of an RC circuit to an applied sinusoidal waveform. |  |
| 6.5 | Describe impedance of a series and parallel RC circuit as a phasor in polar and rectangular form. |  |
| 6.6 | Describe applications of RC circuits. |  |
| 6.7 | Describe how to troubleshoot an RC circuit. |  |

## Benchmark 7: RL Circuit Analysis

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 7.1 | Explain how impedance is used to find circuit current for series and parallel RL circuits. |  |
| 7.2 | Explain the meaning of current phase lag in an RL circuit. |  |
| 7.3 | Define RL circuits including series, parallel, and time constant components. |  |
| 7.4 | Describe the response of an RL circuit to an applied sinusoidal waveform. |  |
| 7.5 | Describe impedance of a series and parallel RL circuit as a phasor in polar and rectangular form. |  |
| 7.6 | Describe applications of RL circuits. |  |
| 7.7 | Describe how to troubleshoot an RL circuit. |  |

## Benchmark 8: RLC Circuits and Resonance

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 8.1 | Define RLC Circuits including series and parallel components. |  |
| 8.2 | Describe resonance of RLC circuits. |  |
| 8.3 | Compute RLC circuit currents using impedance. |  |
| 8.4 | Explain total circuit phase lead or lag of an RLC circuit. |  |
| 8.5 | Describe impedance of a series and parallel RLC circuit as a phasor in polar and rectangular form. |  |
| 8.6 | Describe applications of RC, RL, and RLC circuits. |  |
| 8.7 | Describe how to troubleshoot an RC, RL, and RLC circuit. |  |

## Benchmark 9: Filters

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 9.1 | Construct passive filter circuits and verify their operation. |  |
| 9.2 | List and describe the purpose and categories of filters in an electronic circuit. |  |
| 9.3 | Calculate the critical frequency and roll-off rate for each category of filter. |  |
| 9.4 | Draw and interpret a Bode Plot for each category of filter. |  |

## Benchmark 10: Pulse Response of Reactive Circuits

### Competencies

| **#** | **Description** | **rating** |
| --- | --- | --- |
| 10.1 | Describe the response of first-order RC and RL circuits to a unit-step and impulse. |  |
| 10.2 | Define the categories of pulse response circuits including integrators and differentiators. |  |
| 10.3 | Describe the time response diagram for a single and repetitive pulse input. |  |
| 10.4 | Identify applications of pulse response circuits in electronics. |  |
| 10.5 | Troubleshoot differentiator and integrator circuits. |  |

I certify that the student has received training in the areas indicated.

Instructor Signature:

For more information, contact:

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