# AC Electronics Course No. 40450 Credit: 1.0

|  |  |  |  |
| --- | --- | --- | --- |
| **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:

CTE Pathways Help Desk

(785) 296-4908

pathwayshelpdesk@ksde.org



900 S.W. Jackson Street, Suite 102

Topeka, Kansas 66612-1212

[https://www.ksde.org](https://www.ksde.org/)

The Kansas State Department of Education does not discriminate on the basis of race, color, national origin, sex, disability or age in its programs and activities and provides equal access to any group officially affiliated with the Boy Scouts of America and other designated youth groups. The following person has been designated to handle inquiries regarding the nondiscrimination policies: KSDE General Counsel, Office of General Counsel, KSDE, Landon State Office Building, 900 S.W. Jackson, Suite 102, Topeka, KS 66612, (785) 296-3201.