Fox Valley Technical College

10660114 AC Circuits 1

Course Outcome Summary

Course Information

Description	Covers AC waveforms and different voltage values including Peak, RMS, Average and Peak to Peak. The operation of transformers is also included. Laboratory activities using the oscilloscope are performed to verify the theory.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree
Total Credits	1.00
Total Hours	27.00

Types of Instruction

Instruction Type	Credits/Hours
Lab and Lecture/Flexible	1 Credit/27 Hours

Course History

Revised By	Kaye Krueger (kruegek)
Last Approval Date	9/16/2014

Pre/Corequisites

Corequisite DC Circuits 2 (10-660-111)

Textbooks

Electronics Fundamentals: Circuits, Devices, and Applications
Floyd, Thomas L.; Buchla, David
Prentice-Hall
ISBN: 9780135072950
8th Edition

DC Circuits 1, 2, 3; AC Circuits 1, 2 - Curriculum Manual
Ken Holmes & Ben Gardner
Fox Valley Technical College
ISBN: 660110R070714

Employability Essentials

1. Act Responsibly - Apply ethical standards in both personal and professional behavior.
Status *Active*

2. Adapt to Change - Anticipate changes and positively respond to them.
Status *Active*

3. Communicate Effectively and Respectfully - Apply appropriate writing, speaking, and listening skills across various settings to engage diverse audiences.
Status *Active*

4. Think Critically and Creatively - Apply independent and rigorous reasoning that leads to informed decisions, innovation and personal empowerment.
Status *Active*

5. Work Collaboratively - Work collaboratively with others to complete tasks, solve problems, resolve conflicts, provide information, and offer support.
Status *Active*

Program Outcomes

1. Apply electronic theory to practice.
Type *TSA* ***Status*** *Active*

Criteria
1.1. You mathematically analyze a circuit or system.
1.2. You simulate a circuit or system.
1.3. You construct a circuit or system according to schematics or other documentation.
1.4. You perform circuit or system measurements to collect data.
1.5. You analyze data to validate predicted outcome.

2. Operate test equipment.
Type *TSA* ***Status*** *Active*

Criteria
2.1. You demonstrate measurement of electrical and/or electronic signals.
2.2. You demonstrate measurement of electrical and/or electronic quantities.
2.3. You demonstrate measurement of electrical and/or electronic components.
2.4. You use test equipment to generate electrical and/or electronic signals.
2.5. You apply appropriate safety precautions.

3. Build electronic circuits and systems.
Type *TSA* ***Status*** *Active*

Criteria
3.1. You assemble a prototype for operation.
3.2. You demonstrate soldering and de-soldering techniques.
3.3. You apply appropriate antistatic precautions.
3.4. You identify appropriate interfaces.
3.5. You set up programmable devices and/or systems.
3.6. You apply appropriate safety precautions.

4. Evaluate the operation of electronic circuits or systems.
Type *TSA* ***Status*** *Active*

Criteria
4.1. You determine the correct operation of circuits or systems.

4.2. You identify incorrect operation of circuits or systems.
4.3. You isolate causes of failures in circuits or systems.
4.4. You correct failures in circuits or systems.

5. Communicate technical information.
Type *TSA* ***Status*** *Active*

Criteria
5.1. You interpret electrical and/or electronic diagrams.
5.2. You create electrical and/or electronic diagrams.
5.3. You interpret technical reports and documents.
5.4. You use appropriate terminology in speaking and writing.
5.5. You interpret documentation of electronic devices and systems.
5.6. You locate necessary resources and pertinent information to perform work functions.

Course Competencies

1. Analyze the properties of sinusoidal AC waveforms and the electrical properties of resistive AC circuits.
Domain *Cognitive* ***Level*** *Analyzing* ***Status*** *Active*

Assessment Strategies
1.1. Exam

Criteria

Performance will meet expectations when:

1.1. you achieve a 70% or better.

Learning Objectives
1.a. Define the following terms relating to an AC waveform:
A. Cycle
B. Alternation
C. Period
D. Peak value (max.)
E. Peak-to-Peak
F. Effective value (rms)
G. Instantaneous value
H. Frequency
I. Hertz
J. Cycles per Second
1.b. Define the terms unidirectional and bi-directional as they relate to current in an electrical circuit.
1.c. Draw graphs to show the waveform of a DC sinusoidal and an Alternating Current (sine wave) voltage.
1.d. List the similarities and differences between AC and DC power.
1.e. Identify the type of AC voltage read by a digital or analog voltmeter.
1.f. Draw an AC sine wave, and identify items A through G from objective 1.
1.g. Calculate the effective (rms), peak (Vmax), peak-to-peak (2 Vmax) and average (Ave) values of voltages and currents for a sine wave.
1.h. Identify what type of AC voltage is listed on home appliances and what type of AC voltages are typically listed on schematic diagrams.
1.i. List the factors which determine the frequency produced by an AC generator.
1.j. Describe the operation of an AC generator, and identify when the voltage is minimum or maximum as the loop of wire rotates through the magnetic field.
1.k. Explain how AC current flows to and from the hot and neutral sockets of a home receptacle.
1.l. Calculate the period of one cycle when given the number of AC cycles that occur during a given amount of time.
1.m. Convert between the frequency and period of an AC waveform.
1.n. Solve Ohm’s law problems for resistive circuits with AC voltage applied.
1.o. Describe how rms voltage values compare to DC voltage for heating.
1.p. Apply Watt’s law to calculate wattage dissipated by resistors in AC circuits.

2. Measure electrical properties of voltage waveforms using an oscilloscope.

Domain *Cognitive* ***Level*** *Evaluating* ***Status*** *Active*

Assessment Strategies

2.1. Exam
2.2. Lab Exam

Criteria

Performance will meet expectations when:

2.1. you achieve a 70% or better.

Learning Objectives

2.a. List the four major control sections of the oscilloscope.
2.b. Explain the electrical difference between a 1x and a 10x probe.
2.c. Identify the source of the signals that are applied to the vertical and horizontal plates of the scope.
2.d. Describe the significance of the AC-GND-DC switch, and identify which types of signals can be measured at each position.
2.e. Explain the purpose of triggering and the function of the following trigger controls:
- Slope
- Level
- Auto
- Normal

2.f. Explain the function of the DC offset switch on a signal generator.
2.g. Describe the difference between an attenuator and compensation adjustment on the scope.
2.h. Explain how the vertical and horizontal controls affect the waveform position of one or both channels.
2.i. Explain how the Sec/Div knob affects the waveforms of one or both channels.
2.j. Describe the difference between the intensity and focus controls on the scope.
2.k. Determine the period, frequency, peak-to-peak voltage, rms voltage, and instantaneous voltage at a specified degree of the AC cycle when given a waveform displayed on a scope, a Volts/Div and Sec/Div setting.
2.l. Determine the phase shift, in degrees, between two sine waves displayed on a scope and identify which one leads or lags the other one.

3. Predict the electrical properties of the primary and secondary windings of both ideal and nonideal transformers.

Domain *Cognitive* ***Level*** *Applying* ***Status*** *Active*

Assessment Strategies

3.1. Exam

Criteria

Performance will meet expectations when:

3.1. you achieve a 70% or better.

Learning Objectives

3.a. Describe what is meant by the term “isolation” as it pertains to a transformer.
3.b. Describe the process of how an AC voltage applied to the primary winding induces an AC voltage at the secondary winding.
3.c. Explain how eddy currents in a core can be reduced.
3.d. Describe how the following factors in the primary and secondary differ for a step-up and step-down transformer:
- Turns (Ratio)
- Voltage
- Current
- Power

3.e. Identify what the primary and secondary windings of a transformer are wired to (source or load).
3.f. List applications for the following types of transformers:
- Air-core
- Iron-core

- Ferrite-core

3.g. Describe how the direction in which the primary and secondary windings are wound determine if the primary and secondary voltages are inphase or 180 degrees out of phase and how the phases are identified on the schematic diagram symbol.
3.h. List the factors that will reduce the efficiency of a transformer.
3.i. Describe three ways in which an autotransformer differs from a conventional transformer.
3.j. List the types of problems that occur to cause a transformer to become faulty.
3.k. List the factors that affect the coefficient-of-coupling of a transformer.
3.l. Calculate, given the number of turns, voltages, currents, or wattages in the primary and secondary of a transformer, the various values that are present at each winding or the circuits to which they are connected.
3.m. Draw the wiring configuration for an Edison circuit used in commercial and residential buildings, and list the voltages that are used at the secondary windings.
3.n. Wire a transformer that has a primary, more than one secondary, and a centertapped circuit.
3.o. Calculate the efficiency of a transformer when given the power values in both the primary and secondary windings.

Grant Award

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Course Learning Plans and Performance Assessment Tasks

Type	Title	Source	Status
PAT	Introduction to Alternating Current Exam	Course	Active
PAT	Oscilloscopes Written Exam	Course	Active
PAT	Oscilloscopes Lab Exam	Course	Active
PAT	Transformers Exam	Course	Active
LP	Introduction to Alternating Current	Course	Active
LP	Oscilloscopes	Course	Active
LP	Transformers	Course	Active