

Transformers and AC Circuits

Course 203: Transformers and AC Circuits

Covers differences between DC and AC circuits. Explains AC sine wave, using vectors to solve AC problems, calculating impedance in circuits having inductance, capacitance, and resistance, AC power relationships in single-phase and three-phase circuits, and principles of transformer maintenance.

TPC Training is accredited by IACET to offer **1.0 CEU** for this program.



Lesson 1: Principles of Alternating Current

Topics

AC and DC Electricity; Waveforms; AC Waveform; Frequency; Peak-to-Peak Values; Average Values; Effective Values; Energy Storage; Faraday's Law; Basic Circuit Concepts

Objectives

- State the definition of a waveform.
- Demonstrate how to calculate the frequency of an alternator's output.
- Explain how to calculate an effective value.
- Name the kinds of values that must be used when applying the dc rules and laws to ac circuits.

Lesson 2: Mathematics in AC Circuits

Topics

AC Potential Difference; Angles and Degrees; Right Triangles; Vectors Applied to AC Circuits; Graphic Solutions; Mathematical Solutions; Calculating Instantaneous Values

Objectives

- Describe a triangle.
- State the definition of a vector.
- Identify the vector representing resistance in a vector diagram.
- Demonstrate how to calculate the total impedance in an ac circuit.

Lesson 3: Inductance and Inductive Reactance

Topics

Inductance; Factors Affecting Inductance; Counter Electromotive Force (CEMF); Inductive Reactance; Inductive Time Delay; Phase Angles; Calculating Impedance; Mutual Induction; Inductors in Series; Inductors in Parallel

Objectives

- Name the property of a coil that makes it resist changes in current.
- List the factors that determine inductance in a coil.
- State the definition of counter electromotive force.
- Demonstrate how to convert a frequency in Hz to a frequency in radians per second.

Lesson 4: Capacitance and Capacitive Reactance

Topics

How a Capacitor Works; Units of Capacitance; Factors Controlling Capacitance; Kinds of Capacitors; Discharging Capacitors; Series Capacitors; Parallel Capacitors; Time Constants; Capacitive Reactance; Phase Angle

Objectives

- Name the parts of a capacitor.
- List the factors that affect the amount of charge stored in a capacitor at a given potential difference.
- Demonstrate how to install a multisection electrolytic capacitor.
- State the definition of capacitive reactance.

Lesson 5: Impedance

Topics

Impedance in Series circuits; Phase Angles; Resonance in Series Circuits; Impedance in Parallel Circuits

Objectives

- State the definition of impedance.
- Explain how to calculate the impedance in a series ac circuit.
- Demonstrate how to find the value of a phase angle for a circuit.
- Explain how to calculate the impedance in a parallel circuit.

Lesson 6: Power and Energy in AC Circuits

Topics

Work and Energy; Power; Power in Resistive Circuits; Power in Inductive Circuits; Power in Capacitive Circuits; Importance of the Power Factor; Power Factor Correction; Power Capacitors; Capacitor Installation

Objectives

- State the definition of power.
- Demonstrate how to calculate power in an inductive circuit.
- State the reason why capacitors are added to circuits to increase the power factor.
- Explain how to install capacitors correctly.

Lesson 7: Three-Phase Circuits

Topics

Three-Phase Alternators; Y-Connected Alternators; Delta-Connected Alternators; Power in Three-Phase Circuits; Load Connections; Measuring Power in Three-Phase Circuits

Objectives

- List the main advantages of the three-phase ac system.
- State the definition of phase sequence.
- Demonstrate how to calculate the RMS power in a single-phase circuit.
- Explain how to measure the total power consumed by the load in a three-phase circuit.

Lesson 8: Principles of Transformers

Topics

Magnetic Field; No-Load Operation; Construction of Transformers; Variable Transformers; Transformer Losses and Efficiency; Autotransformers; Instrument Transformers

Objectives

- Explain the difference between the primary winding and the secondary winding in a transformer.
- Explain how the windings are positioned in a core-type transformer.
- List the kinds of losses that occur in transformers.
- State the definition of a current transformer.
- List the functions of an instrument transformer.

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Lesson 9: Transformer Applications

Topics

Transformer Designation; Transformer Insulation; Transformer Cooling; Transformer Polarity; Single-Phase Transformer Connections; Three-Phase Transformer Connections; Three-Phase Transformers; Installing Transformers

Objectives

- Name general kinds of transformers.
- List the temperature limits for each class of transformer insulation.
- Explain how oil-immersed transformers are cooled.
- Name the common methods of connecting three single-phase transformers for three-phase operation.
- Explain how to select the correct location for a transformer.

Lesson 10: Maintaining Transformers

Topics

Preventive Maintenance Program; Inspection; Making Transformer Inspections; Transformer Liquids; Dielectric Test; Breakdown Test; General Testing; Transformer Failure; Electrical Test; Disassembly and Inspection

Objectives

- Explain what to look for during an inspection of sealed transformers.
- List problems that are indicated by an increase in transformer operating temperature.
- Demonstrate how to perform a breakdown test.
- Explain how to locate the exact point of a leak in a welded joint below the liquid level.
- List the steps in inspecting a transformer when a winding fails.