9060

Electrical Trades

AC Fundamentals (12B)

40S/40E/40M

An Electrical Trades Technology Course
Course Description

Students will become familiar with AC theory, including electrical fundamentals, magnetism, electromagnetism, and RLC circuits. Students will also focus on cross-curricular knowledge from mathematics and physics.

**Goal 1:** Describe and apply health and safety practices.

**GLO 1.1:** Describe and apply health and safety practices.

<table>
<thead>
<tr>
<th>SLO 12B.1.1.1:</th>
<th>Identify safety and health requirements. (A2.1)</th>
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<tbody>
<tr>
<td>SLO 12B.1.1.2:</td>
<td>Describe the importance of using personal protective equipment (PPE), and identify PPE and procedures related to PPE. (A2.2) (TSA 16)</td>
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<td>SLO 12B.1.1.3:</td>
<td>Outline the safety principles for working on and around electrical equipment. (A2.3) (TSA 18)</td>
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<td>SLO 12B.1.1.4:</td>
<td>Identify fire safety and outline workplace fire safety principles. (A2.4) (TSA 19)</td>
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<td>SLO 12B.1.1.5:</td>
<td>Recognize and control hazards. (A2.6)</td>
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<td>SLO 12B.1.1.6:</td>
<td>Identify the hazards in confined spaces and the preparation needed to work in a confined space. (A2.7) (TSA 20)</td>
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<td>SLO 12B.1.1.7:</td>
<td>Identify first aid/CPR. (A2.8)</td>
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<td>SLO 12B.1.1.8:</td>
<td>Explain the Workplace Hazardous Material Information System (WHMIS), and identify the safety requirements as they apply to WHMIS. (A2.9) (TSA 13)</td>
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<td>SLO 12B.1.1.9:</td>
<td>Identify and control hazards. (A2.10)</td>
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<td>SLO 12B.1.1.10:</td>
<td>Create and maintain a safe and organized working environment.</td>
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</table>

**GLO 1.2:** Demonstrate awareness of electrical safety as it pertains to the *Trade Safety Awareness Manual*.

No applicable SLOs.
Goal 2: Demonstrate the safe and appropriate identification, selection, operation, maintenance, and management of equipment and tools.

GLO 2.1: Demonstrate the safe and appropriate identification, selection, operation, maintenance, and management of equipment and tools.

SLO 12B.2.1.1: Demonstrate the safe and appropriate identification, selection, and operation of equipment and tools (e.g., mega ohmmeter).

Goal 3: Demonstrate the safe and appropriate identification, selection, installation, maintenance, and management of devices and materials.

GLO 3.1: Demonstrate the safe and appropriate identification, selection, installation, maintenance, and management of devices and materials.

No applicable SLOs.

Goal 4: Demonstrate an understanding of electrical theory.

GLO 4.1: Demonstrate an understanding of electrical theory.

SLO 12B.4.1.1: Describe the nature of magnetic fields, including the concept of flux, force fields, and the field around current-carrying conductors.

SLO 12B.4.1.2: Describe how magnetic flux, flux density, magnetomotive force, and reluctance are related.

SLO 12B.4.1.3: Calculate the current required to establish a required magnetic flux in a series magnetic circuit.

SLO 12B.4.1.4: Demonstrate the operation of a relay as a magnetic circuit.

SLO 12B.4.1.5: Demonstrate how forces are created by magnetic attraction in relays and solenoids (e.g., ampere turns).

SLO 12B.4.1.6: Describe electromagnetism and inductance, including the operation of coils (i.e., rotating magnetic fields, generator applications, stored energy [Lenz’s Law], and motor principles).

SLO 12B.4.1.7: Explain the difference between DC and AC.

SLO 12B.4.1.8: Explain why in some industrial applications DC is preferred to AC.

SLO 12B.4.1.9: Describe the advantages that AC has over DC in the generation, transmission, and distribution systems, and explain why it has these advantages.
SLO 12B.4.1.10: Explain why high voltage DC has been used for transmission of energy from distant generating stations.

SLO 12B.4.1.11: Demonstrate the graphic method of generating sine waves and cosine waves, and relate these waves to the trigonometric formula.

SLO 12B.4.1.12: Demonstrate how a sinusoidal voltage is generated when a coil is rotated in a uniform magnetic field.

SLO 12B.4.1.13: Describe which factors determine the frequency of the voltage from an AC generator.

SLO 12B.4.1.14: Define instantaneous, peak, and RMS values.

SLO 12B.4.1.15: Describe the phase relationship between voltage and current in an AC circuit containing a resistance.

SLO 12B.4.1.16: Describe the effective values of AC current and voltages.

SLO 12B.4.1.17: Calculate the power dissipated in a resistor for a given applied peak voltage.

SLO 12B.4.1.18: Explain the difference between the voltage given by an AC voltmeter and that displayed on an oscilloscope.

SLO 12B.4.1.19: Describe a power curve, the current, and voltage in phase.

SLO 12B.4.1.20: Describe the action of a half and full wave rectifier, and explain why average values instead of effective values are used for computing the DC output.

**Goal 5:** Demonstrate an understanding of the design, layout, and interpretation of branch circuits and systems.

**GLO 5.1:** Demonstrate an understanding of the design, layout, and interpretation of branch circuits and systems.

No applicable SLOs.

**Goal 6:** Demonstrate the procedures used to install and terminate branch circuits and systems.

**GLO 6.1:** Demonstrate the procedures used to install and terminate branch circuits and systems.

No applicable SLOs.
Goal 7: Demonstrate an understanding of the testing, troubleshooting, and documentation of branch circuits and systems.

GLO 7.1: Demonstrate an understanding of the testing, troubleshooting, and documentation of branch circuits and systems.

No applicable SLOs.

Goal 8: Describe and demonstrate the transferable cross-curricular knowledge and skills.

GLO 8.1: Read, interpret, and communicate information.

No applicable SLOs.

GLO 8.2: Apply the knowledge and skills from mathematics.

SLO 12B.8.2.1: Describe and solve right-angle triangles with the use of electrical terminology. (A4.5)

GLO 8.3: Apply the knowledge and skills from the sciences.

No applicable SLOs.

GLO 8.4: Apply the knowledge and skills from information and communication technology.

No applicable SLOs.

Goal 9: Understand career opportunities and working conditions.

GLO 9.1: Describe apprenticeship, education, career opportunities, professional organizations, and working conditions related to electrical trades technology and associated fields.

No applicable SLOs.
Goal 10: Demonstrate awareness of sustainability.

GLO 10.1: Describe the impact of human sustainability on the health and well-being of tradespersons working in the electrical trades and those who use their services.

SLO 12B.10.1.1: Demonstrate an awareness of possible health concerns related to high tension power lines.

GLO 10.2: Describe the electrical trade’s sustainability practices and impact on the environment.

SLO 12B.10.2.1: Minimize wastage of materials.
SLO 12B.10.2.2: Demonstrate an understanding of how electricity is generated, focusing on Manitoba.

GLO 10.3: Describe sustainable business practices within the electrical trades.

No applicable SLOs.

Goal 11: Demonstrate awareness of ethical and legal standards as they pertain to the electrical trades.

GLO 11.1: Demonstrate awareness of ethical and legal standards.

No applicable SLOs.

GLO 11.2: Demonstrate an understanding of electrical codes.

No applicable SLOs.

Goal 12: Demonstrate employability skills.

GLO 12.1: Demonstrate fundamental employability skills.

SLO 12B.12.1.1: Demonstrate regular and punctual attendance.
SLO 12B.12.1.2: Demonstrate the ability to communicate respectfully and effectively with teachers, supervisors, co-workers, and students.
SLO 12B.12.1.3: Demonstrate accountability by taking responsibility for their actions.
SLO 12B.12.1.4: Demonstrate adaptability, initiative, and effort.
SLO 12B.12.1.5: Demonstrate teamwork skills.
SLO 12B.12.1.6: Demonstrate the ability to stay on task and effectively use time in class and work environments.
SLO 12B.12.1.7: Demonstrate the responsible use of wireless communication devices.
**GLO 12.2:** Demonstrate an awareness of cultural competence and its importance in the workplace.

No applicable SLOs.

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**GLO 12.3:** Demonstrate an understanding of the business operation of an electrical trades facility.

SLO 12B.12.3.1: Participate in classroom and workstation cleanup.

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**GLO 12.4:** Demonstrate critical thinking skills in planning, procedures, analysis, and diagnosis.

SLO 12B.12.4.1: Demonstrate critical-thinking skills.
SLO 12B.12.4.2: Use a variety of strategies in order to diagnose and solve problems.

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**Goal 13:** Understand the evolution, technological progression, and emerging trends in the electrical trades.

**GLO 13.1:** Understand the evolution, technological progression, and emerging trends in the electrical trades.

SLO 12B.13.1.1: Demonstrate an awareness of the history behind the adoption of AC over DC as household current.