



9060

ELECTRICAL TRADES
AC FUNDAMENTALS (12B)

40S/40E/40M

An Electrical Trades Technology Course

9060: ELECTRICAL TRADES AC FUNDAMENTALS (12B) 40S/40E/40M

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.

SLO 12B.1.1.1: Identify safety and health requirements. (A2.1)

- overview of *The Workplace Safety and Health Act* (“the Act”)
 - rights and responsibilities of employees under the *Act*
 - rights and responsibilities of employers under the *Act*
 - rights and responsibilities of supervisors under the *Act*
- fourteen (14) regulations
- codes of practice
- guidelines
- right to refuse
- Explanation of right to refuse process
 - rights and responsibilities of employees
 - rights and responsibilities of employers
 - rights and responsibilities of supervisors under the *Act*

SLO 12B.1.1.2: Describe the importance of using personal protective equipment (PPE), and identify PPE and procedures related to PPE. (A2.2) (TSA 16)

- employer and employee responsibilities as related to personal protective equipment.
- standards: Canadian Standards Association (CSA), American National Standards Institute (ANSI) and guidelines
- work protective clothing and danger if it fits poorly.
- gloves—Importance of proper glove selection (when handling chemicals, cold items, slivers, etc.)

- headwear—appropriate protective headwear when required and the approved type of headwear
- eye protection—comparison and distinction of everyday eyeglasses, industrial safety glasses and safety goggles
- foot protection—when required according to safety standards
- hearing protection
 - hazards of various noise levels (hearing protection must be worn)
 - laws
 - types of hearing protection
- respiratory protection—types, overview of proper selection
- fall protection—Manitoba requirements standards guidelines
 - ANSI (U.S.A. standards), etc.
- ladders and scaffolding
- safety principles for working with or around industrial trucks site-specific (forklifts, pallet trucks, etc.)

SLO 12B.1.1.3: Outline the safety principles for working on and around electrical equipment. (A2.3) (TSA 18)

- effects of electric current on the human body
- three factors that affect the severity of an electric shock
- the effects of arc and blast on the human body and equipment
- work with energized equipment

SLO 12B.1.1.4: Identify fire safety and outline workplace fire safety principles. (A2.4) (TSA 19)

- types of fires
- types of firefighting equipment
- classifications of fire extinguishers (A, B and C)
- location of fire extinguishers and fire exits
- fire alarms and drills

- SLO 12B.1.1.5: Recognize and control hazards. (A2.6)
- safe work practices
 - basic risk assessment
 - injury prevention and control measures
 - identification of hazards involved in pneumatic tool use and explanation of how to guard against them
- SLO 12B.1.1.6: Identify the hazards in confined spaces and the preparation needed to work in a confined space. (A2.7) (TSA 20)
- identification of a confined space
 - hazards of a confined space
 - physical
 - biological
 - working in a confined space
 - emergency response plan
 - self-contained breathing apparatus (SCBA)
- SLO 12B.1.1.7: Identify first aid/CPR. (A2.8)
- overview of first-aid regulation
 - obligations of employers regarding first aid
 - • Who is certified to provide first aid?
 - • What to do while waiting for help?
 - • Where is first-aid kit?
 - describe basic first-aid requirements and techniques
 - scope and limits of first-aid intervention
 - specific interventions (cuts, burns, abrasions, fractures, suffocation, shock, electrical shock, etc.)
 - What is it?
 - interface with other services and agencies (e.g. Workers Compensation claims)
 - Describe basic Cardiopulmonary Resuscitation (CPR) requirements and techniques
 - How do you get certified?
 - scope and limits of CPR intervention (include varieties of CPR certification)

- SLO 12B.1.1.8: Explain the Workplace Hazardous Material Information System (WHMIS), and identify the safety requirements as they apply to WHMIS. (A2.9) (TSA 13)
- WHMIS is a system
 - Provincial Regulation under The Workplace Safety and Health Act
 - Each province has a WHMIS regulation
 - Federal Hazardous Products Act
 - WHMIS generic training:
 - WHMIS defined and the format used to convey information about hazardous materials in the workplace
 - Information found on supplier and workplace labeling using WHMIS
 - Hazardous materials in accordance with WHMIS
 - Compliance with government safety standards and regulations
 - Description of WHMIS (include varieties of WHMIS Certification)
 - Typology of WHMIS labels, symbols, and classifications
 - Scope and use of Materials Safety Data Sheets (MSDS)
- SLO 12B.1.1.9: Identify and control hazards. (A2.10)
- basic control measures (injury prevention)
 - safe work procedures
 - explanation on the importance of industrial housekeeping
 - employer responsibilities
 - how and where to store materials
 - safety measures related to walkways, stairs and floor openings
 - explanation of how to protect the worker and others when working in traffic paths
- SLO 12B.1.1.10: Create and maintain a safe and organized working environment.
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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)

- Pythagorean Theorem
 - trigonometry
 - sine function
 - cosine function
 - tangent function
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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.

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.

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.

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.
