



8549

AIRCRAFT ELECTRICAL
SYSTEMS (12B)

40S/40E/40M

An Aviation and Aerospace Technologies Course

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Course Description

Aircraft Electrical Systems is intended for students in the transition phase of aviation and aerospace technologies. Curriculum content provides an introduction to aircraft electrical components and functions. Topics include the following:

- AC/DC circuits
- AC/DC components
- troubleshooting

Cross-curricular learning outcomes, or essential skills from subject areas including, but not limited to, information and communication technologies, science, English language arts, and mathematics, are to be integrated into the authentic learning activities of the course.

The curriculum is not sequential. For instructional purposes, the sequence of learning outcomes can vary based on the learning activities within the course.

Goal 1: Describe and apply appropriate **health and safety** practices for aerospace technologies.

GLO 1.1: Describe and apply appropriate **health and safety** practices for aerospace technologies.

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| SLO 12B.1.1.1 | Describe and apply appropriate health and safety practices for aircraft electrical systems. |
| SLO 12B.1.1.2 | Practise safety precautions related to electrical circuits. |
| SLO 12B.1.1.3 | Practise safety precautions related to solid-state components. |
| SLO 12B.1.1.4 | Practise safety precautions to be used when soldering. |
| SLO 12B.1.1.5 | Identify battery shop safety features and precautions when servicing various types of batteries. |

Goal 2: Demonstrate comprehension of the **principles of flight**, as they apply to aviation and aerospace technologies.

GLO 2.1: Demonstrate an understanding of **aerodynamics, control, and stability** in **fixed-** and **rotary-wing** aircraft.

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| SLO 12B.2.1.1 | Demonstrate an understanding of control and stability as they apply to aircraft electrical systems. |
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Goal 3: Demonstrate an understanding of the **major components of an aircraft** and their **functions**.

GLO 3.1: Demonstrate an understanding of the **major components of an aircraft** and their **functions**.

SLO 12B.3.1.1 Demonstrate an understanding of the major components found in aircraft electrical systems.

Goal 4: Demonstrate comprehension of **aircraft systems**.

GLO 4.1: Describe **aircraft systems** and their purposes.

- SLO 12B.4.1.1 Describe the functions of the major components of an aircraft's electrical system.
- SLO 12B.4.1.2 Define terms related to basic DC electricity, including *passive, active, semiconductor components, and control devices*.
- SLO 12B.4.1.3 Identify basic DC electrical and schematic symbols and components.
- SLO 12B.4.1.4 Explain the theory of chemical batteries.
- SLO 12B.4.1.5 Identify types and construction of aircraft batteries.
- SLO 12B.4.1.6 Explain the process of servicing aircraft batteries.
- SLO 12B.4.1.7 Identify the types of ignition systems.
- SLO 12B.4.1.8 Describe the principles of spark discharge and coil ignition systems.
- SLO 12B.4.1.9 Describe the types of magneto ignition systems.
- SLO 12B.4.1.10 Describe the principles of gas turbine ignition systems.
- SLO 12B.4.1.11 Describe the principles of operation of ignition systems.
- SLO 12B.4.1.12 Describe the operation of a DC generator, a DC alternator, a turbine engine starter-generator, a converter, and a transformer rectifier.
- SLO 12B.4.1.13 Identify common problems encountered in a DC generation system and their typical fixes.
- SLO 12B.4.1.14 Identify common inspection and maintenance practices for an AC generation system.
- SLO 12B.4.1.15 Describe the operation of a basic power distribution system.
- SLO 12B.4.1.16 Describe the operation of an AC generation system.
- SLO 12B.4.1.17 Describe the operation of a split-bus power and parallel bus distribution system.
- SLO 12B.4.1.18 Identify faults in a basic bus distribution system.
- SLO 12B.4.1.19 Identify the types of light bulbs used on aircraft.

- SLO 12B.4.1.20 Describe the configuration, purpose, and operation of each typical aircraft interior, exterior, and emergency lighting system circuit.
- SLO 12B.4.1.21 Define and describe basic aircraft instruments.
- SLO 12B.4.1.22 Describe the various operating principles of aircraft instruments.
- SLO 12B.4.1.23 Describe aircraft internal communications systems.
- SLO 12B.4.1.24 Identify common radio communications failures, and describe typical repairs for each failure.
- SLO 12B.4.1.25 Identify the letters of the phonetic alphabet.
- SLO 12B.4.1.26 Describe the procedures and regulations for transmitting a radio communications check.
- SLO 12B.4.1.27 Explain the function of antennas.

Goal 5: Demonstrate the safe and appropriate **operation of **equipment and tools**.**

GLO 5.1: Describe the safe and appropriate **management of **equipment and tools**.**

- SLO 12B.5.1.1 Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in aircraft electrical systems.
- SLO 12B.5.1.2 Demonstrate precautions required to prevent static damage.

GLO 5.2: Demonstrate the **operation of **tools and equipment** to fabricate **metallic** parts and projects.**

- SLO 12B.5.2.1 Demonstrate proper use of tools, and test equipment utilized in electricity/electronics.
 - SLO 12B.5.2.2 Describe the construction and operation of a multimeter.
 - SLO 12B.5.2.3 Use a multimeter to perform series, parallel, and complex circuit analysis.
 - SLO 12B.5.2.4 Select appropriate test equipment to measure specified functions of an electrical/electronic circuit.
 - SLO 12B.5.2.5 Apply appropriate test equipment techniques to the analysis, repair, and calibration of electrical/electronic circuits and devices.
 - SLO 12B.5.2.6 Use correct procedures to solder electrical/electronic circuitry, including unique and heat sensitive circuits.
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GLO 5.3: Demonstrate the **operation** of **tools and equipment** to fabricate **non-metallic** parts and projects.

No applicable SLOs.

Goal 6: Demonstrate comprehension of the properties and applications of various **materials and consumables** used in the aviation and aerospace industry.

GLO 6.1: Explain the **properties** of various **materials and consumables** used in the aviation and aerospace industry.

SLO 12B.6.1.1 Demonstrate an understanding of material properties as they apply to aviation and aerospace technologies.

SLO 12B.6.1.2 Identify common electrical/electronic passive and active components, such as resistors, conductors, semiconductors, and control devices.

SLO 12B.6.1.3 Describe the function, properties, and schematic symbols of most common electrical/electronic passive, active, and solid-state components.

SLO 12B.6.1.4 Identify the common types of wire and cable and their uses.

SLO 12B.6.1.5 Identify each element of a wire identification number.

GLO 6.2: Describe **applications** of the various aerospace **materials and consumables**.

No applicable SLOs.

Goal 7: Fabricate parts and components for use in the aviation and aerospace industry.

GLO 7.1: Fabricate **metallic** parts.

SLO 12B.7.1.1 Build and install a simple aircraft wiring system.

GLO 7.2: Fabricate **non-metallic** parts.

No applicable SLOs.

GLO 7.3: Fabricate **electrical/electronic** components.

SLO 12B.7.3.1 Construct DC circuits from schematic diagrams.

SLO 12B.7.3.2 Combine electrical/ electronic circuits and systems to create electrical/electronic devices and applications that perform specific functions.

SLO 12B.7.3.3 Determine resistor values using colour codes.

- SLO 12B.7.3.4 Discuss the interrelationship of resistance and capacitive reactance.
- SLO 12B.7.3.5 Calculate all values in an RC circuit.
- SLO 12B.7.3.6 Troubleshoot a DC circuit using schematic diagrams and a multimeter.
- SLO 12B.7.3.7 Identify methods of wire tinning.
- SLO 12B.7.3.8 Demonstrate how and when to tin a wire.
- SLO 12B.7.3.9 Identify methods of wire splicing.
- SLO 12B.7.3.10 Demonstrate how and when to splice a wire.
- SLO 12B.7.3.11 Describe the application of different terminal types and connections.
- SLO 12B.7.3.12 Solder terminal types and connections.
- SLO 12B.7.3.13 Identify the general characteristics of PC boards.
- SLO 12B.7.3.14 Identify the options and procedures available for repairing broken circuit board copper lands.
- SLO 12B.7.3.15 Describe the purpose of wire bundle lacing, spot tying, grommets, Adel clamps, and wrapping.
- SLO 12B.7.3.16 Identify the types and purpose of aircraft wiring splices, terminal lugs, and connectors.
- SLO 12B.7.3.17 Identify parts of a wire harness assembly.
- SLO 12B.7.3.18 Demonstrate an understanding of how a wire harness assembly is constructed using screw-on and twist-and-lock connectors.
- SLO 12B.7.3.19 Analyze a simple aircraft wiring system.
- SLO 12B.7.3.20 Identify and repair faults in a wire and connector assembly.
- SLO 12B.7.3.21 Modify the simple aircraft wiring system according to the Federal Aviation Administration's *AC 43.13-1B – Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair*.

Goal 8: Describe and demonstrate the transferable **cross-curricular skills** as they pertain to **aviation and aerospace technologies**.

GLO 8.1: **Read, interpret, and communicate** information relevant to aviation and aerospace technologies.

- SLO 12B.8.1.1 Read, interpret, and communicate information relevant to aviation and aerospace technologies.
- SLO 12B.8.1.2 Interpret a schematic diagram.

- SLO 12B.8.1.3 Produce schematic and/or block diagrams of electrical/electronic circuits and systems.
- SLO 12B.8.1.4 Use a computer-assisted design and drafting (CADD) system to produce a simple schematic diagram.
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GLO 8.2: Acquire and organize information using **information and communication technology**.

No applicable SLOs.

GLO 8.3: Apply **mathematical** knowledge and skills related to aviation and aerospace technologies.

- SLO 12B.8.3.1 Demonstrate the addition, subtraction, multiplication, and division (for more than 1-digit divisors or 2-digit multipliers) of whole numbers, decimals, and fractions to solve problems.
- SLO 12B.8.3.2 Demonstrate the use of fractions, decimals, ratios, and percentages.
- SLO 12B.8.3.3 Convert from imperial to metric measurements.
- SLO 12B.8.3.4 Recognize and apply common measurement standards used in the aviation and aerospace industry.
- SLO 12B.8.3.5 Analyze series, parallel, and series-parallel circuit diagrams, and calculate problems using Ohm's and Kirchhoff's laws.
- SLO 12B.8.3.6 Apply mathematical calculations and formulas to analyze electrical/electronic circuitry.
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GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies.

- SLO 12B.8.4.1 Demonstrate an understanding of basic DC electrical theory, including concepts such as the atomic model, electrons, current, electromotive force, potential difference, volt, resistance, and inductance.
- SLO 12B.8.4.2 List and discuss the three basic elements of a simple circuit.
- SLO 12B.8.4.3 List the basic units of electrical measurement.
- SLO 12B.8.4.4 Describe the six sources of electrical energy.
- SLO 12B.8.4.5 Discuss the physical characteristics that affect conductor resistance.
- SLO 12B.8.4.6 Define magnetism and describe lines of force.
- SLO 12B.8.4.7 Identify types of magnets.
- SLO 12B.8.4.8 Discuss properties of electromagnets.

- SLO 12B.8.4.9 Discuss the principle of Kirchhoff's voltage and current law.
- SLO 12B.8.4.10 Discuss the characteristics of series, parallel, and series-parallel circuits.
- SLO 12B.8.4.11 Demonstrate an understanding of basic electrical laws and formulas, such as Ohm's law, Watt's law, and the law of magnetism.
- SLO 12B.8.4.12 Compare and contrast electron flow theory and conventional flow theory.
- SLO 12B.8.4.13 Demonstrate an understanding of basic AC electrical theory, including concepts such as sine wave, AC generation, hertz, induction, and capacitive reactance.

Goal 9: Describe **career opportunities** in aviation and aerospace technologies and associated fields.

GLO 9.1: Describe **education** and **career opportunities** and **professional organizations** in aviation and aerospace technologies and associated fields.

- SLO 12B.9.1.1 Demonstrate an awareness of careers in avionics.
- SLO 12B.9.1.2 Demonstrate an awareness of professional organizations associated with the aviation and aerospace industry and associated fields.

Goal 10: Demonstrate an awareness of **sustainability** as it pertains to aviation and aerospace technologies.

GLO 10.1: Describe the impact of the aviation and aerospace industry on **human health and well-being**.

- SLO 12B.10.1.1 Discuss the impacts of aviation on human health and well-being.

GLO 10.2: Describe the aviation and aerospace industry's sustainability practices and impact on the **environment**.

- SLO 12B.10.2.1 Discuss why it is important for the aviation and aerospace industry to reduce its impact on the environment.

GLO 10.3: Describe **sustainable business practices** within the aviation and aerospace industry.

No applicable SLOs.

Goal 11: Demonstrate an awareness of the **ethical and legal standards** as they pertain to aviation and aerospace technologies.

GLO 11.1: Practise the **ethical and legal standards** as they pertain to aviation and aerospace technologies.

No applicable SLOs.

Goal 12: Demonstrate **employability skills** related to aviation and aerospace technologies.

GLO 12.1: Demonstrate **employability skills** related to aviation and aerospace technologies.

- SLO 12B.12.1.1 Define TOWES (Test of Workplace Essential Skills), and state how it relates to employment in the aviation and aerospace industry.
- SLO 12B.12.1.2 Apply the three domains of TOWES (text reading, document use, and numeracy) in learning activities.
- SLO 12B.12.1.3 List and define the criteria that comprise the Global Industry Standard of essential skills for employees.
- SLO 12B.12.1.4 List and define the criteria that comprise the Conference Board of Canada's *Employability Skills 2000+* for employees.

Goal 13: Describe the **evolution** of aviation and aerospace technologies, including **technological progression** and **emerging trends**.

GLO 13.1: Describe the **evolution** of aviation and aerospace technologies, including **technological progression** and **emerging trends**.

- SLO 12B.13.1.1 Describe the evolution of avionics, including technological progression and emerging trends.
 - SLO 12B.13.1.2 Identify several current innovations in electricity/electronics, such as computer numerical control, robotics and automation, digital communication, fibre optic networks, nanotechnology, and circuit simulation software.
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