8547
Reciprocating Engines
(11C)

30S/30E/30M

An Aviation and Aerospace Technologies Course

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Course Description

Reciprocating Engines is intended for students completing the specialization phase of aviation and aerospace technologies. Curriculum content provides an introduction to the operation and maintenance of reciprocating engines. Topics include the following:

- history of reciprocating engines
- engine systems
- components and accessories
- lock wiring

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.

SLO 11C.1.1.1	Demonstrate an awareness of the principles of Workplace Hazardous Materials Information Systems (WHMIS) as they apply to aerospace technologies.
SLO 11C.1.1.2	Describe the purpose of Material Safety Data Sheets (MSDS).
SLO 11C.1.1.3	Identify immediate and potential hazards and assess their impact on self, others, and the environment.
SLO 11C.1.1.4	Establish and follow personal and environmental health and safety procedures and practices.
SLO 11C.1.1.5	Identify and follow maintenance safety practices/ precautions for sheet metal and/or composite materials/ structures.

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.

SLO 11C.2.1.1	Explain factors affecting performance.
SLO 11C.2.1.2	Demonstrate an understanding of aerodynamics related to power plants and propellers.

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 11C.3.1.1	Describe the types of engines developed for aviation use.
SLO 11C.3.1.2	Explain the differences and advantages of different types of engines.
SLO 11C.3.1.3	Describe engine development and application.
SLO 11C.3.1.4	Describe the limitations of piston engines.

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

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

SLO 11C.4.1.1	Identify and describe internal engine components.
SLO 11C.4.1.2	Identify and describe external engine components.
SLO 11C.4.1.3	Identify and describe engine accessories.
SLO 11C.4.1.4	Explain the function of engine components.
SLO 11C.4.1.5	Explain engine operation terminology for both two-stroke and four-stroke engines.
SLO 11C.4.1.6	Explain terms used in aircraft engine identification and classification, and identify them by symbols.
SLO 11C.4.1.7	Classify engines by cylinder arrangement or displacement.
SLO 11C.4.1.8	Explain the purpose of engine data plates.
SLO 11C.4.1.9	Explain piston displacement.
SLO 11C.4.1.10	Explain power calculations.
SLO 11C.4.1.11	Explain engine efficiency.
SLO 11C.4.1.12	Explain the Otto cycle.
SLO 11C.4.1.13	Explain power curves.

SLO 11C.4.1.14	Draw a graph to represent the indicator diagram for the Otto cycle.
SLO 11C.4.1.15	Compute horsepower using the PLANK formula.
SLO 11C.4.1.16	Calculate piston displacement.
SLO 11C.4.1.17	Calculate compression ratio.
SLO 11C.4.1.18	Explain engine timing.
SLO 11C.4.1.19	Describe engine cooling.
SLO 11C.4.1.20	Determine the firing order of various reciprocating engines.
SLO 11C.4.1.21	Identify combustion and valve timing components.
SLO 11C.4.1.22	Identify engine cylinder positions.
SLO 11C.4.1.23	Describe disassembly, cleaning, and inspection procedures.
SLO 11C.4.1.24	Describe dimensional inspection procedures.
SLO 11C.4.1.25	Describe repair and replacement procedures for repairable and replaceable items, respectively.
SLO 11C.4.1.26	Determine parts' serviceability with reference to manufacturers' technical publications.
SLO 11C.4.1.27	Describe assembly and testing procedures.

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 11C.5.1.1	Demonstrate the safe and appropriate cleaning, storage, and management of equipment and tools used in reciprocating engines.
SLO 11C.5.1.2	Demonstrate the use of pounding, turning, cutting, holding, and measuring hand tools in the aviation and aerospace industry.
SLO 11C.5.1.3	Demonstrate the safe operating procedures for the pounding, turning, and cutting equipment used in the aviation and aerospace industry.
SLO 11C.5.1.4	Select, operate, and maintain the appropriate pounding, turning, cutting, holding, and measuring hand tools, power tools, and equipment used in the aviation and aerospace industry.
SLO 11C.5.1.5	Select and utilize tools and equipment for the overhaul and repair of aircraft reciprocating power plants.
SLO 11C.5.1.6	Select and utilize measuring tools.

SLO 11C.5.1.7	Demonstrate the application of torque and the units used to measure torque in reciprocating engine fasteners.
SLO 11C.5.1.8	Use fastener repair methods in reciprocating engine applications.
SLO 11C.5.1.9	Demonstrate the use of fastener locking methods in reciprocating engine applications.

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

No applicable SLOs.

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 11C.6.1.1	Identify and classify common metallic and non-metallic materials.
SLO 11C.6.1.2	Demonstrate comprehension of material properties as they apply to the aviation and aerospace industry.

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

SLO 11C.6.2.1	Identify common metal fasteners used on aircraft engines.

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

GLO 7.1: Fabricate **metallic** parts.

No applicable SLOs.

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

No applicable SLOs.

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

No applicable SLOs.

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 11C.8.1.1	Describe the purpose of and identify the information in the aircraft maintenance, overhaul, structural repair, service, and component manuals.
SLO 11C.8.1.2	Demonstrate how to access information in an aircraft illustrated parts catalogue to determine correct part numbers when replacing components within an installed system.
SLO 11C.8.1.3	Demonstrate the use of a typical aircraft maintenance or overhaul manual to locate information on components repair or overhaul procedures.
SLO 11C.8.1.4	Identify technical information using the Air Transport Association Specification 100 (ATA Spec 100) numbering system.
SLO 11C.8.1.5	Use technical language and terms appropriately in context.
SLO 11C.8.1.6	Identify the main conventions related to simple technical drawings.
SLO 11C.8.1.7	Describe documentation and certification.

GLO 8.2: Acquire and organize information using **information and communication technology.**

SLO 11C.8.2.1	Use a computer-assisted design and drafting (CADD) system to produce a simple technical drawing.
SLO 11C.8.2.2	Support and enhance basic information requirements by using a wide variety of resources (e.g., print, online, community).

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

SLO 11C.8.3.1	Apply common measurement standards used in the aviation and aerospace industry.

SLO 11C.8.3.2 Demonstrate the use of 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 11C.8.3.3 Use fractions, decimals, ratios, and percentages.

SLO 11C.8.3.4 Convert from imperial to metric measurements.

GLO 8.4: Apply **scientific** knowledge and skills related to aviation and aerospace technologies.

SLO 11C.8.4.1 Compare and contrast potential and kinetic energy and how they apply to reciprocating engines.

SLO 11C.8.4.2 Define work, power, and force as they apply to reciprocating engines.

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 11C.9.1.1 Demonstrate an awareness of careers in the area of gas turbine R & O (repair and overhaul).

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 11C.10.1.1 Describe basic concepts of human factors (Dirty Dozen) as applied to aviation maintenance.

SLO 11C.10.1.2 Identify organizational norms and establish a culture of safety in the workplace.

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

SLO 11C.10.2.1 Identify a variety of alternative fuels and explain how the use of these fuels and energy sources can reduce the environmental impact of the aviation and aerospace industry.

SLO 11C.10.2.2 Discuss the impact of chemical hazards on the environment.

SLO 11C.10.2.3 Describe the benefits of using environmentally friendly products and more efficiently designed aircraft.

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 11C.12.1.1	Demonstrate the criteria that comprise the Global Industry Standard of essential skills for employees.
SLO 11C.12.1.2	Demonstrate the skills listed on the Conference Board of Canada's *Employability Skills 2000+* for employees.
SLO 11C.12.1.3	Describe the skills required for a specific career path in the aviation and aerospace industry.

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 11C.13.1.1	Describe the evolution of engine design, including its technological progression and emerging trends.
SLO 11C.13.1.2	Describe the early development of heat engines.
SLO 11C.13.1.3	Describe factors affecting development of engines.
