



8697
ENGINE FUNDAMENTALS
AND SERVICE (11A)

30S/30E/30M

An Automotive Technology Course

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Course Description

A student wanting to develop skills in the automotive service and repair industry must have knowledge of the basic principles of the internal combustion engine and the inner workings and relations of the engine components, as well as how they relate to vehicle operation. The student will learn the procedures to service, repair, and replace engines and their components. They will also learn about the mathematics required for the automotive trade. This course focuses on the following unit in the Apprenticeship Manitoba Level 1 technical training:

- Unit A5: Trade-Related Mathematics
- Unit A6: Engine Fundamentals

It also focuses on the Trade Safety Awareness Manual.

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

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

- SLO 11A.1.1.1 Adhere to safe practices and procedures for facilities, processes, materials, tools, and equipment.
- SLO 11A.1.1.2 Identify the process for reporting injuries.
- SLO 11A.1.1.3 Identify hazards and adhere to safe work practices pertaining to hoisting and lifting.
- SLO 11A.1.1.4 Create and maintain a safe and organized working environment.
- SLO 11A.1.1.5 Demonstrate the ability to follow safety information on supplier labels.
- SLO 11A.1.1.6 Demonstrate the ability to locate first aid and eyewash stations.
- SLO 11A.1.1.7 Identify safety and health requirements. (A2.1)
 - overview of *The Workplace Safety and Health 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 11A.1.1.8 Identify personal protective equipment (PPE) and procedures. (A2.2) (TSA 16)

- employer and employee responsibilities as related to personal protective equipment
- standards: ANSI (U.S.A. standards), etc.
- 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 11A.1.1.9 Outline the safety principles for working on and around electrical or energized 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 11A.1.1.10 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 11A.1.1.11 Identify ergonomics. (A2.5)
- definition of ergonomics and conditions that may affect the body
 - working postures
 - repetition
 - force
 - lifting
 - tools
 - identify tool and safety equipment
 - causes of hand-tool accidents
 - equipment
- SLO 11A.1.1.12 Recognize, report, 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 11A.1.1.13 Identify the hazards in confined spaces and the preparation needed to work in them. (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 11A.1.1.14 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 the 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 CPR requirements and techniques
 - How do you get certified?
 - scope and limits of CPR intervention (include varieties of CPR certification)

SLO 11A.1.1.15 Identify the safety requirements as they apply to WHMIS with emphasis on: (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 11A.1.1.16 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

GLO 1.2: Demonstrate awareness of safety as it pertains to the ***Trade Safety Awareness Curriculum for Level 1 Apprentices.***

SLO 11A.1.2.1 Explain the importance of trade safety and health in reducing injuries and fatalities to young employees in Manitoba. (TSA 1)

SLO 11A.1.2.2 Describe the rights and responsibilities of employees, employers, and supervisors under *The Workplace Safety and Health Act*. (TSA 2)

SLO 11A.1.2.3 Describe the steps to use in the Right to Refuse process. (TSA 3)

SLO 11A.1.2.4 Explain how and where to find information on workplace safety and health. (TSA 4)

SLO 11A.1.2.5 Demonstrate how to handle a potentially dangerous work situation. (TSA 5)

SLO 11A.1.2.6 Explain the S.A.F.E. acronym. (TSA 6)

SLO 11A.1.2.7 Define workplace safety and health hazards. (TSA 7)

- SLO 11A.1.2.8 Give examples of trade-specific workplace safety and health hazards. (TSA 8)
- SLO 11A.1.2.9 Give examples of five types of safety and health hazards. (TSA 9)
- SLO 11A.1.2.10 Define workplace safety and health risk. (TSA 10)
- SLO 11A.1.2.11 Give examples of trade-specific workplace safety and health risks. (TSA 11)
- SLO 11A.1.2.12 Explain the principles of hazard recognition and control as they apply to the specific trade. (TSA 12)
- SLO 11A.1.2.13 Match the WHMIS hazardous materials symbols and their meanings. (TSA 14)
- SLO 11A.1.2.14 Describe the importance of Material Safety Data Sheets (MSDS). (TSA 15)
- SLO 11A.1.2.15 Demonstrate proper selection and use of a variety of personal protective equipment (PPE) and fall protection systems. (TSA 17)

Goal 2: Select, use, and manage tools, equipment, materials, and consumables.

GLO 2.1: Select, use, and manage tools and equipment.

- SLO 11A.2.1.1 Select, use, and manage tools and equipment used in engine fundamentals and service.
- SLO 11A.2.1.2 Identify hazards and describe safe work practices pertaining to the use of tools and equipment. (A3.1)
- SLO 11A.2.1.3 Describe and demonstrate measuring tools and procedures for their use. (A3.3)
- types and applications, including:
 - micrometers
 - vernier calipers
 - inspection, maintenance, and storage procedures

GLO 2.2: Select, use, and manage materials and consumables.

- SLO 11A.2.2.1 Describe the use of gaskets, seals, and sealants in automotive applications.
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Goal 3: Describe, inspect, diagnose, service, and repair automotive components and systems.

GLO 3.1: Describe automotive components and systems.

- SLO 11A.3.1.1 Define terminology associated with engines. (A6.1)
- SLO 11A.3.1.2 Explain internal combustion principles. (A6.2)
- SLO 11A.3.1.3 Identify types of engine classifications. (A6.3)
 - fuel
 - diesel
 - gasoline
 - alternate fuels
 - stroke
- SLO 11A.3.1.4 Identify types of engine configurations and describe their construction. (A6.4)
 - inline
 - rotary
 - opposed
 - V
- SLO 11A.3.1.5 Identify types of valve train configurations and describe their construction. (A6.5)
 - push rod
 - overhead cam
 - multi-valve
 - solenoid operated valve
- SLO 11A.3.1.6 Identify engine components and describe their design, purpose, and operation. (A6.6)
 - block assembly
 - cylinder head assembly
 - timing
 - gears
 - belts
 - chains
 - variable
 - mounts
- SLO 11A.3.1.7 Identify types of fasteners, gaskets, seals, and sealants, and describe their applications and procedures for use. (A6.7)

SLO 11A.3.1.8 Calculate engine displacement, compression ratios, horsepower, area, and volume. (A6.8)

GLO 3.2: Inspect and diagnose automotive components and systems.

- SLO 11A.3.2.1 Demonstrate the ability to perform a cooling system pressure test.
 - SLO 11A.3.2.2 Demonstrate the ability to perform an engine-compression test.
 - SLO 11A.3.2.3 Demonstrate the ability to perform a cylinder leak-down test.
 - SLO 11A.3.2.4 Demonstrate the ability to analyze engine test results to determine suitable repair procedures.
 - SLO 11A.3.2.5 Demonstrate the ability to diagnose engine components and isolate sub-system malfunctions.
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GLO 3.3: Service and repair automotive components and systems.

- SLO 11A.3.3.1 Demonstrate the ability to create an estimate and parts list for engine repairs.
 - SLO 11A.3.3.2 Demonstrate the ability to disassemble, assess, and reassemble engine components for allowable tolerances, wear, and damage.
 - SLO 11A.3.3.3 Demonstrate the ability to clean engine block and cylinder head components.
 - SLO 11A.3.3.4 Demonstrate the ability to inspect and measure engine blocks, cylinder heads, and related components.
 - SLO 11A.3.3.5 Demonstrate an understanding of the procedures required for final testing and inspection.
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Goal 4: Describe and apply transferable **cross-curricular** knowledge and skills.

GLO 4.1: Describe and apply knowledge and skills from **information and communication technologies**.

- SLO 11A.4.1.1 Demonstrate awareness of shop management software (e.g., electronic work order software).
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GLO 4.2: Describe and apply knowledge and skills from the **sciences**.

- SLO 11A.4.2.1 Demonstrate knowledge of science as it relates to engine fundamentals and service.
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GLO 4.3: Read, interpret, and communicate information.

No applicable SLOs.

GLO 4.4: Describe and apply knowledge and skills from mathematics.

SLO 11A.4.4.1 Demonstrate the ability to apply imperial and metric units (e.g., volume, torque).

SLO 11A.4.4.2 Describe the practical importance of math disciplines to the automotive service technician trade. (A5.1)

- definition and scope of relevant math disciplines
- time-sheets, wages, and personal budgeting
- engineering of tools and equipment
- manufacture and packaging of automotive service materials and products
- trade documents, including manufacturers' specifications
- computer technology/applications
- design/technical drawing
- work order preparation
- machinery and equipment set-up
- measurement and related test readings
 - temperatures
 - pressures
 - other measured quantities
- customer relations/perceptions (e.g., schedules, timetables, etc.)
- business management

SLO 11A.4.4.3 Describe “math anxiety” and its remedies. (A5.2)

- definition
- recognition
- options, resources, and techniques for overcoming math anxiety
- other common problems
 - importance of adult learner's recognition of existing math strengths and weaknesses
 - importance of early resolution during term of apprenticeship
 - options/resources for remedial math instruction and other assistance

SLO 11A.4.4.4 Review general math concepts and the use of electronic calculators. (A5.3)

- basic operations
 - addition
 - subtraction
 - multiplication
 - division
 - order of operations
 - fractions and decimals
- ratio and proportion
- percentage calculations
- constructing/solving simple equations
- units of measure
 - imperial
 - metric (SI)
 - conversion factors

SLO 11A.4.4.5 Demonstrate trade-related calculations as specified by the instructor. (A5.4)

- linear measurement
- area and volume
- ratio/proportion
 - ratios
 - percentages
 - rates
- SI/metric units (including conversions)

Goal 5: Demonstrate an understanding of **sustainability**.

GLO 5.1: Demonstrate an understanding of **sustainability**.

SLO 11A.5.1.1 Demonstrate an understanding of how and why lightweight and recyclable materials are used in vehicle production.

Goal 6: Demonstrate awareness of **ethical and legal standards**.

GLO 6.1: Demonstrate awareness of **ethical and legal standards**.

SLO 11A.6.1.1 Demonstrate awareness of legislation related to automotive systems and service.

Goal 7: Demonstrate **employability skills**.

GLO 7.1: Demonstrate **employability skills**.

- SLO 11A.7.1.1 Demonstrate problem-solving skills.
 - SLO 11A.7.1.2 Demonstrate critical-thinking skills.
 - SLO 11A.7.1.3 Demonstrate regular attendance and punctuality.
 - SLO 11A.7.1.4 Demonstrate accountability by taking responsibility for their actions.
 - SLO 11A.7.1.5 Demonstrate adaptability, initiative, and effort.
 - SLO 11A.7.1.6 Accept and follow direction and feedback.
 - SLO 11A.7.1.7 Demonstrate teamwork skills.
 - SLO 11A.7.1.8 Stay on task and use time effectively.
 - SLO 11A.7.1.9 Communicate respectfully and effectively.
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GLO 7.2: Demonstrate an understanding of the **business operation** of a repair/service facility.

No applicable SLOs.

Goal 8: Demonstrate an understanding of **educational and career opportunities**.

GLO 8.1: Demonstrate an understanding of **educational and career opportunities**.

- SLO 11A.8.1.1 Demonstrate awareness of specialized occupations in the automotive service and repair industry.
 - SLO 11A.8.1.2 Demonstrate awareness of apprenticeship.
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Goal 9: Demonstrate awareness of the **evolution, technological progression, and emerging trends** in the automotive industry.

GLO 9.1: Demonstrate awareness of the **evolution, technological progression, and emerging trends** in the automotive industry.

- SLO 11A.9.1.1 Demonstrate awareness of the evolution, technological progression, and emerging trends in engine fundamentals and service.
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