**Student:** **Date:**

| **Outcomes** | **R** | **D** | **C** | **A** | **Changed Outcomes** |
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| **Unit 1: Safety** | | | | | |
| **Topic 1:**  **General Fabrication Room Safety** | | | | | |
| 1.1.1 identify common hazards within the Fabrication Room environment |  |  |  |  |  |
| 1.1.2 demonstrate safe practice for use of hand tools and power tools specific to mechanical repair and maintenance |  |  |  |  |  |
| 1.1.3 demonstrate safe practices within the fabrication area, and proper procedure for handling shop emergencies |  |  |  |  |  |
| 1.1.4 understand the importance of WHMIS and demonstrate knowledge of its key features |  |  |  |  |  |
| 1.1.5 recognize the need to consult Material Safety Data Sheets (MSDS) when handling chemical |  |  |  |  |  |
| **Unit 1: Safety** | | | | | |
| **Topic 2: Occupational Health and Safety** | | | | | |
| 1.2.1 demonstrate knowledge of the Occupational Health and Safety Act |  |  |  |  |  |
| 1.2.2 identify the rights and responsibilities of the various stakeholders including the right to refuse |  |  |  |  |  |
| 1.2.3 explain the process for the reporting of risks, workplace issues and accidents |  |  |  |  |  |
| 1.2.4 explain the duties of OH&S Commission Officers |  |  |  |  |  |
| **Unit 2: Introduction to Engines** | | | | | |
| **Topic 1: Overview of Engine Development** | | | | | |
| 2.1.1 summarize the development of external combustion engines |  |  |  |  |  |
| 2.1.2 summarize the development of the internal combustion engine |  |  |  |  |  |
| 2.1.3 differentiate between internal and external combustion engines |  |  |  |  |  |
| 2.1.4 explain the principles of operation of the major internal and external combustion engine types |  |  |  |  |  |
| 2.1.5 identify common engine classifications |  |  |  |  |  |
| 2.1.6 show the principles of operation of a 4 stroke cycle engine |  |  |  |  |  |
| 2.1.7 demonstrate the methods used to distinguish between a 2 stroke cycle and 4 stroke cycle gasoline engine |  |  |  |  |  |
| 2.1.8 compare and contrast the service life of a 4 stroke versus a 2 stroke cycle internal combustion engine |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 1: Small Engine Overview** | | | | | |
| 3.1.1 define the process of troubleshooting as a problem solving tool |  |  |  |  |  |
| 3.1.2 identify the six basics systems of a 4 stroke cycle gasoline engine |  |  |  |  |  |
| 3.1.3 identify common troubleshooting techniques for 4 stroke cycle engines |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 2: Ignition Systems** | | | | | |
| 3.2.1 locate appropriate sections of the manufacturer’s service manual, dealing with the ignition system on a 4 stroke cycle engine |  |  |  |  |  |
| 3.2.2 demonstrate knowledge of terms and tools used in the industry for ignition systems of a 4 stroke cycle engine |  |  |  |  |  |
| 3.2.3 state the function of the ignition system in small gas engines |  |  |  |  |  |
| 3.2.4 compare and contrast the three most common types of ignition used on small gas engines |  |  |  |  |  |
| 3.2.5 measure ignition system components with the appropriate industry measurement tools |  |  |  |  |  |
| 3.2.6 demonstrate and perform the proper procedure/ tools used in the examination of the ignition system |  |  |  |  |  |
| 3.2.7 complete a tear down and re-assembly of a 4 stroke cycle ignition system |  |  |  |  |  |
| 3.2.8 using a variety of troubleshooting techniques identify an ignition system problem on a malfunctioning 4 stroke cycle engine |  |  |  |  |  |
| 3.2.9 using proper tools and procedures solve an ignition system problem on a malfunctioning 4 stroke cycle engine |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 3: Fuel System** | | | | | |
| 3.3.1 locate appropriate sections of the manufacturer’s service manual, dealing with the fuel system on a 4 stroke cycle engine |  |  |  |  |  |
| 3.3.2 demonstrate knowledge of terms and tools used in the industry for fuel systems of a 4 stroke cycle engine |  |  |  |  |  |
| 3.3.3 differentiate between the methods used to supply fuel in small gas engines |  |  |  |  |  |
| 3.3.4 compare and contrast the three types of carburetors used in small gas engines |  |  |  |  |  |
| 3.3.5 discuss the differences between the two main types of governors used in small gas engines |  |  |  |  |  |
| 3.3.6 describe the three types of air cleaners used in small gas engines operate |  |  |  |  |  |
| 3.3.7 demonstrate the proper procedure/tools used in the examination of the fuel system |  |  |  |  |  |
| 3.3.8 complete a breakdown and assembly of a 4 stroke cycle fuel system |  |  |  |  |  |
| 3.3.9 using a variety of troubleshooting techniques identify a fuel system problem on a malfunctioning 4 stroke cycle engine |  |  |  |  |  |
| 3.3.10 using proper tools and procedures solve a fuel system problem on a malfunctioning 4 stroke cycle engine |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 4: Valve Train/Timing System** | | | | | |
| 3.4.1 locate appropriate sections of the manufacturer’s service manual, dealing with the valve train/timing system on a 4 stroke cycle engine |  |  |  |  |  |
| 3.4.2 demonstrate knowledge of terms and tools used in the industry for valve train/timing systems of a 4 stroke cycle engine |  |  |  |  |  |
| 3.4.3 demonstrate the proper procedure/tools used in the examination of the valve train/timing system |  |  |  |  |  |
| 3.4.4 complete a breakdown and assembly of a 4 stroke cycle valve train/timing system |  |  |  |  |  |
| 3.4.5 measure valve train/timing system components with the appropriate industry measurement tools |  |  |  |  |  |
| 3.4.6 diagnose potential valve train/timing system problems that will reduce engine economy |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 5: Compression System** | | | | | |
| 3.5.1 locate appropriate sections of the manufacturer’s service manual, dealing with the compression system on a 4 stroke cycle engine |  |  |  |  |  |
| 3.5.2 demonstrate knowledge of terms and tools used in the industry for compression systems of a 4 stroke cycle engine |  |  |  |  |  |
| 3.5.3 measure compression system components with the appropriate industry measurement tools |  |  |  |  |  |
| 3.5.4 demonstrate the proper procedure/tools used in the examination of the compression system |  |  |  |  |  |
| 3.5.6 diagnose potential compression system problems that will reduce engine economy |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 6: Lubrication/Cooling System** | | | | | |
| 3.6.1 locate appropriate sections of the manufacturer’s service manual, dealing with the lubrication/cooling system on a 4 stroke cycle engine |  |  |  |  |  |
| 3.6.2 demonstrate knowledge of terms and tools used in the industry for lubrication/cooling systems of a 4 stroke cycle engine |  |  |  |  |  |
| 3.6.3 differentiate between the types of lubrication systems found on small gas engines |  |  |  |  |  |
| 3.6.4 describe characteristics of various lubrications used in small gas engines |  |  |  |  |  |
| 3.6.5 compare and contrast the types of cooling systems found on small gas engines |  |  |  |  |  |
| 3.6.6 measure lubrication/cooling system components with the appropriate industry measurement tools |  |  |  |  |  |
| 3.6.7 demonstrate the proper procedure/tools used in the examination of the lubrication/cooling system |  |  |  |  |  |
| 3.6.8 complete a breakdown and assembly of a 4 stroke cycle lubrication/cooling system |  |  |  |  |  |
| 3.6.9 diagnose potential lubrication/cooling system problems that will reduce engine economy |  |  |  |  |  |
| **Unit 3: Experiencing Small Engines Modularly** | | | | | |
| **Topic 7: Mechanical System** | | | | | |
| 3.7.1 locate appropriate sections of the manufacturer’s service manual, dealing with the mechanical system on a 4 stroke cycle engine |  |  |  |  |  |
| 3.7.2 demonstrate knowledge of terms and tools used in the industry for mechanical systems of a 4 stroke cycle engine |  |  |  |  |  |
| 3.7.3 measure mechanical system components with the appropriate industry measurement tools |  |  |  |  |  |
| 3.7.4 demonstrate the proper procedure/ tools used in the examination of the mechanical system pertaining to repair and maintenance |  |  |  |  |  |
| 3.7.5 complete a breakdown and assembly of a 4 stroke cycle mechanical system |  |  |  |  |  |
| 3.7.6 diagnose potential mechanical system problems that will reduce engine economy |  |  |  |  |  |
| **Unit 4: Introduction to Alternative Energy** | | | | | |
| **Topic 1: Types of Energy** | | | | | |
| 4.1.1 Understand the relationship between work and energy |  |  |  |  |  |
| 4.1.2 differentiate between kinetic and potential energy |  |  |  |  |  |
| 4.1.3 classify the main types of energy as being either potential or kinetic |  |  |  |  |  |
| 4.1.4 state the first law of thermodynamics |  |  |  |  |  |
| **Unit 4: Introduction to Alternative Energy** | | | | | |
| **Topic 2: Sources of Energy** | | | | | |
| 4.2.1 describe the most common fossil and alternative fuel |  |  |  |  |  |
| 4.2.2 define renewable, non-renewable and inexhaustible with respect to energy sources |  |  |  |  |  |
| 4.2.3 classify the common fossil fuels and alternative fuels as renewable, non-renewable and inexhaustible |  |  |  |  |  |
| 4.2.4 become aware of the environmental considerations involved with renewable, non-renewable and inexhaustible energy sources |  |  |  |  |  |
| 4.2.5 understand the significance of an ecological footprint  - Calculate what an individual’s footprint would be considering their daily energy use |  |  |  |  |  |
| **Unit 4: Introduction to Alternative Energy** | | | | | |
| **Topic 3: Power and Energy Overview** | | | | | |
| 4.3.1 Relate the history of technological development dealing with power generation |  |  |  |  |  |
| 4.3.2 examine in detail one specific example of a technological development in power generation |  |  |  |  |  |
| 4.3.3 Identify the main types of power generation technology in use in Canada |  |  |  |  |  |
| 4.3.4 describe the common qualities of power generation technology |  |  |  |  |  |
| 4.3.5 review the common qualities of power generation technology and alternative energy production |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 1: Design for Construction** | | | | | |
| 5.1.1 identify the steps in the design process  The discussion should focus on:   * Needs identification * Defining the Problem * Generating Options * Selecting the Best Option * Developing the Solution * Prototyping and Testing * Evaluation and Redesign |  |  |  |  |  |
| 5.1.2 apply the design process in the design of a simple alternative energy implementation |  |  |  |  |  |
| 5.1.3 review the legislation dealing with the use of windmill and solar power generation methods in Newfoundland and Labrador |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 2: Windmill Technology** | | | | | |
| 5.2.1 review and demonstrate proper safety procedures when working with a wind turbine power generation system |  |  |  |  |  |
| 5.2.2 outline the historical use and development of windmill technology |  |  |  |  |  |
| 5.2.3 describe the planned wind-farm technology to be used in Newfoundland and Labrador |  |  |  |  |  |
| 5.2.4 determine the proper placement for a wind turbine, taking into account wind gusts, placement, safety and other considerations |  |  |  |  |  |
| 5.2.5 monitor wind turbine efficiency by comparing output to general daily wind speeds or to artificial variations to account for same |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 3: Solar Cell Technology** | | | | | |
| 5.3.1 review and demonstrate proper safety procedures when working with a solar cell power generation system |  |  |  |  |  |
| 5.3.2 outline the historical use and development of solar cell technology |  |  |  |  |  |
| 5.3.3 describe common usages for solar cell technology in Newfoundland and Labrador |  |  |  |  |  |
| 5.3.4 set-up a solar cell, taking into account sunlight exposure, angle, placement, safety and other considerations |  |  |  |  |  |
| 5.3.5 wire a solar cell into a solar charge controller and green meter panel |  |  |  |  |  |
| 5.3.6 monitor solar cell efficiency by comparing output to sunshine availability |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 4: Service Panel Wiring for Off-The-Grid Technologies** | | | | | |
| 5.4.1 describe the components and function of a standard residential electrical service |  |  |  |  |  |
| 5.4.2 demonstrate safe practices for use of tools and test equipment common in the installation of an electrical |  |  |  |  |  |
| 5.4.3 discuss safe practices when working with electricity and an electrical service |  |  |  |  |  |
| 5.4.4 review the building code requirements for placement of an electrical service and panel |  |  |  |  |  |
| 5.4.5 install breakers within a standard service panel |  |  |  |  |  |
| 5.4.6 tie a branch circuit into an electrical panel |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 5: Hydrogen Fuel Cells** | | | | | |
| 5.5.1 trace the historical development of hydrogen as a fuel source |  |  |  |  |  |
| 5.5.2 review and demonstrate proper safety procedures when working with hydrogen fuel cell technology |  |  |  |  |  |
| 5.5.3 explain how a fuel cell can produce electricity |  |  |  |  |  |
| 5.5.4 differentiate between the types of fuel cell and their applications |  |  |  |  |  |
| 5.5.5 discuss barriers to mainstream use of fuel cell technology |  |  |  |  |  |
| 5.5.6 demonstrate the use of a hydrogen fuel cell device |  |  |  |  |  |
| 5.5.7 identify a series of machines that can be powered by fuel cell technology |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 6: Heat Pump Technology** | | | | | |
| 5.6.1 review and demonstrate proper safety procedures when working with a heat pump system |  |  |  |  |  |
| 5.6.2 outline the historical use and development of heat pump technology |  |  |  |  |  |
| 5.6.3 differentiate between the different types of heat pump installations |  |  |  |  |  |
| 5.6.4 describe the common usages for heat pump technology in Newfoundland and Labrador |  |  |  |  |  |
| **Unit 5: Experiencing Alternative Energy Modularly** | | | | | |
| **Topic 7: Sustainable Housing** | | | | | |
| 5.7.1 describe what is entailed within the concept of sustainable housing  Concepts to emphasize:   * R-2000 * Air flow * Insulative values |  |  |  |  |  |
| 5.7.2 define R-value in terms of energy loss over square footage of a material   * R-value * U-value * Methods of heat transfer:   + Conduction   + Convection   + Radiation |  |  |  |  |  |
| 5.7.3 differentiate between different insulation types and their appropriate use in residential construction/renovation   * R-value * Batt or blanket insulation * Loose-fill insulation * Rigid board insulation * Spray-foam insulation * Radiant Barrier Insulation |  |  |  |  |  |
| 5.7.4 describe the function of a vapour/air barrier in insulation use   * Differentiate Vapor Barrier / Air Barrier * Role of House Wrap |  |  |  |  |  |
| 5.7.5 follow safety rules and guidelines when working with various types of insulation installations |  |  |  |  |  |
| 5.7.6 install a variety of insulations in different wall/roof/floor situations |  |  |  |  |  |