

## **COURSE MEC1010: MODES & MECHANISMS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students research, design, build and test a model of a transportation vehicle, using a simple power source, common materials and tools.

**Parameters:** Access to tools and fasteners commonly used in the trade.

**Outcomes:** The student will:

### **1. demonstrate the safe use of tools and follow established laboratory procedures**

- 1.1 demonstrate knowledge of and follow safety rules and guidelines related to the use of basic hand and power tools
- 1.2 identify the hazards associated with the use of:
  - 1.2.1 compressed gases
  - 1.2.2 liquids under pressure
  - 1.2.3 flammable materials
  - 1.2.4 components under tension

### **2. list and describe operating systems and structures common to all modes of transportation**

- 2.1 identify a transportation mode that can be used to move passengers or goods in the following environments:
  - 2.1.1 terrestrial
  - 2.1.2 marine
  - 2.1.3 atmospheric
  - 2.1.4 space
- 2.2 describe, in a given environment, what forces must be overcome to start and keep a vehicle/craft in motion
- 2.3 list and describe the function of the following systems:
  - 2.3.1 propulsion
  - 2.3.2 guidance
  - 2.3.3 control
  - 2.3.4 suspension
  - 2.3.5 structural
  - 2.3.6 solar and wind
- 2.4 describe and demonstrate how energy produces motion using:
  - 2.4.1 gravity
  - 2.4.2 elastic or spring materials under tension
  - 2.4.3 compressed gases
  - 2.4.4 liquids under pressure
  - 2.4.5 electromagnetic combustion
- 2.5 identify and compare the guidance and control mechanisms that are used in connection with a:
  - 2.5.1 land vehicle
  - 2.5.2 marine craft
  - 2.5.3 aircraft
  - 2.5.4 spacecraft

- 2.6 identify and compare the means by which a vehicle or craft is supported:
  - 2.6.1 on land
  - 2.6.2 in air
  - 2.6.3 in water or space
- 2.7 identify the types of structures and materials that are used to support vehicular systems to provide maximum safety and performance
- 3. research, design, build and test a concept vehicle**
  - 3.1 research, design and construct a vehicle or craft for a predetermined use
  - 3.2 identify an appropriate measurement technique used to assess factors including:
    - 3.2.1 speed
    - 3.2.2 pulling power
    - 3.2.3 payload
    - 3.2.4 efficiency
  - 3.3 describe operation and construction of the transportation vehicle
- 4. demonstrate basic competencies**
  - 4.1 demonstrate fundamental skills to:
    - 4.1.1 communicate
    - 4.1.2 manage information
    - 4.1.3 use numbers
    - 4.1.4 think and solve problems
  - 4.2 demonstrate personal management skills to:
    - 4.2.1 demonstrate positive attitudes and behaviours
    - 4.2.2 be responsible
    - 4.2.3 be adaptable
    - 4.2.4 learn continuously
    - 4.2.5 work safely
  - 4.3 demonstrate teamwork skills to:
    - 4.3.1 work with others
    - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1015: MECHANICS TOOLS & MATERIALS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students develop knowledge, skills and attitudes in the safe use of specialty hand tools, measuring tools and fasteners.

**Parameters:** Access to tools and fasteners commonly used in the trade.

**Outcomes:** The student will:

**1. create a health and safety plan with special emphasis on conditions and factors related to the specific pathway or series of courses**

- 1.1 research and identify the following eight common elements of a health and safety management system:
  - 1.1.1 management, leadership and organizational commitment including policies, guidelines and responsibilities
  - 1.1.2 hazard identification and assessment
  - 1.1.3 hazard control
  - 1.1.4 worker competency and training including: technical competence, safe work practices and procedures, personal protective equipment
  - 1.1.5 work site inspection
  - 1.1.6 incident investigation
  - 1.1.7 emergency response
  - 1.1.8 management system administration including: evaluation, records and statistics, maintenance of system
- 1.2 explain each of the elements reflecting on occupational health and safety implications
- 1.3 define health and safety elements relevant to the world-of-work
- 1.4 present a health and safety plan clarifying its relevance to the work world and society in general

**2. research common processes and methods of hazard identification, assessment and control specific to the pathway or series of courses**

- 2.1 research and identify common job site hazard identification processes
- 2.2 research and identify common methods for assessment and control of hazards
- 2.3 explain and demonstrate appropriate health and safety effective practices
- 2.4 demonstrate a proactive personal commitment toward improvement of workplace health and safety including concern for others and following instructions, rules and guidelines

**3. identify, describe and demonstrate the safe and correct use of shop procedures and equipment**

- 3.1 demonstrate knowledge of and follow safety rules and guidelines related to the use of specialty hand and measuring tools, as well as shop/laboratory routines
- 3.2 identify the hazards with the use of:
  - 3.2.1 adhesives
  - 3.2.2 sealers

**4. identify, describe and demonstrate the safe and correct use of power and specialty hand tools used in the trade**

- 4.1 identify and describe the following common specialty tools:
  - 4.1.1 tube flare kit
  - 4.1.2 tubing cutter
  - 4.1.3 tubing bender
  - 4.1.4 twist drills

- 4.1.5 reamers
  - 4.1.6 taps and tap handles
  - 4.1.7 dies and diestock
  - 4.1.8 stud extractors
  - 4.1.9 pneumatic tools
  - 4.1.10 drill press
  - 4.1.11 pedestal grinder
  - 4.1.12 vises
  - 4.1.13 hack saws
- 5. identify, describe and demonstrate the safe and correct use of measuring tools used in the trade**
- 5.1 describe and use the following common measuring tools:
    - 5.1.1 steel rule
    - 5.1.2 feeler blades
    - 5.1.3 vernier, dial and digital slide calipers
    - 5.1.4 micrometer
    - 5.1.5 dial indicator
    - 5.1.6 transfer gauges
    - 5.1.7 Plastigauge™
    - 5.1.8 torque wrench
    - 5.1.9 pull scale
- 6. list and describe fastening devices used in the trade**
- 6.1 identify and describe the following:
    - 6.1.1 threaded fasteners
    - 6.1.2 bolt grades
    - 6.1.3 bolt identification
    - 6.1.4 nuts
    - 6.1.5 washers
    - 6.1.6 torquing techniques
    - 6.1.7 snap rings and clips
    - 6.1.8 set screws
    - 6.1.9 keys
    - 6.1.10 splines
    - 6.1.11 pins
    - 6.1.12 plastic trim fasteners
  - 6.2 describe the use of:
    - 6.2.1 adhesives
    - 6.2.2 sealers
- 7. demonstrate proper techniques when using fastening devices**
- 7.1 select or modify a plan for a simple product that will meet a defined need
  - 7.2 identify and select the appropriate tools, materials and processes required to make the product
  - 7.3 list the steps that are required to make a product in a safe and logical order
  - 7.4 demonstrate the following tasks:
    - 7.4.1 tap a blind hole
    - 7.4.2 cut threads with a die and diestock
    - 7.4.3 repair threads using thread-restoring inserts
    - 7.4.4 broken fastener removal
    - 7.4.5 convert numbers between decimals and fractions
    - 7.4.6 identify linear measurements in imperial and SI units
    - 7.4.7 identify torque measurements in imperial and SI units

**8. demonstrate basic competencies**

- 8.1 demonstrate fundamental skills to:
  - 8.1.1 communicate
  - 8.1.2 manage information
  - 8.1.3 use numbers
  - 8.1.4 think and solve problems
- 8.2 demonstrate personal management skills to:
  - 8.2.1 demonstrate positive attitudes and behaviours
  - 8.2.2 be responsible
  - 8.2.3 be adaptable
  - 8.2.4 learn continuously
  - 8.2.5 work safely
- 8.3 demonstrate teamwork skills to:
  - 8.3.1 work with others
  - 8.3.2 participate in projects and tasks

**9. make personal connections to the cluster content and processes to inform possible pathway choices**

- 9.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 9.2 create a connection between a personal inventory and occupational choices



## **COURSE MEC1020: VEHICLE SERVICE & CARE**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students develop the knowledge, skills and attitudes to care for and service a motor vehicle.

**Parameters:** Access to commercially available products and related resources.

**Note:** Customer work must be checked by a qualified technician.

**Outcomes:** The student will:

- 1. demonstrate the safe use of tools and follow established laboratory procedures**
  - 1.1 demonstrate knowledge of and follow practices that promote safety and protect the environment
- 2. develop a preventive maintenance service schedule for a vehicle**
  - 2.1 explain why preventive maintenance can:
    - 2.1.1 avoid expensive repairs
    - 2.1.2 improve reliability and safety
    - 2.1.3 improve efficiency
    - 2.1.4 extend the life of the vehicle
  - 2.2 identify and locate a vehicle's major mechanical and structural components that need regular service and care
  - 2.3 identify and safely use common hand tools and equipment
  - 2.4 identify from the owner's manual the recommended:
    - 2.4.1 type and grade of motor oil
    - 2.4.2 type of engine coolant
    - 2.4.3 brake fluid
    - 2.4.4 power steering fluid
    - 2.4.5 transmission fluid
    - 2.4.6 type of filters
  - 2.5 identify potential trouble signs including:
    - 2.5.1 warning lights or gauges
    - 2.5.2 unusual odours or noises
    - 2.5.3 burning oil
    - 2.5.4 leaks
    - 2.5.5 other
- 3. inspect and service a vehicle according to the vehicle service schedule**
  - 3.1 identify the components of a work order
  - 3.2 prepare a repair order
  - 3.3 prepare a service schedule using the owner's manual or a shop manual to determine when to:
    - 3.3.1 change lubrication fluids
    - 3.3.2 replace filters
    - 3.3.3 drain and replace coolants
    - 3.3.4 lubricate body components
    - 3.3.5 inspect and lubricate suspension and steering joints
    - 3.3.6 inspect brake linings

- 3.3.7 repack wheel bearings
- 3.3.8 rotate tires
- 3.3.9 other
- 3.4 demonstrate a visual inspection of:
  - 3.4.1 fluid levels
  - 3.4.2 hose and belt condition
  - 3.4.3 tire pressure and condition
  - 3.4.4 lights and accessories
  - 3.4.5 battery condition
- 3.5 demonstrate the procedure used to:
  - 3.5.1 replace engine motor oil, coolant and filters
  - 3.5.2 lubricate chassis and body parts
  - 3.5.3 clean and check the battery condition
  - 3.5.4 rotate tires
  - 3.5.5 check tire pressure
  - 3.5.6 dispose of used fluids and parts
  - 3.5.7 remove and replace a tire and rim from a vehicle
  - 3.5.8 boost (jump-start) a vehicle
  - 3.5.9 demonstrate basic troubleshooting on a stalled vehicle
- 4. clean and apply a protective coating to the exterior and interior surfaces of a vehicle for use or storage**
  - 4.1 describe what steps should be taken when a vehicle is stored for a period of time
  - 4.2 explain why it is necessary to shelter or protect a vehicle from:
    - 4.2.1 the sun's radiation
    - 4.2.2 salt
    - 4.2.3 heat and cold
    - 4.2.4 other
  - 4.3 identify and demonstrate the use of products that can be safely used to:
    - 4.3.1 clean a painted surface
    - 4.3.2 degrease components
    - 4.3.3 wax and polish a surface
    - 4.3.4 other; e.g., chip protection
- 5. demonstrate basic competencies**
  - 5.1 demonstrate fundamental skills to:
    - 5.1.1 communicate
    - 5.1.2 manage information
    - 5.1.3 use numbers
    - 5.1.4 think and solve problems
  - 5.2 demonstrate personal management skills to:
    - 5.2.1 demonstrate positive attitudes and behaviours
    - 5.2.2 be responsible
    - 5.2.3 be adaptable
    - 5.2.4 learn continuously
    - 5.2.5 work safely
  - 5.3 demonstrate teamwork skills to:
    - 5.3.1 work with others
    - 5.3.2 participate in projects and tasks

**6. make personal connections to the cluster content and processes to inform possible pathway choices**

- 6.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 6.2 create a connection between a personal inventory and occupational choices



## **COURSE MEC1040: ENGINE FUNDAMENTALS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students investigate and describe operating principles, construction and applications of engines.

**Parameters:** Access to engine measuring tools, related resources and engine units.

**Outcomes:** The student will:

### **1. demonstrate the safe use of tools and follow established laboratory procedures**

- 1.1 demonstrate knowledge of and follow laboratory safety procedures
- 1.2 describe the hazards associated with:
  - 1.2.1 gasoline and other flammable liquids
  - 1.2.2 exhaust gases
  - 1.2.3 hot coolants and liquids

### **2. compare operating principles of two- and four-cycle piston engines**

- 2.1 identify and use measuring tools in both imperial and metric systems of measurement including:
  - 2.1.1 steel rule
  - 2.1.2 callipers and dividers
  - 2.1.3 micrometer
  - 2.1.4 dial indicator
  - 2.1.5 torque wrench
  - 2.1.6 pressure gauges
  - 2.1.7 other
- 2.2 identify and use fasteners associated with engines (measurements in both imperial and metric) including:
  - 2.2.1 bolts, studs and nuts
  - 2.2.2 washers
  - 2.2.3 pins
  - 2.2.4 keys
  - 2.2.5 snap rings
  - 2.2.6 machine screws
  - 2.2.7 other
- 2.3 describe the effects of heating a gas in an enclosed space
- 2.4 identify the types of fuels commonly used in combustion engines
- 2.5 describe the difference between an internal and external combustion engine
- 2.6 identify the type of engines and fuels that are used for air, land, sea and space applications

### **3. determine the condition of an internal combustion engine**

- 3.1 locate and use resources related to:
  - 3.1.1 service bulletins and repair manuals
  - 3.1.2 engine specifications documentation
  - 3.1.3 parts numbers and assembly procedures
- 3.2 identify and label the major parts of a reciprocating engine
- 3.3 demonstrate how reciprocating motion is converted to rotary motion
- 3.4 explain the difference between a two- and a four-stroke cycle engine

- 3.5 explain the purpose of the following support systems:
  - 3.5.1 cooling
  - 3.5.2 lubrication
  - 3.5.3 ignition
  - 3.5.4 fuel
  - 3.5.5 exhaust
- 3.6 demonstrate how engines differ according to their:
  - 3.6.1 number of cylinders
  - 3.6.2 design
  - 3.6.3 size
  - 3.6.4 make and model
  - 3.6.5 other
- 3.7 appraise the condition of an engine
- 4. describe the by-products of combustion and their impact on the environment**
  - 4.1 describe the by-products of combustion and their effects on personal health and the environment
- 5. demonstrate basic competencies**
  - 5.1 demonstrate fundamental skills to:
    - 5.1.1 communicate
    - 5.1.2 manage information
    - 5.1.3 use numbers
    - 5.1.4 think and solve problems
  - 5.2 demonstrate personal management skills to:
    - 5.2.1 demonstrate positive attitudes and behaviours
    - 5.2.2 be responsible
    - 5.2.3 be adaptable
    - 5.2.4 learn continuously
    - 5.2.5 work safely
  - 5.3 demonstrate teamwork skills to:
    - 5.3.1 work with others
    - 5.3.2 participate in projects and tasks
- 6. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 6.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 6.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1090: ELECTRICAL FUNDAMENTALS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students identify and describe the operating principles and applications of electricity.

**Parameters:** Access to a multimeter, a battery hydrometer, a battery charger, related battery tools and electrical supplies.

**Outcomes:** The student will:

**1. demonstrate the safe use of electrical tools and equipment and follow established laboratory procedures**

- 1.1 safely use tools/equipment and follow established laboratory procedures
- 1.2 identify causes of battery explosion/acid burns
- 1.3 describe electrical shock/burns/fires
- 1.4 outline a plan of action when an accident occurs

**2. apply electrical principles and concepts to test electrical circuits and components**

- 2.1 describe magnetic attraction and repulsion
- 2.2 produce a temporary and permanent magnet
- 2.3 find the polarity of an electromagnet
- 2.4 describe the electron theory in relation to the parts of an atom
- 2.5 describe production of electricity in the following ways:
  - 2.5.1 chemically
  - 2.5.2 thermally
  - 2.5.3 photoelectrically
  - 2.5.4 piezoelectrically
  - 2.5.5 electromagnetically
- 2.6 explain the difference between AC and DC current
- 2.7 identify and label the parts of a simple circuit
- 2.8 identify the physical form and circuit symbol of a:
  - 2.8.1 light
  - 2.8.2 motor
  - 2.8.3 heating element
  - 2.8.4 solenoid
  - 2.8.5 fuse
  - 2.8.6 other
- 2.9 describe what conditions create:
  - 2.9.1 an open circuit
  - 2.9.2 a closed circuit
  - 2.9.3 a short circuit
  - 2.9.4 a grounded circuit
- 2.10 describe how a frame ground circuit operates on a motor vehicle

- 2.11 define what is meant by:
  - 2.11.1 amperage
  - 2.11.2 voltage
  - 2.11.3 resistance
- 2.12 compare the similarity between electrical and fluid energy
- 2.13 construct and compare a series and a parallel circuit
- 2.14 measure, with appropriate meters, the resistance, voltage and amperage in a given circuit
- 2.15 describe the relationship that exists among the amperage, voltage and resistance within a circuit
- 2.16 describe the condition of a battery and service
- 3. demonstrate basic competencies**
  - 3.1 demonstrate fundamental skills to:
    - 3.1.1 communicate
    - 3.1.2 manage information
    - 3.1.3 use numbers
    - 3.1.4 think and solve problems
  - 3.2 demonstrate personal management skills to:
    - 3.2.1 demonstrate positive attitudes and behaviours
    - 3.2.2 be responsible
    - 3.2.3 be adaptable
    - 3.2.4 learn continuously
    - 3.2.5 work safely
  - 3.3 demonstrate teamwork skills to:
    - 3.3.1 work with others
    - 3.3.2 participate in projects and tasks
- 4. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 4.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 4.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1110: PNEUMATICS & HYDRAULICS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students identify and describe the operating principles and applications of pneumatic and hydraulic systems.

**Parameters:** Access to related pneumatic and hydraulic units and resources.

**Outcomes:** The student will:

- 1. demonstrate the safe use of pneumatic and hydraulic tools and equipment and follow established laboratory procedures**
  - 1.1 demonstrate knowledge of and follow laboratory safety procedures
  - 1.2 list hazards related to working with fluids and gases under pressure and related equipment
- 2. compare operating principles of pneumatic and hydraulic systems**
  - 2.1 state why fluid systems are widely used in transportation and power applications
  - 2.2 contrast hydraulic and pneumatic systems
  - 2.3 demonstrate how pressure affects a liquid and a gas in an enclosed space
  - 2.4 describe what units are used to measure pressure in a fluid
  - 2.5 describe what units are used to calculate the flow of fluid past a point
  - 2.6 demonstrate the relationship between flow rate and pressure in a fluid system
  - 2.7 describe how a small force can be multiplied in a fluid system
  - 2.8 contrast the action of common pumps and compressors including:
    - 2.8.1 impeller
    - 2.8.2 gear
    - 2.8.3 piston
    - 2.8.4 diaphragm
    - 2.8.5 vane type
  - 2.9 locate examples of these pumps and compressors in a motor vehicle or some other power system
- 3. apply principles and concepts of pneumatics and hydraulics to test and operate a pneumatic and/or hydraulic system**
  - 3.1 observe and demonstrate the use of valves to control:
    - 3.1.1 direction of flow
    - 3.1.2 pressure of fluids
    - 3.1.3 flow rate of fluids
  - 3.2 locate valves on a given vehicle
  - 3.3 demonstrate how fluids under pressure can be used to move a:
    - 3.3.1 motor
    - 3.3.2 cylinder
    - 3.3.3 diaphragm
  - 3.4 identify and operate pneumatic and hydraulic units on a given vehicle
  - 3.5 describe the principles in a fluid system such as:
    - 3.5.1 hydraulic hoist
    - 3.5.2 hydraulic brakes

- 3.6 demonstrate how to check and adjust fluid levels
- 3.7 demonstrate how to double and single flare a steel line and indicate when each flare type should be used
- 4. demonstrate basic competencies**
  - 4.1 demonstrate fundamental skills to:
    - 4.1.1 communicate
    - 4.1.2 manage information
    - 4.1.3 use numbers
    - 4.1.4 think and solve problems
  - 4.2 demonstrate personal management skills to:
    - 4.2.1 demonstrate positive attitudes and behaviours
    - 4.2.2 be responsible
    - 4.2.3 be adaptable
    - 4.2.4 learn continuously
    - 4.2.5 work safely
  - 4.3 demonstrate teamwork skills to:
    - 4.3.1 work with others
    - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1130: MECHANICAL SYSTEMS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students identify and describe the operating principles and applications of mechanisms used to transmit and control mechanical energy.

**Parameters:** Access to examples of mechanical units and related resources.

**Outcomes:** The student will:

**1. demonstrate the safe use of tools and follow established laboratory procedures**

- 1.1 demonstrate knowledge of and follow laboratory safety procedures
- 1.2 explain dangers associated with rotating/moving components

**2. describe principles and concepts related to the use of mechanisms to control and transmit force and motion in a mechanical system**

- 2.1 describe the application of mechanical systems that are found in all aspects of human endeavour
- 2.2 demonstrate the use of simple machines to change the:
  - 2.2.1 direction in which a force acts
  - 2.2.2 size of the force
  - 2.2.3 place where the force acts
- 2.3 identify and describe a mechanism that produces:
  - 2.3.1 linear motion
  - 2.3.2 reciprocating motion
  - 2.3.3 oscillating motion
  - 2.3.4 rotary motion
  - 2.3.5 other
- 2.4 use a graph to describe the action of a cam as it changes rotary motion to linear motion
- 2.5 explain the difference between direct and indirect transmission of power
- 2.6 describe the purpose and types of:
  - 2.6.1 shafts
  - 2.6.2 couplers
  - 2.6.3 universal joints
  - 2.6.4 pins
  - 2.6.5 others

**3. apply basic principles and concepts of mechanical systems**

- 3.1 demonstrate the use of simple machines to:
  - 3.1.1 start and stop motion
  - 3.1.2 change directions
  - 3.1.3 increase or decrease speed
  - 3.1.4 increase or decrease torque
- 3.2 describe the relationship between torque, velocity and gear ratios
- 3.3 explain why friction has both positive and negative attributes
- 3.4 compare the coefficient of friction between two different materials
- 3.5 describe how friction can be increased or decreased in a mechanical system
- 3.6 calculate the mechanical advantage of one or more mechanisms to determine the efficiency of the system

- 3.7 explain how mechanical energy can be changed to:
  - 3.7.1 heat energy
  - 3.7.2 electrical energy
  - 3.7.3 fluid energy
  - 3.7.4 other
- 3.8 list, observe and service mechanical systems on a given vehicle
- 4. demonstrate basic competencies**
  - 4.1 demonstrate fundamental skills to:
    - 4.1.1 communicate
    - 4.1.2 manage information
    - 4.1.3 use numbers
    - 4.1.4 think and solve problems
  - 4.2 demonstrate personal management skills to:
    - 4.2.1 demonstrate positive attitudes and behaviours
    - 4.2.2 be responsible
    - 4.2.3 be adaptable
    - 4.2.4 learn continuously
    - 4.2.5 work safely
  - 4.3 demonstrate teamwork skills to:
    - 4.3.1 work with others
    - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1150: RIDE & CONTROL SYSTEMS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students develop a basic knowledge of ride and control systems associated with vehicles.

**Parameters:** Access to a floor jack, safety stands, a suspension/steering system and related resources.

**Outcomes:** The student will:

- 1. demonstrate the safe use of tools and follow established laboratory procedures**
  - 1.1 demonstrate knowledge of and follow established safety procedures
- 2. describe the purpose, operation and interdependent nature of ride and control systems**
  - 2.1 locate and identify the components that are used to provide:
    - 2.1.1 stopping action
    - 2.1.2 directional control
    - 2.1.3 rolling action
    - 2.1.4 stabilization
    - 2.1.5 cushioning
    - 2.1.6 other actions
  - 2.2 describe methods of directional control on land, sea and air vehicles/crafts
  - 2.3 describe the method of steering used by most wheeled vehicles
  - 2.4 explain the purpose of the parts of a conventional steering system; e.g., steering gear, tie rod end, idler arm, pitman arm and steering knuckle
  - 2.5 list the parts of a steering system that are subject to wearing or bending
  - 2.6 identify and describe the action of the following types of braking systems and possible application:
    - 2.6.1 mechanical
    - 2.6.2 hydraulic
    - 2.6.3 electric
    - 2.6.4 air
    - 2.6.5 other
  - 2.7 explain the difference between the braking action of a disc brake and the breaking action of a drum brake
  - 2.8 determine how tires and tracks vary according to:
    - 2.8.1 road or terrain use
    - 2.8.2 seasonal use
    - 2.8.3 methods of construction
  - 2.9 show how to examine the wear pattern on a tire to determine whether it has been:
    - 2.9.1 overinflated or underinflated
    - 2.9.2 improperly aligned
    - 2.9.3 subject to suspension faults
    - 2.9.4 balanced improperly

- 3. inspect and service ride and control systems**
  - 3.1 check and complete a tire repair
  - 3.2 complete a tire balance
  - 3.3 identify tire wear problems
  - 3.4 inspect and repack wheel bearing
  - 3.5 list and identify the parts of a braking system that are subject to wearing, seizing or leaking
- 4. demonstrate basic competencies**
  - 4.1 demonstrate fundamental skills to:
    - 4.1.1 communicate
    - 4.1.2 manage information
    - 4.1.3 use numbers
    - 4.1.4 think and solve problems
  - 4.2 demonstrate personal management skills to:
    - 4.2.1 demonstrate positive attitudes and behaviours
    - 4.2.2 be responsible
    - 4.2.3 be adaptable
    - 4.2.4 learn continuously
    - 4.2.5 work safely
  - 4.3 demonstrate teamwork skills to:
    - 4.3.1 work with others
    - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1160: STRUCTURES & MATERIALS**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students identify the types of materials and components used in vehicle construction.

**Parameters:** Access to a vehicle, hand tools, fasteners, materials and related resources.

**Outcomes:** The student will:

- 1. demonstrate the safe use of tools and follow established laboratory procedures**
  - 1.1 state health and environmental issues related to the replacement and repair of coated surfaces
  - 1.2 state how hazardous materials are handled and disposed of
- 2. explain the relationship between the function of a vehicle and the materials used in its construction**
  - 2.1 outline the historical development of materials used in transportation vehicles
  - 2.2 identify what parts of a vehicle are recyclable
  - 2.3 cite examples of initiatives that will increase the percentage of parts that can be recycled
  - 2.4 list ways government regulations have altered the design and construction of vehicles
  - 2.5 identify design features that are tied more closely to consumer taste than function
  - 2.6 identify and discuss the factors that have contributed to the use and development of new structural materials
  - 2.7 identify the factors used to select a material for a given function
  - 2.8 indicate how design and construction of a vehicle is affected by the medium (land, sea, air, space) in which it operates
  - 2.9 identify the monolith and composite materials used in a modern vehicle
- 3. examine and identify the basic parts and materials used in vehicle construction**
  - 3.1 describe the most appropriate methods of identifying the type of materials used in a part or structure
  - 3.2 describe the action of a coil spring when subject to rapid loading
  - 3.3 describe how to:
    - 3.3.1 reduce the weight of a vehicle
    - 3.3.2 reduce drag
    - 3.3.3 increase passenger safety
    - 3.3.4 increase longevity of structural parts
    - 3.3.5 improve passenger comfort and space
  - 3.4 demonstrate knowledge of common types of fasteners used including:
    - 3.4.1 studs, bolts, screws
    - 3.4.2 nuts
    - 3.4.3 rivets
    - 3.4.4 clips
    - 3.4.5 clamps

- 3.5 identify what structural coatings are used to:
  - 3.5.1 protect against corrosion
  - 3.5.2 add to the appearance
  - 3.5.3 reduce effects of the sun's radiation
  - 3.5.4 reduce noise

**4. demonstrate basic competencies**

- 4.1 demonstrate fundamental skills to:
  - 4.1.1 communicate
  - 4.1.2 manage information
  - 4.1.3 use numbers
  - 4.1.4 think and solve problems
- 4.2 demonstrate personal management skills to:
  - 4.2.1 demonstrate positive attitudes and behaviours
  - 4.2.2 be responsible
  - 4.2.3 be adaptable
  - 4.2.4 learn continuously
  - 4.2.5 work safely
- 4.3 demonstrate teamwork skills to:
  - 4.3.1 work with others
  - 4.3.2 participate in projects and tasks

**5. make personal connections to the cluster content and processes to inform possible pathway choices**

- 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1165: MECHANICS WELDING FUNDAMENTALS**

**Level:** Introductory

**Prerequisite:** MEC1015: Mechanics Tools & Materials

**Description:** Students perform metal heating and cutting operations safely using oxyacetylene equipment, and perform non-structural welding using Gas Metal Arc Welding (GMAW) equipment.

**Parameters:** Access to a materials work centre, complete with oxyacetylene heating and cutting equipment, GMAW equipment, fabrication facilities, and to instruction from an individual with formal specialized training in oxyacetylene and GMAW.

**Outcomes:** The student will:

### **Using Oxyacetylene Equipment:**

#### **1. identify and demonstrate the use of personal protective equipment**

- 1.1 use an appropriate fire extinguisher in the event of fire
- 1.2 use eye protection
- 1.3 use protective clothing
- 1.4 use protective footwear
- 1.5 use proper ventilation
- 1.6 follow proper safety procedures

#### **2. describe the characteristics and safe handling procedures for oxygen and acetylene**

- 2.1 identify and describe the properties of oxygen gas
- 2.2 identify and describe the make-up of an oxygen cylinder/bottle including valves and safety devices
- 2.3 identify and describe the properties of acetylene gas
- 2.4 identify and describe the make-up of an acetylene cylinder/bottle including valves and safety devices
- 2.5 correctly follow cylinder transport procedures
- 2.6 correctly mount cylinder and attach regulator and hoses

#### **3. demonstrate safe handling procedures for regulators and hoses**

- 3.1 identify and describe regulators and torches including:
  - 3.1.1 purpose
  - 3.1.2 regulator types
  - 3.1.3 torch types
  - 3.1.4 identification, hoses
  - 3.1.5 flashback arrestors
  - 3.1.6 torch check valves—reverse flow check valves
  - 3.1.7 torch types and parts

#### **4. demonstrate the safe use, care and maintenance of torches and tips**

- 4.1 identify and describe conditions that lead to backfires and flashbacks
- 4.2 identify and describe flame types and functions
- 4.3 demonstrate:
  - 4.3.1 purge and leak tests
  - 4.3.2 start-up and shut-down procedures

- 4.4 demonstrate:
  - 4.4.1 correct heating tip selection
  - 4.4.2 check and clean tips and torches
  - 4.4.3 install tips
  - 4.4.4 balance regulators and adjust torch flame
  - 4.4.5 heat metal
  - 4.4.6 shut down equipment

**5. perform basic cutting operations**

- 5.1 fit, light and adjust cutting torch
- 5.2 maintain cutting torch and tips
- 5.3 select correct tip for planned activity
- 5.4 cut holes in metal plate
- 5.5 cut and remove rivets and bolts
- 5.6 shut down cutting torch

**Using GMAW Welding Equipment:**

**6. identify and demonstrate the use of personal protective equipment**

- 6.1 identify the appropriate fire extinguisher in the event of a fire
- 6.2 use eye protection
- 6.3 use protective clothing
- 6.4 use protective footwear
- 6.5 use proper ventilation
- 6.6 follow proper safety procedures

**7. describe the principles of operation of GMAW**

- 7.1 identify and describe:
  - 7.1.1 principles of operation
  - 7.1.2 metal transfer

**8. identify the components of a basic GMAW set-up**

- 8.1 apply safe work practices and procedures to:
  - 8.1.1 select and use appropriate personal protective equipment
  - 8.1.2 maintain a clean and tidy work station
  - 8.1.3 demonstrate safe tool/material handling and storage techniques
- 8.2 for a given type of weld and/or weldment, select the appropriate:
  - 8.2.1 wire type, size and feed rate
  - 8.2.2 current
  - 8.2.3 shielding gas type and flow rate
- 8.3 prepare and clean all surfaces to be welded
- 8.4 properly position metal for welding
- 8.5 identify precautions to take against electric shock, toxic fumes and radiant energy associated with GMAW

**9. diagnose and demonstrate corrective measures for malfunctioning GMAW equipment**

- 9.1 describe and demonstrate the maintenance required for wire drive systems and gun assemblies

**10. demonstrate basic welding technique**

- 10.1 demonstrate tack weld components to gain competency
- 10.2 make light-gauge fillet welds in the flat and horizontal position and down-hand fillet welds on light gauge tubing

## **11. demonstrate basic competencies**

- 11.1 demonstrate fundamental skills to:
  - 11.1.1 communicate
  - 11.1.2 manage information
  - 11.1.3 use numbers
  - 11.1.4 think and solve problems
- 11.2 demonstrate personal management skills to:
  - 11.2.1 demonstrate positive attitudes and behaviours
  - 11.2.2 be responsible
  - 11.2.3 be adaptable
  - 11.2.4 learn continuously
  - 11.2.5 work safely
- 11.3 demonstrate teamwork skills to:
  - 11.3.1 work with others
  - 11.3.2 participate in projects and tasks

## **12. make personal connections to the cluster content and processes to inform possible pathway choices**

- 12.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 12.2 create a connection between a personal inventory and occupational choices



## **COURSE MEC1170: METAL FORMING & FINISHING**

**Level:** Introductory

**Prerequisite:** MEC1160: Structures & Materials

**Description:** Students repair and re-form damaged metal panels.

**Parameters:** Access to oxy-fuel welding equipment, basic autobody hand/power tools, basic metal refinishing material, resources and to instruction from an individual with formal specialized training.

**Supporting Course:** FAB1040: Oxyacetylene Welding

**Outcomes:** The student will:

- 1. demonstrate safe work practices when metal forming and finishing and follow established laboratory procedures**
  - 1.1 demonstrate safe practices in relation to:
    - 1.1.1 personal protective equipment/clothes
    - 1.1.2 use of impact tools, drills, grinders, cutters, sheet metal brake and shear
    - 1.1.3 safe use of oxyacetylene and Gas Metal Arc Welding (GMAW) equipment
    - 1.1.4 hazards of body fillers
- 2. describe the effects of physical damage caused by distortion and corrosion on sheet metal components**
  - 2.1 identify properties of:
    - 2.1.1 low carbon steels
    - 2.1.2 high strength steels
- 3. apply metal forming and finishing skills to repair minor panel damage**
  - 3.1 list tools and equipment available to shape and finish sheet metal
  - 3.2 identify the process required for specific types of metal shaping
  - 3.3 identify processes for metal working and repairing small dents using:
    - 3.3.1 pry bar
    - 3.3.2 pulling tools
    - 3.3.3 hammering techniques
  - 3.4 describe possible methods of small rust out repair
  - 3.5 describe the best method of small rust out repair
  - 3.6 identify various plastic filler materials available
  - 3.7 describe the suitable type of plastic fillers to be used
  - 3.8 complete a small rust out repair
  - 3.9 demonstrate how to:
    - 3.9.1 hammer and dolly metal panel to smooth contour
    - 3.9.2 pick, file and grind panel to desired finish
    - 3.9.3 prepare the surface for filler application
    - 3.9.4 apply plastic fillers and refinish

**4. demonstrate basic competencies**

- 4.1 demonstrate fundamental skills to:
  - 4.1.1 communicate
  - 4.1.2 manage information
  - 4.1.3 use numbers
  - 4.1.4 think and solve problems
- 4.2 demonstrate personal management skills to:
  - 4.2.1 demonstrate positive attitudes and behaviours
  - 4.2.2 be responsible
  - 4.2.3 be adaptable
  - 4.2.4 learn continuously
  - 4.2.5 work safely
- 4.3 demonstrate teamwork skills to:
  - 4.3.1 work with others
  - 4.3.2 participate in projects and tasks

**5. make personal connections to the cluster content and processes to inform possible pathway choices**

- 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1190: SURFACE PREPARATION 1**

<b>Level:</b>	Introductory
<b>Prerequisite:</b>	None
<b>Description:</b>	Students assess the state of a painted surface and use appropriate restoration procedures.
<b>Parameters:</b>	Access to painting facilities, surface preparation tools/materials and related resources.
<b>Outcomes:</b>	The student will:

### **1. demonstrate safe work practices for surface preparation and follow established laboratory procedures**

1.1 demonstrate safe practices in relation to:

- 1.1.1 abrasive dust
- 1.1.2 chemicals/fumes

### **2. identify products, equipment and procedures associated with surface preparation**

- 2.1 identify and describe problem conditions in painted surfaces
- 2.2 list types of equipment/tools used in surface preparation processes
- 2.3 list types of abrasives used in surface preparation
- 2.4 identify alternative method of surface preparation; e.g., chemical stripping, blasting
- 2.5 demonstrate knowledge of types, purpose and methods of applying undercoats
- 2.6 identify types and uses of putties
- 2.7 identify methods of masking
- 2.8 list equipment used in masking

### **3. prepare and perform a surface preparation**

- 3.1 explain and demonstrate methods of sanding
- 3.2 use appropriate methods of surface preparation
- 3.3 identify and apply appropriate metal conditioner
- 3.4 demonstrate how to mask a surface prior to painting

### **4. demonstrate basic competencies**

- 4.1 demonstrate fundamental skills to:
  - 4.1.1 communicate
  - 4.1.2 manage information
  - 4.1.3 use numbers
  - 4.1.4 think and solve problems
- 4.2 demonstrate personal management skills to:
  - 4.2.1 demonstrate positive attitudes and behaviours
  - 4.2.2 be responsible
  - 4.2.3 be adaptable
  - 4.2.4 learn continuously
  - 4.2.5 work safely
- 4.3 demonstrate teamwork skills to:
  - 4.3.1 work with others
  - 4.3.2 participate in projects and tasks

**5. make personal connections to the cluster content and processes to inform possible pathway choices**

- 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 5.2 create a connection between a personal inventory and occupational choices

## **COURSE MEC1910: MEC PROJECT A**

**Level:** Introductory

**Prerequisite:** None

**Description:** Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

**Parameters:** Introductory project courses must connect with a minimum of two CTS courses, one of which must be at the introductory level and be in the same occupational area as the project course. The other CTS course(s) can be either at the same level or at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

**All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.**

### **Outcomes:**

The teacher/student will:

- 1. identify the connection between this project course and two or more CTS courses**
  - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
  - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
- 2. propose the project and/or performance**
  - 2.1 identify the project and/or performance by:
    - 2.1.1 preparing a plan
    - 2.1.2 clarifying the purposes
    - 2.1.3 defining the deliverables
    - 2.1.4 specifying time lines
    - 2.1.5 explaining terminology, tools and processes
    - 2.1.6 defining resources; e.g., materials, costs, staffing
  - 2.2 identify and comply with all related health and safety standards
  - 2.3 define assessment standards (indicators for success)
  - 2.4 present the proposal and obtain necessary approvals

The student will:

- 3. meet goals as defined within the plan**
  - 3.1 complete the project and/or performance as outlined
  - 3.2 monitor the project and/or performance and make necessary adjustments
  - 3.3 present the project and/or performance, indicating the:
    - 3.3.1 outcomes attained
    - 3.3.2 relationship of outcomes to goals originally set

- 3.4 evaluate the project and/or performance, indicating the:
  - 3.4.1 processes and strategies used
  - 3.4.2 recommendations on how the project and/or performance could have been improved
- 4. demonstrate basic competencies**
  - 4.1 demonstrate fundamental skills to:
    - 4.1.1 communicate
    - 4.1.2 manage information
    - 4.1.3 use numbers
    - 4.1.4 think and solve problems
  - 4.2 demonstrate personal management skills to:
    - 4.2.1 demonstrate positive attitudes and behaviours
    - 4.2.2 be responsible
    - 4.2.3 be adaptable
    - 4.2.4 learn continuously
    - 4.2.5 work safely
  - 4.3 demonstrate teamwork skills to:
    - 4.3.1 work with others
    - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
  - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
  - 5.2 create a connection between a personal inventory and occupational choices