

## **COURSE FAB3010: MATERIALS TESTING**

**Level:** Advanced

**Prerequisite:** FAB1010: Fabrication Tools & Materials

**Description:** Students are introduced to the principles of materials testing and to the development and evaluation of a mechanical materials test.

**Parameters:** Access to common hand and power assisted tools and to instruction from an individual with specialized training in materials testing.

**Supporting Courses:** FAB1100: Fabrication Principles  
DES1020: The Design Process

**Outcomes:** The student will:

- 1. describe the purpose and nature of materials testing**
  - 1.1 identify and describe common methods of testing materials; e.g., non-destructive, destructive
  - 1.2 explain how test results are recorded and communicate a plan showing how to anticipate the results of a test
  - 1.3 identify common hazards associated with the use of a specific tool, material and/or process
  - 1.4 identify and correct potential hazards within the working environment
  - 1.5 describe a safety plan in case of an accident
- 2. apply testing principles to construct or use a piece of materials testing apparatus**
  - 2.1 design a piece of testing apparatus or test procedure
  - 2.2 create safety controls
  - 2.3 construct testing devices
  - 2.4 identify type of test, calibration and data recovery
  - 2.5 prepare the materials, as required
- 3. test and compare the properties of common materials used in construction and fabrication**
  - 3.1 conduct a given test on a variety of materials and record the test results
  - 3.2 analyze an existing piece of test equipment and describe its:
    - 3.2.1 purpose
    - 3.2.2 operation
    - 3.2.3 method of calibration and data recovery
  - 3.3 compare the data obtained from the materials tested to anticipated results
  - 3.4 explain the reliability of the testing procedure
  - 3.5 identify the advantages/disadvantages of the test being carried out
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3020: METALLURGY FUNDAMENTALS**

**Level:** Advanced

**Prerequisite:** FAB1010: Fabrication Tools & Materials

**Description:** Students develop fundamental understanding and skills related to metallurgy and apply these skills to fabrication processes.

**Parameters:** Access to a fabrication work centre, complete with heat treating equipment, and to instruction from an individual with specialized training in heat treating practices.

**Supporting Course:** FAB3010: Materials Testing

**Outcomes:** The student will:

- 1. identify and describe the fundamental principles of metallurgy and its industrial applications**
  - 1.1 list and describe the three major fields of metallurgy; i.e., extractive, mechanical, physical
  - 1.2 explain how the principles of metallurgy are used in:
    - 1.2.1 welding
    - 1.2.2 foundry
    - 1.2.3 mechanically forming and finishing metals
  - 1.3 explain the relationship between the properties of a metal and its structure
  - 1.4 describe the effects of adding greater or lesser percentages of carbon to the strength, hardness and brittleness of steel
  - 1.5 describe the effects of cooling on the size and shape of a crystal
- 2. identify the basic alloy components and properties of common alloys**
  - 2.1 use terms to describe the internal structure of metals; e.g., atomic structure, compound, solution, crystal
  - 2.2 compare the effects of heating and cooling on steel with varying carbon contents
  - 2.3 identify elements that are dissolved together to form common alloys including:
    - 2.3.1 steel
    - 2.3.2 bronze
    - 2.3.3 brass
    - 2.3.4 aluminum
  - 2.4 identify the basic alloy components and common uses of the following steel types:
    - 2.4.1 carbon
    - 2.4.2 alloy
    - 2.4.3 tool
    - 2.4.4 stainless
  - 2.5 describe common methods of identifying ferrous and non-ferrous materials such as spark, magnetic and specific gravity tests
  - 2.6 describe the electrochemical nature of corrosion
  - 2.7 identify common methods of reducing corrosion; e.g., protective coating, oxide layers, alloys

- 3. apply metallurgical principles, skills and processes to heat treat a component or product**
  - 3.1 describe the process and purpose of:
    - 3.1.1 quenching
    - 3.1.2 normalizing
    - 3.1.3 annealing
    - 3.1.4 tempering
    - 3.1.5 surface hardening
  - 3.2 explain how heat treating principles are applied to welding and other fabrication processes
  - 3.3 explain how cold working differs from heat treating
  - 3.4 determine the procedures and critical temperatures to heat treat one or more of the following tools:
    - 3.4.1 wood chisel
    - 3.4.2 screwdriver
    - 3.4.3 centre punch
    - 3.4.4 cold chisel
  - 3.5 describe the safe start-up and shut-down procedures of a heat treating furnace
  - 3.6 use the appropriate materials, processes and tools to fabricate and condition a new product or make repairs on an existing product
  - 3.7 research ways to test a product for hardness and toughness
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3030: GAS TUNGSTEN ARC WELDING**

**Level:** Advanced

**Prerequisite:** FAB2030: Oxyfuel Welding

**Description:** Students develop basic knowledge and skills related to the use of Gas Tungsten Arc Welding (GTAW) equipment and supplies to weld mild steel in the flat and horizontal positions.

**Parameters:** Access to a welding facility, complete with GTAW equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Supporting Courses:** FAB2060: Arc Welding 2  
FAB2070: Gas Metal Arc Welding 1

**Outcomes:** The student will:

- 1. take preventive measures to avoid accidents and personal injury to self and others by identifying health and safety hazards associated with GTAW**
  - 1.1 identify and describe the health and safety issues associated with GTAW, including:
    - 1.1.1 electric current
    - 1.1.2 inert gases
    - 1.1.3 arc radiation
    - 1.1.4 ventilation
  - 1.2 describe a safety plan in case of an accident
- 2. outline the advantages of GTAW over other forms of welding**
  - 2.1 describe the basic components and operating principles of GTAW
  - 2.2 identify the advantages of GTAW over other forms of arc welding
  - 2.3 describe the major types of power supplies and current outputs; e.g., high frequency current, alternating current (AC), direct current straight polarity (DCSP), direct current reverse polarity (DCRP)
- 3. demonstrate basic GTAW competencies in the flat and horizontal positions**
  - 3.1 identify the appropriate type of current used for welding:
    - 3.1.1 low carbon steel
    - 3.1.2 aluminium
    - 3.1.3 stainless steel
  - 3.2 explain the purpose of a shielding gas
  - 3.3 identify the appropriate type of gas to be used with:
    - 3.3.1 low carbon steel
    - 3.3.2 aluminium
    - 3.3.3 stainless steel
  - 3.4 select, prepare and install the appropriate electrode for:
    - 3.4.1 AC
    - 3.4.2 DCSP or direct current electrode negative (DCEN) welding
    - 3.4.3 DCRP or direct current electrode positive (DCEP) welding
  - 3.5 identify and demonstrate the appropriate start-up and shut-down procedures for welding mild steel
  - 3.6 show that mill scale, rust, paint or oil has been removed from the weldments

- 3.7 list the characteristics of a weld that meets trade standards
- 3.8 demonstrate proper handling techniques to prevent weld contamination
- 3.9 identify the degreasers that are commonly used to clean filler materials
- 3.10 describe the correct torch angle for a lap and groove weld in the flat, horizontal and vertical positions
- 3.11 make lap and groove welds in the flat, horizontal and vertical positions
- 3.12 perform a visual inspection of a weld and describe its characteristics
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3040: SPECIALIZED WELDING**

**Level:** Advanced

**Prerequisite:** FAB2030: Oxyfuel Welding

**Description:** Students develop specific skills associated with advanced welding techniques to join and repair metals other than low carbon steel.

**Parameters:** Access to a welding facility, complete with advanced level welding equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Supporting Courses:** FAB3030: Gas Tungsten Arc Welding  
FAB3050: Arc Welding 3  
FAB3170: Gas Metal Arc Welding 2

**Outcomes:** The student will:

- 1. list specific health and safety hazards associated with welding metals other than low carbon steels, and take preventive measures to avoid accidents and personal injury to self and others**
  - 1.1 describe the health hazards connected with welding metals containing zinc, cadmium, lead, tin and chromium
  - 1.2 describe a safety plan in case of an accident
- 2. describe the unique welding characteristics of weldable metals other than low carbon steel**
  - 2.1 research and describe the unique welding characteristics of:
    - 2.1.1 stainless steel
    - 2.1.2 cast iron
    - 2.1.3 aluminum
    - 2.1.4 white metal (zinc die cast metal)
- 3. select appropriate filler material and welding process to weld a metal other than low carbon steel**
  - 3.1 identify a suitable filler metal and flux to join or repair:
    - 3.1.1 stainless steel
    - 3.1.2 cast iron
    - 3.1.3 aluminum
    - 3.1.4 white metal (zinc die cast metal)
  - 3.2 identify the appropriate joint preparation, supports and techniques for a given metal
  - 3.3 perform a weld or repair on one or more metals other than a low carbon steel
  - 3.4 complete a visual inspection by considering the overall appearance, size and shape of the beads and degree of penetration
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3048: FLUX CORED ARC WELDING 2**

**Level:** Advanced

**Prerequisite:** FAB2048: Flux Cored Arc Welding 1

**Description:** Students develop skills to evaluate and improve the quality of Flux Cored Arc Welding (FCAW), and they extend their FCAW skills by performing horizontal and vertical groove welds.

**Parameters:** Access to a fabrication work centre, complete with FCAW equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Outcomes:** The student will:

### **1. identify variables that affect the quality of flux core arc welds and identify strategies to evaluate and improve weld quality**

1.1 identify the variables that can directly affect weld quality including the:

- 1.1.1 welding current and voltage
- 1.1.2 type of shielding gas/flux
- 1.1.3 diameter and type of filler metal
- 1.1.4 type and condition of equipment
- 1.1.5 welding technique

1.2 select the appropriate shielding gas mixture based on the:

- 1.2.1 mode of metal transfer
- 1.2.2 base metal type and thickness
- 1.2.3 joint design
- 1.2.4 filler material
- 1.2.5 desired weld quality

1.3 describe how to select the type and size of filler metal

1.4 explain how to avoid contamination of filler materials

1.5 identify the relationship between:

- 1.5.1 wire speed and amperage
- 1.5.2 welding voltage and arc length

1.6 describe the effects of:

- 1.6.1 backhand or pull welding
- 1.6.2 forehand or push welding

1.7 describe the effects of torch angle on:

- 1.7.1 weld penetration
- 1.7.2 weld appearance

1.8 describe corrective actions that can be taken to avoid:

- 1.8.1 surface porosity
- 1.8.2 subsurface porosity
- 1.8.3 lack of fusion
- 1.8.4 burn-through
- 1.8.5 lack of penetration
- 1.8.6 cold lapping

- 2. perform safe set-up, maintenance and troubleshooting procedures with FCAW equipment**
  - 2.1 perform maintenance required for wire drive systems and gun assemblies
  - 2.2 diagnose and demonstrate corrective measures for malfunctioning FCAW equipment
  - 2.3 for a given type of weld and/or weldment, select the appropriate:
    - 2.3.1 wire type, size and feed rate
    - 2.3.2 current
    - 2.3.3 shielding gas type and flow rate
  - 2.4 select the proper fit-up for a given weld
- 3. demonstrate safe FCAW practices and perform groove welds on mild steel plate in the horizontal and vertical positions**
  - 3.1 describe safety issues related to:
    - 3.1.1 using personal protective equipment
    - 3.1.2 handling and storing consumables
    - 3.1.3 keeping the welding area free of hazards
    - 3.1.4 ensuring adequate ventilation
  - 3.2 describe a safety plan in case of an accident
  - 3.3 apply safe work practices and procedures to:
    - 3.3.1 select and use appropriate personal protective equipment
    - 3.3.2 maintain a clean and tidy workstation
    - 3.3.3 demonstrate safe tool/material handling and storage techniques
  - 3.4 prepare and clean all surfaces to be welded
  - 3.5 properly position metal for welding
  - 3.6 demonstrate safe FCAW techniques and perform groove welds in the horizontal and vertical positions on mild steel plate
  - 3.7 identify problems common to out-of-position welding
  - 3.8 complete a visual inspection, i.e., non-destructive test, by observing and assessing:
    - 3.8.1 overall size, shape and appearance of beads
    - 3.8.2 plate penetration
    - 3.8.3 fusion
    - 3.8.4 degree of undercutting and overlapping
  - 3.9 perform a destructive test, where appropriate
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3050: ARC WELDING 3**

**Level:** Advanced

**Prerequisite:** FAB2060: Arc Welding 2

**Description:** Students learn the role of codes and standards in the welding trade, as well as test welds and develop vertical position welding skills.

**Parameters:** Access to a welding facility, complete with Shielded Metal Arc Welding (SMAW) equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Outcomes:** The student will:

### **1. examine and maintain SMAW equipment and accessories**

- 1.1 before beginning to weld:
  - 1.1.1 analyze the condition of cables and lugs
  - 1.1.2 ensure adequate air flow for proper cooling
  - 1.1.3 check the condition of all personal protective equipment

### **2. read and interpret weld drawings and symbols**

- 2.1 explain the purpose of welding:
  - 2.1.1 codes
  - 2.1.2 standards
  - 2.1.3 specifications
- 2.2 identify agencies that establish codes and standards in Canada and the United States; e.g., Canadian Standards Association, American Welding Society, Canadian Welding Bureau, American Society of Mechanical Engineers
- 2.3 explain the purpose of a welding symbol
- 2.4 identify the basic data included in a welding symbol
- 2.5 show how a welding symbol can be used to specify the:
  - 2.5.1 location of a weld
  - 2.5.2 type of weld
  - 2.5.3 welding process
  - 2.5.4 root opening
  - 2.5.5 contour
  - 2.5.6 degree of penetration
  - 2.5.7 type of electrode
- 2.6 analyze common destructive and non-destructive testing methods
- 2.7 use a welding symbol to determine the:
  - 2.7.1 location of a weld
  - 2.7.2 type of weld
  - 2.7.3 root opening
  - 2.7.4 type of electrode

### **3. demonstrate advanced level SMAW competencies in the vertical position**

- 3.1 use the appropriate equipment and supplies to make single and multiple pass fillet and groove welds in the vertical position
- 3.2 perform one or more destructive and non-destructive tests on a weld sample

**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. create a transitional strategy to accommodate personal changes and build personal values**

5.1 identify short-term and long-term goals

5.2 identify steps to achieve goals

**COURSE FAB3060: ARC WELDING 4**

**Level:** Advanced

**Prerequisite:** FAB3050: Arc Welding 3

**Description:** Students apply and extend positional welding skills by using a variety of common electrodes and thickness of materials.

**Parameters:** Access to a welding facility, complete with Shielded Metal Arc Welding (SMAW) equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Outcomes:** The student will:

**1. explain the effects heating and cooling have on a weld and weldment**

- 1.1 describe the effect of single and multiple pass welds on the base metal and previously deposited filler metal
- 1.2 explain the effect cold working conditions might have on weld quality
- 1.3 explain the need to preheat or postheat
- 1.4 describe the factors to be considered when choosing an electrode including:
  - 1.4.1 static and dynamic loading
  - 1.4.2 weld position
  - 1.4.3 materials to be welded
  - 1.4.4 current supply
  - 1.4.5 ease of use
  - 1.4.6 joint design and alignment
  - 1.4.7 rate of deposit
  - 1.4.8 depth of penetration
  - 1.4.9 weld finish

**2. demonstrate advanced level SMAW competencies in the flat, horizontal and vertical positions**

- 2.1 describe the properties and uses of the following electrodes:
  - 2.1.1 E6010 and E6011
  - 2.1.2 E7014, E7018 and E7024
- 2.2 select the appropriate electrode for a given application
- 2.3 prepare the surfaces for welding
- 2.4 correctly position the weld
- 2.5 adjust the equipment to coincide with the type of electrode, weld and metal thickness
- 2.6 demonstrate first period arc welding skills in the flat, horizontal and vertical positions using a variety of weld types, joints, electrodes and thicknesses of mild steel
- 2.7 prepare welds for testing
- 2.8 perform a non-destructive and a destructive test, where appropriate

**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. create a transitional strategy to accommodate personal changes and build personal values**
  - 4.1 identify short-term and long-term goals
  - 4.2 identify steps to achieve goals

**COURSE FAB3070: PIPE & TUBULAR WELDING**

**Level:** Advanced

**Prerequisite:** FAB3170: Gas Metal Arc Welding 2

**Description:** Students develop specific skills related to pipe layout, preparation of pipe/tube joints and welding techniques.

**Parameters:** Access to a welding facility, complete with welding equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Supporting Courses:** FAB2040: Thermal Cutting  
FAB2060: Arc Welding 2  
FAB3050: Arc Welding 3

**Outcomes:** The student will:

- 1. take preventive measures to avoid accident and personal injury to self and others by identifying health and safety hazards associated with pipe and enclosed vessel welding**
  - 1.1 identify the standards of certification required for welding:
    - 1.1.1 low pressure water lines or light structural application
    - 1.1.2 medium pressure residential gas lines
    - 1.1.3 high pressure gas lines and motorcycle and aircraft frames
  - 1.2 identify the precautions that must be taken prior to cutting or welding pipe or other enclosed vessels
  - 1.3 review a safety plan in case of an accident
- 2. describe the advances made in pipe welding and identify common types of joints and welding procedures**
  - 2.1 list the advantages of welding over other forms of joining pipe related to:
    - 2.1.1 strength
    - 2.1.2 required maintenance
    - 2.1.3 flow of liquids and gases
    - 2.1.4 weight of joint
- 3. demonstrate basic pipe/tube preparation and welding competencies**
  - 3.1 calculate the cut angle for a butt joint in relation to the wall thickness and intended application
  - 3.2 prepare a template for one or more of the following joints:
    - 3.2.1 90° two-piece turn
    - 3.2.2 full T-joint
    - 3.2.3 full lateral joint
    - 3.2.4 butt joint
  - 3.3 perform a V-groove weld using roll and position pipe welding techniques
  - 3.4 prepare and perform a:
    - 3.4.1 full T-joint
    - 3.4.2 full lateral joint tube and pipe weld
  - 3.5 apply suitable destructive and non-destructive tests to ensure weld quality

**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. create a transitional strategy to accommodate personal changes and build personal values**

5.1 identify short-term and long-term goals

5.2 identify steps to achieve goals

## **COURSE FAB3080: AUTOMATED WELDING**

**Level:** Advanced

**Prerequisite:** FAB3170: Gas Metal Arc Welding 2

**Description:** Students investigate and describe the operation of various manual, semi-automated and automated welding processes and systems used in fabrication industries.

**Parameters:** Access to a welding facility, complete with welding equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Supporting Courses:** FAB2030: Oxyfuel Welding  
FAB2040: Thermal Cutting  
FAB2060: Arc Welding 2

**Outcomes:** The student will:

- 1. explain how manual, semi-automated and automated welding processes differ from one another**
  - 1.1 explain the difference between manual, semi-automated and automated cutting and welding processes:
  - 1.2 research the use of robots in welding to determine their advantages and disadvantages
  - 1.3 identify the main types of robots and describe their work envelope
  - 1.4 identify the main parts of a robot and the components of a robotic welding system
- 2. apply knowledge of advanced welding processes to demonstrate/simulate an automated welding system**
  - 2.1 identify the hazards associated with specific machine and automated processes
  - 2.2 describe methods that are commonly used to protect an individual from injury by an automated system such as a robot
  - 2.3 describe a safety plan in case of an accident
  - 2.4 describe the specialized welding techniques that are suitable for semi-automated processes; e.g., resistance welding, Gas Metal Arc Welding (GMAW), Gas Tungsten Arc Welding (GTAW), plasma arc cutting, laser beam welding and cutting
  - 2.5 describe the use of a teach pendant in programming a robot to perform the designated task
  - 2.6 demonstrate or simulate a viable production system using semi- and/or fully automated processes
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 4.1 identify short-term and long-term goals
  - 4.2 identify steps to achieve goals

## **COURSE FAB3090: SHEET FABRICATION 4**

**Level:** Advanced

**Prerequisite:** FAB2100: Sheet Fabrication 3

**Description:** Students develop specialized skills in cylindrical and conical pattern development and seam construction of ferrous and non-ferrous sheet metals.

**Parameters:** Access to a fabrication facility, complete with sheet metal shearing, forming, fastening and layout tools, and to instruction from an individual with specialized training in sheet metal practices.

**Outcomes:** The student will:

- 1. describe the procedures that are used to lay out a typical cylindrical and conical shape**
  - 1.1 research the properties of and applications of the following sheet materials:
    - 1.1.1 aluminum
    - 1.1.2 copper
    - 1.1.3 brass
    - 1.1.4 galvanized steel
    - 1.1.5 mild steel
    - 1.1.6 stainless steel
    - 1.1.7 tin plate
  - 1.2 describe which materials are most malleable
  - 1.3 describe the techniques that are used to form sheet stock
  - 1.4 explain when single, double, grooved and wired seams are used in conjunction with cylindrical and conical fabrication
  - 1.5 identify and describe the use of the following solder coppers:
    - 1.5.1 square point
    - 1.5.2 bottoming
    - 1.5.3 roofing
- 2. demonstrate parallel and radial line pattern making skills**
  - 2.1 describe the type of pattern development that is used to lay out a:
    - 2.1.1 cylinder
    - 2.1.2 cone
    - 2.1.3 rectangle to round
  - 2.2 create the necessary pattern development, using a computer or conventional means
- 3. perform advanced cylindrical and conical sheet stock fabrication skills and processes**
  - 3.1 use a micrometer, calliper or sheet gauge to measure the thickness of a piece of sheet stock
  - 3.2 calculate the inside, outside and mean diameter of a cylindrical component
  - 3.3 identify the correct formula to calculate the allowances for seams and edges
  - 3.4 select a product that incorporates:
    - 3.4.1 cylindrical and conical shapes
    - 3.4.2 grooved and double seams
    - 3.4.3 solder joints and finished edges
  - 3.5 select the appropriate material for a given product and finish

- 3.6 use the appropriate tools, materials and processes to:
  - 3.6.1 cut and bend sheet stock
  - 3.6.2 raise and finish a surface
  - 3.6.3 locate and make joints watertight
- 3.7 wear personal protective clothing and equipment
- 3.8 show that tools are kept in working order
- 3.9 handle, store and discard metal off-cuts in a correct manner
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3110: SHEET FABRICATION 5**

**Level:** Advanced

**Prerequisite:** FAB2100: Sheet Fabrication 3

**Description:** Students apply and develop specialized skills in duct component pattern making and fabrication techniques.

**Parameters:** Access to a fabrication facility, complete with sheet metal shearing, forming, fastening and layout tools, and to instruction from an individual with specialized training in sheet metal practices.

**Supporting Course:** FAB3090: Sheet Fabrication 4

**Outcomes:** The student will:

### **1. identify common duct components and applications**

- 1.1 prepare a list of duct system applications
- 1.2 list and state the purpose of the following components used in a duct system:
  - 1.2.1 radius elbow
  - 1.2.2 riser
  - 1.2.3 offset
  - 1.2.4 branch tee
  - 1.2.5 take-off
- 1.3 describe how air volume and pressures are measured
- 1.4 analyze the effect of component resistance on static and velocity air pressures in a ducting system

### **2. demonstrate the principle of triangulation to create a transition pattern**

- 2.1 differentiate among the use of parallel line, radial line and triangulation in pattern development
- 2.2 use triangulation to develop a pattern for an object whose sides are not parallel

### **3. apply pattern making and sheet metal fabrication skills to create a duct component**

- 3.1 list and describe the use and construction of the following joints:
  - 3.1.1 S and drive
  - 3.1.2 T-lock
  - 3.1.3 hammerlock
  - 3.1.4 government locks
- 3.2 state the advantages and disadvantages of using each of the above systems
- 3.3 calculate the material allowance for:
  - 3.3.1 S and drive
  - 3.3.2 T-lock
  - 3.3.3 hammerlock
- 3.4 use the appropriate tools, materials and processes to fabricate specific components in a ducting system

**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. create a transitional strategy to accommodate personal changes and build personal values**

5.1 identify short-term and long-term goals

5.2 identify steps to achieve goals

## **COURSE FAB3120: FOUNDRY – CORE MOULDING**

**Level:** Advanced

**Prerequisite:** FAB1120: Foundry – One-piece Pattern

**Description:** Students investigate and apply advanced foundry processes to produce a hollow casting, using a sand and core mould.

**Parameters:** Access to a fabrication facility, complete with foundry equipment and supplies, and to instruction from an individual with specialized training in foundry practices.

**Supporting Course:** FAB2120: Foundry – Split Pattern

**Outcomes:** The student will:

### **1. list and describe common core materials and production processes**

- 1.1 explain the purpose of a core and provide examples of products that require their use in casting
- 1.2 describe the variables and characteristics of a good core mix
- 1.3 identify common shapes and methods of producing and drying a core
- 1.4 for a given casting, identify the appropriate core shape placement technique, core mix and reinforcement techniques
- 1.5 prepare a sketch showing the location of:
  - 1.5.1 parting line and type of mould
  - 1.5.2 core and core prints
  - 1.5.3 venting, gating and pouring system for a given casting

### **2. demonstrate advanced sand casting and coring skills and techniques**

- 2.1 identify common binders that can be used with core sand; e.g.: sodium silicate and carbon dioxide, linseed oil, wheat flour and molasses, and other commercially prepared products
- 2.2 describe safety concerns related to:
  - 2.2.1 personal protective equipment
  - 2.2.2 mould construction
  - 2.2.3 foundry furnace start-up and shut-down procedures
  - 2.2.4 heating and pouring procedures
  - 2.2.5 cleaning and finishing castings
- 2.3 describe a safety plan in case of an accident
- 2.4 create a casting using common pattern making, coring and pouring techniques
- 2.5 clean and finish the casting according to specifications
- 2.6 analyze the overall size, shape and structural soundness of the product

### **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. create a transitional strategy to accommodate personal changes and build personal values**
  - 4.1 identify short-term and long-term goals
  - 4.2 identify steps to achieve goals

## **COURSE FAB3130: PRECISION TURNING 2**

**Level:** Advanced

**Prerequisite:** FAB2130: Precision Turning 1

**Description:** Students develop specialized lathe skills for thread cutting and taper turning techniques.

**Parameters:** Access to a fabrication facility, complete with a metal lathe and accessories, and to instruction from an individual with specialized training in metal lathe practices.

**Outcomes:** The student will:

### **1. demonstrate print reading and job sequencing competencies**

- 1.1 use a machine drawing to identify the:
  - 1.1.1 overall size and shape of a machine part
  - 1.1.2 thread type, size, tolerance and fit
  - 1.1.3 taper type, size and fit
  - 1.1.4 materials
- 1.2 research hole-machining operation procedures
- 1.3 create a systematic sequence of operations to machine a given part
- 1.4 calculate the appropriate cutting speeds, feed rates and depth of cuts for a given operation

### **2. perform safe taper turning and thread cutting set-up procedures**

- 2.1 describe the hazards associated with metal lathes and metal cutting operations
- 2.2 list and describe common lathe accessories such as drill chuck, taper attachment and thread dial
- 2.3 list and describe common types of tapers including:
  - 2.3.1 Morse taper
  - 2.3.2 standard milling machine taper
  - 2.3.3 taper pins
- 2.4 identify the parts of a thread
- 2.5 describe a safety plan in case of an accident

### **3. perform taper turning and thread cutting operations**

- 3.1 observe methods of cutting a taper by using the:
  - 3.1.1 compound rest
  - 3.1.2 tailstock offset
  - 3.1.3 taper attachment methods
- 3.2 identify the factors that determine the most efficient method of cutting a taper including the:
  - 3.2.1 length and angle of taper
  - 3.2.2 quality of finish
  - 3.2.3 number of duplicates
- 3.3 describe the principal features of a:
  - 3.3.1 Unified National Coarse
  - 3.3.2 Unified National Fine
  - 3.3.3 tapered pipe thread
  - 3.3.4 ISO metric thread
- 3.4 describe the set-up procedures to cut internal and external left- and right-handed threads
- 3.5 describe the classes of fit associated with the Unified thread system

- 3.6 demonstrate skills in:
  - 3.6.1 hole-machining operations
  - 3.6.2 inside and outside taper turning
  - 3.6.3 cutting inside and outside threads
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3140: PRECISION MILLING 2**

**Level:** Advanced

**Prerequisite:** FAB2140: Precision Milling 1

**Description:** Students develop specialized skills to use vertical and/or horizontal milling machines.

**Parameters:** Access to a fabrication facility, complete with a horizontal mill and accessories, and to instruction from an individual with specialized training in advanced level machining practices.

**Outcomes:** The student will:

### **1. demonstrate print reading and job sequencing competencies**

- 1.1 use a machine drawing to determine:
  - 1.1.1 the overall size and shape of a machine part
  - 1.1.2 specific types and sizes of grooves/slots, keyways and gear teeth
- 1.2 list and describe the machining operations for a given machine part and/or feature in a logical sequence
- 1.3 identify the appropriate type of milling machine and cutters for each operation
- 1.4 select workpiece holding device
- 1.5 calculate the appropriate cutting speeds, feed rates and recommended depths of cut for a given operation
- 1.6 select appropriate cutting fluids

### **2. perform safe vertical and/or horizontal mill set-up procedures**

- 2.1 describe the hazards associated with manual milling operations
- 2.2 describe a safety plan in case of an accident
- 2.3 describe safe set-up procedures to mill grooves, keyways and gear teeth
- 2.4 identify the conditions that produce cutter failure including:
  - 2.4.1 excessive heat
  - 2.4.2 clogging
  - 2.4.3 work hardening
- 2.5 identify common machine parts that require indexing

### **3. perform groove keyway and gear cutting operations**

- 3.1 identify and describe the types of cutters that are available for cutting common grooves/slots, keyways and gear teeth
- 3.2 explain the difference between a high speed steel and a tungsten carbide cutter
- 3.3 describe how an indexing head is used when cutting a spur gear
- 3.4 demonstrate skills in milling:
  - 3.4.1 grooves/slots
  - 3.4.2 keyways
  - 3.4.3 gear teeth

**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. create a transitional strategy to accommodate personal changes and build personal values**

- 5.1 identify short-term and long-term goals
- 5.2 identify steps to achieve goals

## **COURSE FAB3150: CNC MILLING**

**Level:** Advanced

**Prerequisite:** FAB1130: Principles of Machining

**Description:** Students develop skills in computer numerical control (CNC) programming to manufacture a three-dimensional product.

**Parameters:** Access to a CNC milling centre and to instruction from an individual with specialized training in CNC millwork.

**Supporting Course:** FAB2150: CNC Turning

**Outcomes:** The student will:

### **1. demonstrate three-dimensional CNC programming skills**

- 1.1 identify the relationship of the  $x$ ,  $y$  and  $z$  axis on a vertical milling machine
- 1.2 determine how to program a CNC mill using absolute coordinates
- 1.3 describe the types of canned cycles used in machining operations
- 1.4 identify when to use canned cycles to improve efficiency
- 1.5 list the information required to calculate and format a canned cycle
- 1.6 prepare a program from a print using absolute coordinates and/or produce a computer assisted drafting (CAD) design

### **2. apply CNC programming and operating skills to manufacture a milled part**

- 2.1 after observing the operation of a CNC mill, describe how the cutting speeds, feed rates and depth of cuts are controlled, and how the cutting tools and different sizes and shapes of workpieces are mounted
- 2.2 identify the milling capabilities of a given machine; e.g., size of cutters, size and types of materials
- 2.3 describe the safety features that are built into the CNC equipment
- 2.4 describe the:
  - 2.4.1 appropriate use of personal protective equipment
  - 2.4.2 importance of keeping all covers and guards in place and following the manufacturer's recommendations
  - 2.4.3 need to keep the work area clean and free of personal hazards
- 2.5 describe a safety plan in case of an accident
- 2.6 load the program or convert a CAD file
- 2.7 mount and secure the workpiece
- 2.8 identify reference and clearance points
- 2.9 mount and set cutting tool(s)
- 2.10 carry out a test run
- 2.11 manufacture the part
- 2.12 inspect the part to see that it meets the print dimensions, tolerances and specifications

**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. create a transitional strategy to accommodate personal changes and build personal values**

- 4.1 identify short-term and long-term goals
- 4.2 identify steps to achieve goals

## **COURSE FAB3160: PREFABRICATION PRINCIPLES**

**Level:** Advanced

**Prerequisite:** FAB2160: Custom Fabrication

**Description:** Students work in a cooperative learning environment to plan and construct a prefabricated product/structure to meet the specific needs of a client.

**Parameters:** Access to fabrication facilities and equipment, and to instruction from an individual with journey person qualifications if students are involved in customer work related to welding or other trade-related activities.

**Outcomes:** The student will:

- 1. perform basic shop drawing take-off skills**
  - 1.1 explain procedures that are used to create a cutting list from a shop drawing
  - 1.2 create a cutting list from a shop drawing
- 2. demonstrate advanced level resource management skills**
  - 2.1 locate appropriate materials and supplies
  - 2.2 identify specialized equipment and processes that will be required
  - 2.3 prepare a production flowchart
  - 2.4 show how to meet with the customer to determine the product/structure specifications
  - 2.5 create a suitable prefabricated design, time line and budget
  - 2.6 show how to apprise the customer of any need to make changes
- 3. demonstrate appropriate prefabrication skills and practices**
  - 3.1 cite examples of products that are built from prefabricated parts
  - 3.2 describe the advantages and disadvantages of prefabricating a component
  - 3.3 identify specific design considerations that must be adhered to when using prefabricated components
  - 3.4 describe safe rigging procedures that are used to move materials and components
  - 3.5 prepare the required templates, jigs and fixtures
  - 3.6 assign responsibilities to:
    - 3.6.1 break out materials according to a prearranged plan
    - 3.6.2 process materials with a minimum number of set-ups
    - 3.6.3 assemble, finish and prepare the product for delivery
  - 3.7 explain the need to:
    - 3.7.1 identify group and individual responsibilities
    - 3.7.2 identify and capitalize on individual strengths
  - 3.8 help install/assemble the product, if contracted
  - 3.9 participate in group and self-evaluation processes
  - 3.10 demonstrate strategies for positive criticism
  - 3.11 complete a customer satisfaction follow-up survey
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3170: GAS METAL ARC WELDING 2**

**Level:** Advanced

**Prerequisite:** FAB2070: Gas Metal Arc Welding 1

**Description:** Students develop skills to evaluate and improve the quality of gas metal arc weldings, and they extend their Gas Metal Arc Welding (GMAW) skills by performing horizontal and vertical groove welds.

**Parameters:** Access to a fabrication work centre, complete with GMAW equipment and supplies, and to instruction from an individual with welding trade qualifications.

**Outcomes:** The student will:

### **1. identify variables that affect the quality of gas metal arc welds and identify strategies to evaluate and improve weld quality**

- 1.1 identify the variables that can directly affect weld quality; e.g., the welding current and voltage, type of shielding gas/flux, diameter and type of filler metal, type and condition of equipment, welding technique
- 1.2 select the appropriate shielding gas mixture based on:
  - 1.2.1 mode of metal transfer
  - 1.2.2 base metal type and thickness
  - 1.2.3 joint design
  - 1.2.4 filler material
  - 1.2.5 desired weld quality
- 1.3 describe how to select the type and size of filler metal
- 1.4 explain how to avoid contamination of filler materials
- 1.5 identify the relationship between:
  - 1.5.1 wire speed and amperage
  - 1.5.2 welding voltage and arc length
- 1.6 describe the effects of:
  - 1.6.1 backhand or pull welding
  - 1.6.2 forehand or push welding
- 1.7 describe the effects of torch angle on:
  - 1.7.1 weld penetration
  - 1.7.2 weld appearance
- 1.8 complete a visual inspection, i.e., non-destructive test, by observing and assessing:
  - 1.8.1 overall size, shape and appearance of beads
  - 1.8.2 plate penetration
  - 1.8.3 fusion
  - 1.8.4 degree of undercutting and overlapping
- 1.9 perform a destructive test, where appropriate

### **2. perform safe set-up, maintenance and troubleshooting procedures with GMAW equipment**

- 2.1 apply safe work practices and procedures to:
  - 2.1.1 select and use appropriate personal protective equipment
  - 2.1.2 maintain a clean and tidy work station
  - 2.1.3 demonstrate safe tool/material handling and storage techniques

- 2.2 for a given type of weld and/or weldment, select the appropriate:
  - 2.2.1 wire type, size and feed rate
  - 2.2.2 current
  - 2.2.3 shielding gas type and flow rate
- 2.3 select the proper fit-up for a given weld
- 2.4 describe corrective actions that can be taken to avoid:
  - 2.4.1 surface porosity
  - 2.4.2 subsurface porosity
  - 2.4.3 lack of fusion
  - 2.4.4 burn-through
  - 2.4.5 lack of penetration
  - 2.4.6 cold lapping
- 2.5 identify problems common to out-of-position welding
- 2.6 perform maintenance required for wire drive systems and gun assemblies
- 2.7 diagnose and demonstrate corrective measures for malfunctioning GMAW equipment
- 3. demonstrate safe GMAW practices to perform groove welds on mild steel plate in the horizontal and vertical positions**
  - 3.1 describe safety issues related to:
    - 3.1.1 using personal protective equipment
    - 3.1.2 handling and storing consumables
    - 3.1.3 keeping the welding area free of hazards
    - 3.1.4 ensuring adequate ventilation
  - 3.2 describe a safety plan in case of an accident
  - 3.3 prepare and clean all surfaces to be welded
  - 3.4 properly position metal for welding
  - 3.5 demonstrate safe GMAW techniques and perform groove welds in the horizontal and vertical positions on mild steel plate
- 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3910: FAB PROJECT D**

**Level:** Advanced

**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:** Advanced project courses must connect with a minimum of two CTS courses, one of which must be at the advanced level and be in the same occupational area as the project course. The other CTS course(s) must be at least 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3920: FAB PROJECT E**

**Level:** Advanced

**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:** Advanced project courses must connect with a minimum of two CTS courses, one of which must be at the advanced level and be in the same occupational area as the project course. The other CTS course(s) must be at least 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. create a transitional strategy to accommodate personal changes and build personal values**
  - 5.1 identify short-term and long-term goals
  - 5.2 identify steps to achieve goals

## **COURSE FAB3950: FAB ADVANCED PRACTICUM**

**Level:** Advanced

**Prerequisite:** None

**Description:** Students apply prior learning and demonstrate the attitudes, skills and knowledge required by an external organization to achieve a credential/credentials or an articulation.

**Parameters:** This practicum course, which may be delivered on- or off-campus, should be accessed only by students continuing to work toward attaining a recognized credential/credentials or an articulation offered by an external organization. This course must be connected to at least one CTS course from the same occupational area and cannot be used in conjunction with any introductory (1XXX) level course. A practicum course cannot be delivered as a stand-alone course, cannot be combined with a CTS project course and cannot be used in conjunction with the Registered Apprenticeship Program or the Green Certificate Program.

**Outcomes:** The student will:

- 1. perform assigned tasks and responsibilities, as required by the organization granting the credential(s) or articulation**
  - 1.1 identify regulations and regulatory bodies related to the credential(s) or articulation
  - 1.2 describe personal roles and responsibilities, including:
    - 1.2.1 key responsibilities
    - 1.2.2 support functions/responsibilities/expectations
    - 1.2.3 code of ethics and/or conduct
  - 1.3 describe personal work responsibilities and categorize them as:
    - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
    - 1.3.2 non-routine tasks; e.g., emergencies
    - 1.3.3 tasks requiring personal judgement
    - 1.3.4 tasks requiring approval of a supervisor
  - 1.4 demonstrate basic employability skills and perform assigned tasks and responsibilities related to the credential(s) or articulation
- 2. analyze personal performance in relation to established standards**
  - 2.1 evaluate application of the attitudes, skills and knowledge developed in related CTS courses
  - 2.2 evaluate standards of performance in terms of:
    - 2.2.1 quality of work
    - 2.2.2 quantity of work
  - 2.3 evaluate adherence to workplace legislation related to health and safety
  - 2.4 evaluate the performance requirements of an individual who is trained, experienced and employed in a related occupation in terms of:
    - 2.4.1 training and certification
    - 2.4.2 interpersonal skills
    - 2.4.3 technical skills
    - 2.4.4 ethics

**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. create a transitional strategy to accommodate personal changes and build personal values**

- 4.1 identify short-term and long-term goals
- 4.2 identify steps to achieve goals