COURSE ISA3400: TOOLS & EQUIPMENT

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety

Description: Students learn to use basic hand and power tool and production skills to safely complete various instrumentation jobs.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. **use tools and equipment related to the instrumentation and control technician trade**
   - 1.1 describe various energy isolation procedures and applications to establish zero energy
   - 1.2 describe and apply safe techniques for using various workshop hand tools and power tools, including:
     - 1.2.1 non-cutting hand tools; e.g., hammers, punches, metal stamps, screwdrivers, wrenches, pliers, clamps, bench vises
     - 1.2.2 cutting hand tools; e.g., hacksaws, files, chisels, abrasive products, taps, dies, knock-out punches
   - 1.3 demonstrate the safe use of hand tools and equipment, including:
     - 1.3.1 layout tools; e.g., layout dyes, scribers, dividers, squares
     - 1.3.2 power tools; e.g., drills, grinders, cut-off saws
   - 1.4 demonstrate the safe use of power tools and specialty tools related to the instrumentation and control technician trade
   - 1.5 maintain and document calibration, configuration, and test equipment
2. **demonstrate basic competencies**
   - 2.1 demonstrate fundamental skills to:
     - 2.1.1 communicate
     - 2.1.2 manage information
     - 2.1.3 use numbers
     - 2.1.4 think and solve problems
   - 2.2 demonstrate personal management skills to:
     - 2.2.1 demonstrate positive attitudes and behaviours
     - 2.2.2 be responsible
     - 2.2.3 be adaptable
     - 2.2.4 learn continuously
     - 2.2.5 work safely
   - 2.3 demonstrate teamwork skills to:
     - 2.3.1 work with others
     - 2.3.2 participate in projects and tasks

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

3.1 identify short-term and long-term goals

3.2 identify steps to achieve goals

COURSE ISA3405: TUBE PRACTICE

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students are introduced to both the theory and the practice of the geometry and mathematics of pipe bending associated with instrumentation installations.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resource: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. perform tube joining and bending

1.1 identify types and sizes of tube and tube fittings, including:

- 1.1.1 coiled or straight tubing, outside diameters (OD) 1.59 to 63 mm (0.0625” to 2.475”); e.g., high strength stainless steel, duplex and super duplex stainless steel, titanium, nickel alloy
- 1.1.2 ball valves
- 1.1.3 bleed valves
- 1.1.4 check valves
- 1.1.5 double ferrule compression fittings
- 1.1.6 filters
- 1.1.7 gasket face seal fitting
- 1.1.8 instrumentation fittings
- 1.1.9 medium pressure products
- 1.1.10 metering valves
- 1.1.11 modular fitting/valve systems
- 1.1.12 needle valves
- 1.1.13 O-ring face seal fittings
- 1.1.14 pipe fittings
- 1.1.15 pneumatic/electric actuators
- 1.1.16 regulators
- 1.1.17 relief valves
- 1.1.18 rotary plug valves
- 1.1.19 sample cylinders
- 1.1.20 sanitary valves/fittings
- 1.1.21 single ferrule compression fittings
- 1.1.22 spray guns
- 1.1.23 tube ended pressure gauges
- 1.1.24 valves
- 1.1.25 weld fittings

1.2 identify tools and techniques used in tube joining, including:
- 1.2.1 body dies
- 1.2.2 hydraulic hand pumps
- 1.2.3 gap gauges
- 1.2.4 deburring tools
- 1.2.5 mini tubing cutters
- 1.2.6 hacksaws
- 1.2.7 vises
- 1.2.8 mini-preset tools
- 1.2.9 nut dies
- 1.2.10 Par-lock wrench packages
- 1.2.11 pre-setting tools
- 1.2.12 tube cutters for stainless steel

1.3 identify tools and techniques used in tube bending, including:
- 1.3.1 hand benders
- 1.3.2 mini tube cutters
- 1.3.3 roller benders
- 1.3.4 tube cutters for stainless steel

1.4 identify hazards associated with the selection and installation of tubes and fittings, including:
- 1.4.1 fittings thrown off at high speed
- 1.4.2 high-velocity fluid discharge
- 1.4.3 explosion or burning of the conveyed fluid
- 1.4.4 electrocution from high-voltage electric power lines
- 1.4.5 contact with suddenly moving or falling objects that are controlled by the conveyed fluid
- 1.4.6 injections by high-pressure fluid discharge
- 1.4.7 dangerous whipping from uncontrolled hose
- 1.4.8 contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious
- 1.4.9 sparking or explosion caused by static electricity buildup or other sources of electricity
- 1.4.10 sparking or explosion while spraying paint or flammable liquids
- 1.4.11 injuries resulting from inhalation, ingestion or exposure to fluids

1.5 calculate tube bending lengths for various tube configurations and angles

1.6 demonstrate tube bending for instrument installations

1.7 design and install raceway to support tubing

1.8 install tubing and tube fittings, considering:
- 1.8.1 expansion
- 1.8.2 contraction
- 1.8.3 excessive strain

1.9 demonstrate the use of tube joining tools

1.10 demonstrate soft soldering techniques for joining copper tube

2. demonstrate basic competencies

2.1 demonstrate fundamental skills to:
- 2.1.1 communicate
- 2.1.2 manage information
- 2.1.3 use numbers
- 2.1.4 think and solve problems

2.2 demonstrate personal management skills to:
- 2.2.1 demonstrate positive attitudes and behaviours
- 2.2.2 be responsible
- 2.2.3 be adaptable

2.2.4 learn continuously
2.2.5 work safely

2.3 demonstrate teamwork skills to:
2.3.1 work with others
2.3.2 participate in projects and tasks

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

3.1 identify short-term and long-term goals
3.2 identify steps to achieve goals

COURSE ISA3410: PIPE PRACTICE

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students are introduced to both the theory and the practice of the geometry and mathematics of pipe threading, pipe joining and electric and electrical connections associated with instrumentation installations.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. perform pipe threading and pipe joining

1.1 identify types and sizes of pipe, fittings and flanges, including:

- 1.1.1 carbon steel (CS)
- 1.1.2 low temperature service carbon steel (LTCS)
- 1.1.3 stainless steel (SS)
- 1.1.4 malleable iron
- 1.1.5 nonferrous metals; e.g., Inconel, Incoloy, cupro-nickel
- 1.1.6 non-metallic; e.g., acrylonitrile butadiene styrene (ABS), polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), glass-reinforced epoxy (GRE), high-density polyethylene (HDPE), tempered glass
- 1.1.7 chrome-molybdenum steel (alloy steel) that is generally used for high-temperature service
- 1.1.8 elbows
- 1.1.9 couplings
- 1.1.10 unions
- 1.1.11 reducers
- 1.1.12 olets
- 1.1.13 tee fittings
- 1.1.14 cross fittings
- 1.1.15 cap fittings
- 1.1.16 plug fittings
- 1.1.17 nipples
- 1.1.18 barb fittings
- 1.1.19 valves

1.2 identify hazards associated with pipe and fitting selection and installation, including:
- 1.2.1 fittings thrown off at high speed
- 1.2.2 high-velocity fluid discharge
- 1.2.3 explosion or burning of the conveyed fluid
- 1.2.4 electrocution from high-voltage electric power lines
- 1.2.5 contact with suddenly moving or falling objects that are controlled by the conveyed fluid
- 1.2.6 injections by high-pressure fluid discharge
- 1.2.7 dangerous whipping from uncontrolled hose
- 1.2.8 contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious
- 1.2.9 sparking or explosion caused by static electricity buildup or other sources of electricity
- 1.2.10 sparking or explosion while spraying paint or flammable liquids
- 1.2.11 injuries resulting from inhalation, ingestion or exposure to fluids

1.3 explain tools used in pipe joining

1.4 explain how to achieve a pipe installation emphasizing threaded pipe joints

1.5 demonstrate threading of steel pipe with the use of power threaders and hand threaders

1.6 install threaded pipe and fittings for a safe leak-tight installation

1.7 install flange connections for a safe leak-tight installation

2. install mounting and support hardware

2.1 identify fasteners used in mounting and support hardware, including:
- 2.1.1 weldless eye nut
- 2.1.2 clevis with pin
- 2.1.3 all-threaded rod
- 2.1.4 turnbuckle
- 2.1.5 machine threaded rod
- 2.1.6 rod coupling
- 2.1.7 threaded eye rod
- 2.1.8 two-bolt clamp
- 2.1.9 three-bolt clamp
- 2.1.10 riser clamp
- 2.1.11 adjustable clevis clamp
- 2.1.12 yoke clamp
- 2.1.13 U-bolt
- 2.1.14 pipe shoe

2.2 describe location considerations and limitations of mounting and support hardware

2.3 identify tools used in mounting and support hardware, including:
- 2.3.1 wrenches
- 2.3.2 drills
- 2.3.3 screwdrivers
- 2.3.4 hacksaws
- 2.3.5 dies
- 2.3.6 cut-off saws
- 2.3.7 hammers
- 2.3.8 levels
- 2.3.9 prick punches and centre punches

2.4 fabricate mounting and support hardware

2.5 install mounting and support hardware

3. use precision measuring instruments

3.1 describe precision measurement used in dimensional measurement

3.2 describe measuring instruments used for precision measurement, including:

- 3.2.1 scribers; e.g., pocket driver, double-end scriber, knife-end scriber
- 3.2.2 divider and trammel
- 3.2.3 hermaphrodite calipers; e.g., firm joint, lock joint with fine adjustment
- 3.2.4 squares; e.g., solid square, combination square
- 3.2.5 combination sets; e.g., square head, steel rule (blade), bevel protractor, centre head
- 3.2.6 surface gauges
- 3.2.7 height gauges; e.g., dial height gauge, electronic digital height gauge, vernier height gauge
- 3.2.8 tape measure
- 3.2.9 ruler
- 3.2.10 scales

3.3 demonstrate techniques for using precision measuring instruments

4. assemble electrical and electronic connections

4.1 describe the tools, materials, and techniques used for soldering electronic circuits, including:

- 4.1.1 solder, e.g., tin-lead, tin-zinc, tin-silver, tin-bismuth, 63/37, 60/40, 50/50
- 4.1.2 flux; e.g., water soluble, no-clean, rosin
- 4.1.3 soldering gun/iron
- 4.1.4 soldering tips
- 4.1.5 processes; e.g., soldering and brazing, silver soldering**,** induction soldering**,** pipe solder, mechanical and aluminum, resistance soldering

4.2 describe methods used in electrical connections, including:

- 4.2.1 wave soldering
- 4.2.2 reflow soldering
- 4.2.3 hand soldering

4.3 describe static and anti-static devices; e.g., bag, garments, agent, mat, strap

4.4 demonstrate electrical connection techniques

4.5 desolder and remove components from printed circuit boards

4.6 install and solder electronic components onto a printed circuit board

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

6.1 identify short-term and long-term goals

6.2 identify steps to achieve goals

COURSE ISA3415: ELECTRICAL THEORY

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students develop an understanding of the basic parameters of an electrical circuit in order to understand why there are different sizes of wires, different ratings of circuit breakers and different types of insulation. Students also learn to identify resistors and understand the purpose of resistors and to interpret their ratings.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. apply knowledge of voltage, current, resistance and power
- 1.1 describe an electric current, including:
  - 1.1.1 static electricity
  - 1.1.2 quantity of charge and current
  - 1.1.3 conventional flow and electron flow
  - 1.1.4 measurement of a current using tools such as an ammeter or a multimeter
- 1.2 describe the difference between electron current flow and conventional current flow
- 1.3 describe voltage, including:
  - 1.3.1 electromotive force (EMF)
  - 1.3.2 electrical circuit
  - 1.3.3 sources of EMF
  - 1.3.4 symbols used for voltage
  - 1.3.5 measuring voltage
- 1.4 describe resistance and state and apply Ohm's law, including:
  - 1.4.1 resistance definition
  - 1.4.2 the formula for Ohm's law
  - 1.4.3 measuring resistance
- 1.5 describe work, energy and power as it relates to current, voltage and resistance
- 1.6 connect and verify the relationship between voltage, current and resistance according to Ohm's law
- 1.7 connect an electrical circuit and verify the power formulae

2. use conductors, semiconductors and insulators
- 2.1 describe the factors affecting resistance, including:
  - 2.1.1 the length of conductor
  - 2.1.2 the cross-sectional area
  - 2.1.3 the type of material
  - 2.1.4 the temperature of material

2.1.5 resistivity
2.1.6 the American Wire Gauge (AWG) table
2.1.7 applications of resistivity and temperature coefficients

2.2 calculate the resistance of a conductor of specific dimensions, considering:
2.2.1 exponents
2.2.2 SI units of measurement
2.2.3 prefixes
2.2.4 scientific notation
2.2.5 resistance calculations using the resistance equation
2.2.6 resistance calculations involving temperature

2.3 describe the electrical properties of materials, classified as:
2.3.1 conductors
2.3.2 insulators
2.3.3 semiconductors

3. identify types of resistors

3.1 list two categories of resistors, including:
3.1.1 fixed resistors; e.g., composition resistors, film resistors, wire wound resistors
3.1.2 variable resistors; e.g., rheostats and potentiometers

3.2 describe resistor construction

3.3 explain the methods used to determine the ratings of fixed resistors, considering:
3.3.1 resistance rating
3.3.2 power rating
3.3.3 tolerance rating

3.4 use colour codes to determine the resistance of a resistor, including:
3.4.1 resistance and tolerance colour codes
3.4.2 precision resistor colour codes

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 ISA3420: RESISTIVE CIRCUITS

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment
ISA3415: Electrical Theory

Description: Students examine electrical circuits and their properties or voltage, current and resistance using Ohm's law and Kirchhoff's current and voltage laws.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrument technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. **analyze series resistive circuits**
   - 1.1 define a series circuit
   - 1.2 calculate current in a series circuit
   - 1.3 calculate resistance in a series circuit
   - 1.4 apply Kirchhoff's voltage law to a series circuit
   - 1.5 perform calculations using ratio and direct proportion
   - 1.6 state the relationship between the resistive values of components and their voltage drops
   - 1.7 solve problems using the voltage divider rule
   - 1.8 determine the voltage drop across a closed- or open-circuit component in a series circuit
   - 1.9 connect and verify Kirchhoff's current and voltage laws in a series resistive circuit
2. **analyze parallel circuits**
   - 2.1 define a parallel circuit
   - 2.2 calculate the total resistance of a parallel circuit
   - 2.3 apply Kirchhoff's current law to a parallel circuit
   - 2.4 describe the effects of open circuits on a parallel circuit
   - 2.5 use the current divider principle to calculate branch currents
   - 2.6 connect and verify Kirchhoff's current laws in a parallel resistive circuit
3. **analyze series-parallel resistive circuits**
   - 3.1 identify resistors that are in series
   - 3.2 identify resistors that are in parallel
   - 3.3 calculate the total resistance of a series-parallel circuit
   - 3.4 apply Kirchhoff's current law
   - 3.5 apply Kirchhoff's voltage law
   - 3.6 solve problems involving series-parallel circuits
   - 3.7 connect and verify the relationship of current, voltage and resistance in each part of a series/parallel circuit

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 ISA3425: POWER & EFFICIENCY

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment
ISA3415: Electrical Theory

Description: Students study the mathematical relationships that exist between the electrical properties of simple circuits and power and learn the construction, operation and application of different types of storage batteries. Students also explore the basic nature of magnetism.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrument technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. describe cells and batteries

1.1 define terminology of cells, including:
- 1.1.1 the cell
- 1.1.2 the battery
- 1.1.3 the primary cell
- 1.1.4 the secondary cell
- 1.1.5 the electrode (positive and negative)
- 1.1.6 electrolyte
- 1.1.7 electromotive force (EMF)
- 1.1.8 the dry cell
- 1.1.9 battery resistance
- 1.1.10 battery capacity

1.2 describe the construction and operation of a basic primary cell, considering:
- 1.2.1 Leclanché cells
- 1.2.2 EMF and cell capacity
- 1.2.3 alkaline cells

1.3 describe the construction and operation of types of lead-acid batteries, including:
- 1.3.1 flooded cell batteries
- 1.3.2 gelled electrolyte cell batteries
- 1.3.3 absorptive glass mat (AGM) cell batteries

1.4 describe the construction and operation of a nickel-cadmium battery

1.5 describe the construction and operation of a lithium battery

1.6 describe hazards when charging, handling, and disposing of batteries, considering:
- 1.6.1 desulfation
- 1.6.2 bulk charging
- 1.6.3 absorption charging

1.6.4 float charging
1.6.5 equalization

1.7 describe battery performance ratings, including:
1.7.1 ampere-hour rating
1.7.2 cranking amps
1.7.3 reserve capacity rating

1.8 determine the effects of battery internal resistance

2. describe magnetism, electromagnetism and electromagnetic induction

2.1 describe the properties of magnetic materials, including:
2.1.1 magnetism
2.1.2 classification of magnets; e.g., temporary and permanent
2.1.3 magnetic poles; e.g., north pole, south pole
2.1.4 behaviour of magnetic poles

2.2 define terminology related to magnetism, including:
2.2.1 magnetic flux
2.2.2 flux density
2.2.3 permeability
2.2.4 reluctance
2.2.5 residual magnetism and retentivity
2.2.6 saturation

2.3 describe electromagnetism and basic design considerations for electromagnetic devices, including:
2.3.1 determining the direction of the magnetic field
2.3.2 using the right-hand rule for conductors
2.3.3 using Maxwell's screw rule
2.3.4 determining the polarity of a magnetic coil
2.3.5 describing the three factors that affect the strength of an electromagnet; e.g., amount of current in the coil, number of turns on the coil, type of core as part of the magnetic circuit
2.3.6 describing retentivity of core material; e.g., hysteresis losses
2.3.7 describing magnetic core structural design; e.g., eddy currents, iron losses
2.3.8 describing core saturation

2.4 describe how an induced voltage is generated, including:
2.4.1 using Faraday's law of induction
2.4.2 using Fleming's right-hand rule
2.4.3 describing factors affecting the induced voltage; e.g., flux density, number of turns in the conductor, rate at which lines of force are cut by conductor

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 ISA3430: INDUCTANCE & CAPACITANCE

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment
ISA3415: Electrical Theory

Description: Students are introduced to the factors that affect impedance in an alternating current (AC) circuit as well as the effects of a coil and capacitor on the circuit.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. describe the fundamental characteristics of AC circuits
- 1.1 explain the generation of an AC sine wave
- 1.2 determine the output frequency of an AC generator, considering:
  - 1.2.1 the number of electrical cycles completed in one second is the frequency of the output of a generator
  - 1.2.2 the symbol for frequency is *f*
  - 1.2.3 the unit measurement for frequency in hertz
  - 1.2.4 the symbol for hertz is Hz
  - 1.2.5 the time require to complete one cycle is known as the period (i.e., time period)
  - 1.2.6 the unit of measurement for period is seconds (s)
  - 1.2.7 the symbol for period is *T*
  - 1.2.8 frequency and poles
  - 1.2.9 calculating frequency
- 1.3 calculate standard AC sine wave values, including:
  - 1.3.1 maximum or peak values
  - 1.3.2 instantaneous values
  - 1.3.3 effective values

2. apply the concepts of inductance and capacitance and their use in DC circuits
- 2.1 describe an inductor
- 2.2 describe inductance and the factors that affect it, including:
  - 2.2.1 more turns – higher inductance
  - 2.2.2 higher core permeability – higher inductance
  - 2.2.3 larger core area – higher inductance
  - 2.2.4 shorter path – higher inductance
  - 2.2.5 air gap – lower inductance
  - 2.2.6 no air gap – higher inductance
- 2.3 describe induction and its effects, including:
  - 2.3.1 Faraday's law

2.3.2 types of induction; e.g., mutual induction, self-induction
2.3.3 Lenz's law
2.3.4 factors affecting counter-EMF

2.4 define capacitance

2.5 describe the construction of a basic capacitor, including:
2.5.1 the area of the plates
2.5.2 distance between the plates
2.5.3 the type of dielectric material that separates the plates

2.6 describe dielectric strength, and state the unit of measurement for electric charge, including:
2.6.1 relative permeability
2.6.2 the types of dielectric strengths; e.g., air, paper, mica, porcelain
2.6.3 the voltage rating of a capacitor
2.6.4 the electric charge
2.6.5 the calculation of electric charge on a capacitor
2.6.6 the electric charge rate

2.7 describe capacitor types and applications, including:
2.7.1 non-polarized capacitors; e.g., air, oil-filled, paper (tubular), mica, ceramic (disc), electrolytic
2.7.2 polarized capacitors; e.g., electrolytic
2.7.3 applications; e.g., timers, rectifier smoothing and filtering, power factor correction, motor starting

3. apply the concepts of circuit time constraints

3.1 describe the resistor-capacitor circuit time constraints and the relationship to the characteristic charge and discharge waveforms

3.2 describe time effects in selected resistor-capacitor circuits

3.3 calculate the instantaneous and steady state voltages in resistor-capacitor circuits

3.4 describe time effects of an inductor in a DC circuit

4. analyze AC inductive and capacitive circuits

4.1 describe the effects of an inductor in an AC circuit, including:
4.1.1 inductive reactance
4.1.2 symbol and unit of measurement for inductive reactance
4.1.3 equation for inductive reactance
4.1.4 inductive reactance calculations

4.2 describe the power relationships in an inductive circuit; e.g., reactive power

4.3 describe the effects of a capacitor in an AC circuit

4.4 describe the power relationships in a capacitive circuit

4.5 analyze an AC inductive circuit, including:
4.5.1 the phase relationship between voltage and current; e.g., direct current source, alternating current source
4.5.2 phasor diagrams for an inductive circuit

4.6 analyze an AC capacitive circuit, including:
4.6.1 the symbol and unit for capacitive reactance
4.6.2 factors affecting capacitive reactance
4.6.3 how to determine capacitive reactance
4.6.4 how to determine capacitance
4.6.5 the phase relationship between voltage and current
4.6.6 phasor diagrams for a capacitive circuit

5. apply the properties of AC circuits

5.1 describe the factors affecting impedance in an AC circuit
5.2 describe the power relationships in an AC circuit
5.3 demonstrate the relationship between sine waves and phasor diagrams

6. demonstrate basic competencies

6.1 demonstrate fundamental skills to:
- 6.1.1 communicate
- 6.1.2 manage information
- 6.1.3 use numbers
- 6.1.4 think and solve problems

6.2 demonstrate personal management skills to:
- 6.2.1 demonstrate positive attitudes and behaviours
- 6.2.2 be responsible
- 6.2.3 be adaptable
- 6.2.4 learn continuously
- 6.2.5 work safely

6.3 demonstrate teamwork skills to:
- 6.3.1 work with others
- 6.3.2 participate in projects and tasks

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

7.1 identify short-term and long-term goals
7.2 identify steps to achieve goals

COURSE ISA3435: HAZARDS & REGULATIONS

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students are introduced to the regulations, codes and potential hazards associated with work in the instrumentation and control technician trade.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. apply electrical codes and regulations

1.1 describe the instrumentation and control technician's area of electrical work/responsibility, including:

- 1.1.1 consulting diagrams and technical documentation, such as schematics, manuals, standards and codes
- 1.1.2 maintaining backup and revision documentation for control systems and instrumentation
- 1.1.3 installing, configuring, calibrating and maintaining control; measuring; and indicating instrumentation
- 1.1.4 installing and terminating electrical connections
- 1.1.5 inspecting and testing the operation of instruments and systems to diagnose faults
- 1.1.6 removing, repairing, adjusting and replacing components
- 1.1.7 calibrating components and systems
- 1.1.8 performing scheduled maintenance programs
- 1.1.9 considering various industrial sectors; e.g., pulp and paper processing companies; nuclear, thermal and hydro generating companies; mining, petrochemical, oil and gas companies; steel companies; water treatment facilities; manufacturing companies; and industrial instrument servicing companies
- 1.1.10 following Canadian Electrical Code (CEC) Rule 2-304

1.2 describe the role of the *Safety Codes Act* (*SCA*) and the Canadian Electrical Code, Part I and how they relate to the instrumentation field, including:

- 1.2.1 accreditation (*SCA*)
- 1.2.2 regulations (*SCA*)
- 1.2.3 instrumentation technician responsibilities (*SCA*)
- 1.2.4 enforcement of the act (*SCA*)
- 1.2.5 electrical equipment (CEC)
- 1.2.6 circuitry (CEC)
- 1.2.7 authorized and qualified people (CEC)

1.3 describe the role of Canada Standards Association (CSA) International, the National Electrical Manufacturers Association (NEMA) and the Underwriters Laboratories of Canada (ULC) and how they relate to the instrumentation field, including:
    1.3.1 certification/approval
    1.3.2 inspection

2. describe the classification of hazardous locations and the general rules that apply to these locations

2.1 define the specific terms from Section 18 of the Canadian Electrical Code, Part I that apply to area classifications, including:
    2.1.1 hazardous locations; e.g., class I, class II, class III
    2.1.2 explosion-proof equipment
    2.1.3 intrinsically safe circuits
2.2 apply the general rules regarding installation and maintenance in hazardous locations, including the:
    2.2.1 guidelines for selecting equipment
    2.2.2 requirements for marking and locating equipment; e.g., gas groupings, dust groupings, electrical installations
    2.2.3 parameters for separating hazard-free areas
    2.2.4 conditions that allow exemption from any part of the ruling in Section 18
    2.2.5 guidelines for gas groupings
    2.2.6 guidelines for dust groupings
2.3 describe an area classification drawing

3. apply protection methods for electrical equipment in hazardous areas

3.1 define the purpose of explosion-proof equipment, considering:
    3.1.1 the fire triangle
    3.1.2 protection methods and hazardous locations; e.g., explosion containment, prevention and segregation
    3.1.3 types of explosion-proof equipment; e.g., explosion-proof and flame-proof enclosures, enclosure joints, sealed fittings
3.2 define installation requirements for conduits, seals, fixtures and appliances, including:
    3.2.1 class 1, zone 0 installation; e.g., equipment, wiring, sealing
    3.2.2 class 1, zone 1 installation; e.g., equipment, wiring, sealing, flexible cords, receptacles and attachment plugs
    3.2.3 class 1, zone 2 installation; e.g., equipment, wiring, sealing, flexible cords, receptacles and attachment plugs
3.3 describe maintenance procedures for explosion-proof enclosures, including:
    3.3.1 checking closures
    3.3.2 servicing protected equipment
3.4 describe non-incendive equipment, including:
    3.4.1 non-incendive circuits
    3.4.2 installation and wiring requirements
3.5 describe an intrinsically safe loop, including the:
    3.5.1 intrinsically safe apparatus (field-device bracket)
    3.5.2 associated apparatus (intrinsically safe barrier or high-energy limiting device)
    3.5.3 field wiring
3.6 describe an intrinsically safe loop drawing
3.7 describe the grounding requirements of an intrinsically safe system, including:
    3.7.1 passive barriers
    3.7.2 cable shields
3.8 define the relationship between explosion-proof and intrinsically safe systems

3.9 describe maintenance procedures for intrinsically safe systems, including:
    3.9.1 system documentation
    3.9.2 maintenance in hazardous areas
    3.9.3 maintenance in non-hazardous areas
3.10 describe the role of purging under the Canadian Standards Association (CSA) and International Society of Automation (ISA) definition, including:
    3.10.1 following CEC Rule 18-064
    3.10.2 ISA S12.4
3.11 describe the role of sealing, plotting and encapsulating for electrical safety, including:
    3.11.1 process sealing; e.g., primary and secondary seals
    3.11.2 following CEC Rule 18-072 Flammable Fluid Seals (appendix B)
    3.11.3 segregation; e.g., encapsulation, oil immersion, powder filling
3.12 describe arc flash
3.13 demonstrate how to install a secondary seal
3.14 select and install an intrinsically safe barrier

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 ISA3440: PRESSURE MEASUREMENT

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students are introduced to the physics of pressure, the pressure standards used in instrumentation and pressure scales.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. **apply the principles of pressure and the standards used to measure pressure**
   - 1.1 perform calculations for pressure and pressure units, considering:
     - 1.1.1 system international (SI) prefixes
     - 1.1.2 mass
     - 1.1.3 force
     - 1.1.4 density
     - 1.1.5 relative density
     - 1.1.6 principles of hydrostatics
     - 1.1.7 methods for describing pressure; e.g., force over area, height of a column of liquid
     - 1.1.8 methods for calculating pressure; e.g., calculating pressure as force over area, calculating pressure as pgh, calculating pressure in the United States Customary System Units (USCS) system, calculating pressure using the SI system
   - 1.2 apply the principles of pressure standards to pressure measurement techniques, including:
     - 1.2.1 defining the terms pressure standards, international standards, working standards, primary standard and secondary standard
     - 1.2.2 describing types of pressure standards; e.g., hydraulic deadweight tester, pneumatic deadweight tester, U-tube manometer, well manometer, inclined well manometer, mechanical and digital master gauge
   - 1.3 perform calculations for pressure scales and reference points, including:
     - 1.3.1 pressure readings; e.g., atmospheric pressure; absolute, gauge, atmospheric and vacuum pressure readings; gauge pressure readings; atmosphere pressure readings; vacuum pressure readings
     - 1.3.2 absolute, gauge and vacuum pressure gauges
2. **calibrate link and lever systems**
   - 2.1 define span, angularity, zero, hysteresis and deadband as they relate to mechanical systems

2.2 perform calibrations of link and lever systems, including:
- 2.2.1 squaring the linkage
- 2.2.2 pre-calibration tests
- 2.2.3 calibration procedure
- 2.2.4 post-calibration tests; e.g., determining deadband error, determining hysteresis error, analyzing the results

3. select, calibrate and install pressure gauges

3.1 describe the construction, applications and limitations of pressure gauges, including:
- 3.1.1 measuring elements
- 3.1.2 movements
- 3.1.3 dial and pointers
- 3.1.4 case

3.2 describe the installation in protection methods for pressure gauges, including:
- 3.2.1 shut-off devices
- 3.2.2 siphons
- 3.2.3 diaphragm seals
- 3.2.4 pressure gauge restrictors

3.3 demonstrate the methods and standards used to calibrate pressure gauges

3.4 demonstrate a method to protect pressure gauges

4. select, install and maintain pneumatic components and feedback systems

4.1 describe the operation and construction of flapper nozzles, including:
- 4.1.1 simple motion detector
- 4.1.2 baffle-nozzle assembly

4.2 describe the operation and construction of pneumatic pilot valves, including:
- 4.2.1 direct-acting valves
- 4.2.2 reverse-acting valves
- 4.2.3 non-bleed-type valves
- 4.2.4 bleed-type valves
- 4.2.5 single-acting valves
- 4.2.6 double-acting valves

4.3 describe the operation and construction of pneumatic relays, including:
- 4.3.1 direct-acting relay; e.g., non-bleed-type, bleed-type
- 4.3.2 reverse-acting relay

4.4 describe the applications for pneumatic relays, including:
- 4.4.1 volume boosters relays
- 4.4.2 ratio relays
- 4.4.3 ratio relays with bias and reversing
- 4.4.4 constant differential relays

4.5 explain the different types of negative feedback systems used in pneumatic instruments, including:
- 4.5.1 moment-balance negative feedback
- 4.5.2 true force-balance feedback
- 4.5.3 angle motion-balance negative feedback
- 4.5.4 linear motion-balance negative feedback

4.6 describe the safety considerations of pneumatic instruments, considering:
    4.6.1 hearing
    4.6.2 vision
    4.6.3 trapped pneumatic pressure
    4.6.4 instrument safety instructions
    4.6.5 pinch points, punctures and lacerations
4.7 describe the specifications of pneumatic instruments, including:
    4.7.1 instrument air supply
    4.7.2 output signal
    4.7.3 static air consumption
    4.7.4 delivery capacity
    4.7.5 exhaust capacity
    4.7.6 accuracy
    4.7.7 ambient temperature limits
    4.7.8 materials of construction
4.8 describe the benefits and disadvantages of pneumatic instruments
4.9 describe alternate gas supplies used in pneumatic instruments and their related hazards, including:
    4.9.1 plant air
    4.9.2 plant gas
    4.9.3 process gas
4.10 demonstrate the calibration of a feedback system

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

6.1 identify short-term and long-term goals
6.2 identify steps to achieve goals

COURSE ISA3445: CALIBRATION

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students understand the construction of the components of pneumatic instruments, the function of components and how pneumatic instruments are used in various instrumentation systems. Students are introduced to the knowledge and skills necessary to install and calibrate pneumatic instruments.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. **select, install and maintain pressure regulators**
   - 1.1 describe the operating principles and applications of regulators, including:
     - 1.1.1 regulator function
     - 1.1.2 essential elements; e.g., restricting elements, loading force, the measuring element
     - 1.1.3 categories of regulators; e.g., direct-operated regulators, pilot-operated regulators
   - 1.2 illustrate the design and differences between spring-loaded, weight-loaded and pilot-operated regulators
   - 1.3 identify hazards associated with pressure regulator selection and installation, including:
     - 1.3.1 regulator shut-off capability
     - 1.3.2 process fluid characteristics
     - 1.3.3 regulator accuracy
     - 1.3.4 required materials
     - 1.3.5 stroking speed
     - 1.3.6 overpressure protection
   - 1.4 describe maintenance procedures for pressure regulators
   - 1.5 service a pressure regulator
2. **select, install and maintain pressure transmitters**
   - 2.1 describe the function and construction of pressure transmitters, including:
     - 2.1.1 absolute pressure sensor
     - 2.1.2 gauge pressure sensor
     - 2.1.3 vacuum pressure sensor
     - 2.1.4 differential pressure sensor
     - 2.1.5 sealed pressure sensor
   - 2.2 describe the applications and installation requirements for pressure transmitters, including:
     - 2.2.1 pressure-sensing transmitter
     - 2.2.2 altitude-sensing transmitter
     - 2.2.3 flow-sensing transmitter

2.2.4 level/depth-sensing transmitter
2.2.5 leak testing
2.2.6 ratiometric correction of transducer output

2.3 describe analog signal standards

2.4 describe the calibration process and the application of input/output calculations for pressure transmitters

2.5 calibrate pressure transmitters

3. select, install and maintain chart recorders

3.1 describe the function and construction of chart recorders, including:
3.1.1 strip chart
3.1.2 circular chart
3.1.3 roll chart

3.2 describe applications and installation requirements for chart recorders, including:
3.2.1 temperature
3.2.2 pressure
3.2.3 humidity
3.2.4 flow

3.3 describe the calibration procedures used on chart recorders

3.4 describe and interpret charts and recording methods for chart recorders

3.5 calibrate chart recorders

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 ISA3450: CONTROL ELEMENTS

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students are introduced to control valves and how they can be used to control conditions such as flow, pressure, temperature and liquid level by being opened or closed automatically by electronic, hydraulic or pneumatic actuators.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. install and service reciprocating control valves
- 1.1 describe the applications and construction of reciprocating control valves, including:
  - 1.1.1 globe valves
  - 1.1.2 cage trim valves
  - 1.1.3 slide valves
- 1.2 identify the hazards associated with reciprocating control valves, including:
  - 1.2.1 extreme temperatures
  - 1.2.2 chemical reactions
  - 1.2.3 very high pressure
- 1.3 describe the servicing procedures used on reciprocating control valves
- 1.4 install a reciprocating control valve
- 1.5 service a reciprocating control valve

2. install and service rotary control valves
- 2.1 describe the applications and construction of rotary control valves, including:
  - 2.1.1 butterfly valve bodies
  - 2.1.2 V-notch ball control valve bodies
  - 2.1.3 eccentric-disk control valve bodies
  - 2.1.4 eccentric-plug control valve bodies
- 2.2 identify the hazards associated with rotary control valves, including:
  - 2.2.1 extreme temperatures
  - 2.2.2 chemical reactions
  - 2.2.3 very high pressure
- 2.3 describe the servicing procedures used on rotary control valves
- 2.4 install a rotary control valve
- 2.5 service a rotary control valve

3. install and service valve actuators
- 3.1 describe the applications and selection of actuators and accessories, including:
  - 3.1.1 rotary
  - 3.1.2 linear-reciprocating
- 3.2 identify the hazards associated with servicing valve actuators

3.3 describe the servicing procedures used on valve actuators
3.4 demonstrate how to service and set-up various valve actuators

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 ISA3455: CONTROL VALVES

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students are introduced to the main parts of control valves and how to properly select, install and maintain control valves.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. **install and service valve positioners**
   - 1.1 describe the applications and selection of valve positioners
   - 1.2 describe the features of positioners
   - 1.3 describe valve positioner servicing procedures
   - 1.4 demonstrate the operation and calibration of pneumatic valve positioners
2. **explain the variables and procedures used in selecting and maintaining control valves**
   - 2.1 describe the principles of friction and the coefficient of friction associated with fluids in motion
   - 2.2 describe flow characteristics, valve CV, cavitation, flashing, erosion, corrosion and specialized trim
   - 2.3 describe the procedures and considerations when determining valve sizes and construction materials
   - 2.4 identify the required fail-safe mode and flow direction when selecting valves for a given application
   - 2.5 describe valve packing materials and applications
3. **prepare control valves for installation and maintenance**
   - 3.1 describe the OHS requirements for energy isolation
   - 3.2 identify hazards associated with removing a control valve from service
   - 3.3 describe the methods used in isolating control valves for maintenance
   - 3.4 demonstrate how to isolate a control valve for maintenance
   - 3.5 install an actuator, perform bench set and adjust valve stroke
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 ISA3460: APPLIED MATH

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment

Description: Students solve problems with fractions, ratios, proportions, percentages and percentage changes using the system international (SI) and the imperial system and also demonstrate the ability to convert between the two systems.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. solve trade-related mathematical problems

- 1.1 describe SI units, prefixes and conversions between the SI system and the imperial system
- 1.2 transpose and solve equations involving:
  - 1.2.1 fractions
  - 1.2.2 ratios
  - 1.2.3 proportions
  - 1.2.4 percentages
  - 1.2.5 exponents
  - 1.2.6 algebra
  - 1.2.7 trigonometry
  - 1.2.8 logarithms
- 1.3 describe units of angular measurement, right angles, obtuse angles, isosceles triangles, equilateral triangles, and the application of Pythagoras's theorem to right-angled triangles
- 1.4 calculate the perimeter, area and volume of various objects, including:
  - 1.4.1 rectangle
  - 1.4.2 square
  - 1.4.3 triangle
  - 1.4.4 trapezoid
  - 1.4.5 parallelogram
  - 1.4.6 circle
  - 1.4.7 ellipse
  - 1.4.8 sector
  - 1.4.9 cylinder
  - 1.4.10 sphere
  - 1.4.11 cone
  - 1.4.12 prism
  - 1.4.13 combination shapes

2. solve problems related to motion and force

2.1 describe velocity, acceleration, displacement, average velocity, average acceleration, momentum, gravitational acceleration, scalar vector quantities, force and mass

2.2 solve problems related to force, mass and acceleration

2.3 describe Newton's three laws of motion and the law of conservation of motion or momentum, including:

- 2.3.1 first law: when viewed in an inertial reference frame, an object either is at rest or moves at a constant velocity unless acted upon by an external force
- 2.3.2 second law: the vector sum of the forces on an object is equal to the total mass of that object multiplied by the acceleration of the object
- 2.3.3 third law: when one body exerts a force on a second body, the second body simultaneously exerts a force equal in magnitude and opposite in direction to that of the first body
- 2.3.4 the law of conservation of motion or momentum: total momentum in an isolated system does not change; the law of physics states that the linear momentum does not change unless an external force acts upon it

2.4 describe moment of force, moment of torque, balancing of forces on a beam, equilibrium of a lever system, effort and mechanical advantage

2.5 solve problems related to force balance about a point and the mechanical advantage of a beam

2.6 describe the mechanical advantage or velocity ratio in terms of diameter or radius of wheels, axles, pulleys and gears

2.7 solve problems related to speed or rotation of pulleys and gears based on diameter or radius as well as the mechanical advantage of a block and tackle system

3. solve problems related to work and power

3.1 describe the terms work, power and efficiency and their associated units

3.2 express efficiency in terms of output versus input of work and power

3.3 solve problems related to work done based on force and distance data

3.4 solve problems related to power based on force, distance and time data

4. solve problems related to energy

4.1 describe energy, potential energy, kinetic energy and the units of energy

4.2 describe the forms of energy and their formulae

4.3 describe the relationship between potential and kinetic energy and the laws of conservation of energy

4.4 solve problems related to potential energy based on force and height data and kinetic energy based on mass and velocity data

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

6.1 identify short-term and long-term goals

6.2 identify steps to achieve goals

COURSE ISA3465: APPLIED PHYSICS

Level: First Period Apprenticeship

Prerequisite: ISA3900: Apprenticeship Safety
ISA3400: Tools & Equipment
ISA3460: Applied Math

Description: Students solve problems related to fluids and the flow of fluids; temperature; and the principles of heat and heat transfer, ideal gases and solids.

Parameters: Access to a material work centre, complete with basic instrumentation tools and materials, and to instruction from an individual with journeyperson certification in the instrumentation and control technician trade.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Outcomes: The student will:

1. solve problems related to fluids and the flow of fluids

1.1 describe the following:
- 1.1.1 atom
- 1.1.2 molecule
- 1.1.3 element
- 1.1.4 molecular attraction
- 1.1.5 cohesion
- 1.1.6 adhesion
- 1.1.7 capillary action
- 1.1.8 compressibility
- 1.1.9 thermal expansion
- 1.1.10 density
- 1.1.11 relative density
- 1.1.12 specific volume

1.2 solve problems related to the mass, density and relative density of liquids and solids
1.3 describe Pascal's law and pressure head
1.4 solve problems related to:
- 1.4.1 pressure
- 1.4.2 density
- 1.4.3 height of a liquid column

1.5 describe Archimedes' principle and concept of buoyancy
1.6 solve problems related to objects submerged in liquids
1.7 describe turbulent flow, laminar flow and the continuity equation
1.8 describe Bernoulli's equation, resistance to flow and flow turbulence

2. solve problems related to heat and temperature

- 2.1 describe the relationship between temperature scales
- 2.2 describe temperature, heat, sources of heat energy, specific heat and the laws of thermodynamics
- 2.3 describe the molecular theory of heat and heat transfer and its significance on the change of state of a substance
- 2.4 describe the coefficient of:
  - 2.4.1 linear expansion
  - 2.4.2 volumetric expansion
  - 2.4.3 surface expansion of liquids and solids
- 2.5 solve problems related to expansion of solids, expansion of liquids, and the changes in heat content of liquids
- 2.6 describe the laws related to heat, conductors, insulators and the process of heat transfer through:
  - 2.6.1 conduction
  - 2.6.2 convection
  - 2.6.3 radiation
- 2.7 describe the steam tables and the following properties:
  - 2.7.1 sensible heat
  - 2.7.2 latent heat of fusion
  - 2.7.3 latent heat of evaporation
  - 2.7.4 saturation temperature
  - 2.7.5 superheat
- 2.8 solve problems related to heat and heat transfer

3. solve problems related to ideal gases

- 3.1 describe Boyle's law, Charles' law and the general gas law, in relation to:
  - 3.1.1 pressure
  - 3.1.2 temperature
  - 3.1.3 volume
- 3.2 solve problems involving gas laws
- 3.3 describe the principles of gas compressibility and volumetric expansion

4. solve problems related to solids

- 4.1 define elasticity, stress, strain, Hooke's law and Young's modulus of elasticity
- 4.2 define the relationship between:
  - 4.2.1 elastic limit
  - 4.2.2 yield point
  - 4.2.3 ultimate strength
  - 4.2.4 breaking strength
  - 4.2.5 safe working stress
  - 4.2.6 factor of safety
- 4.3 define tensile, compressive and shear stresses
- 4.4 solve problems related to stress, force area and strain

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

6.1 identify short-term and long-term goals
6.2 identify steps to achieve goals

COURSE ISA3470: ISA PRACTICUM A

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
   - 1.1 identify regulations and regulatory bodies related to the credential
   - 1.2 describe personal roles and responsibilities, including:
     - 1.2.1 key responsibilities
     - 1.2.2 support functions/responsibilities
     - 1.2.3 code of ethics
   - 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
2. **analyze personal performance in relation to established standards**
   - 2.1 evaluate application of competencies 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 policies and procedures related to health and safety
   - 2.4 evaluate the work environment in terms of:
     - 2.4.1 location
     - 2.4.2 floor plan of work area
     - 2.4.3 analysis of workflow patterns

2.5 evaluate a professional in a related occupation in terms of:
- 2.5.1 training and certification
- 2.5.2 interpersonal skills
- 2.5.3 technical skills
- 2.5.4 professional 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

COURSE ISA3475: ISA PRACTICUM B

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
   - 1.1 identify regulations and regulatory bodies related to the credential
   - 1.2 describe personal roles and responsibilities, including:
     - 1.2.1 key responsibilities
     - 1.2.2 support functions/responsibilities
     - 1.2.3 code of ethics
   - 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
2. **analyze personal performance in relation to established standards**
   - 2.1 evaluate application of competencies 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 policies and procedures related to health and safety
   - 2.4 evaluate the work environment in terms of:
     - 2.4.1 location
     - 2.4.2 floor plan of work area
     - 2.4.3 analysis of workflow patterns

2.5 evaluate a professional in a related occupation in terms of:
- 2.5.1 training and certification
- 2.5.2 interpersonal skills
- 2.5.3 technical skills
- 2.5.4 professional 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

COURSE ISA3480: ISA PRACTICUM C

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
   - 1.1 identify regulations and regulatory bodies related to the credential
   - 1.2 describe personal roles and responsibilities, including:
     - 1.2.1 key responsibilities
     - 1.2.2 support functions/responsibilities
     - 1.2.3 code of ethics
   - 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
2. **analyze personal performance in relation to established standards**
   - 2.1 evaluate application of competencies 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 policies and procedures related to health and safety
   - 2.4 evaluate the work environment in terms of:
     - 2.4.1 location
     - 2.4.2 floor plan of work area
     - 2.4.3 analysis of workflow patterns

2.5 evaluate a professional in a related occupation in terms of:
- 2.5.1 training and certification
- 2.5.2 interpersonal skills
- 2.5.3 technical skills
- 2.5.4 professional 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

COURSE ISA3485: ISA PRACTICUM D

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
   - 1.1 identify regulations and regulatory bodies related to the credential
   - 1.2 describe personal roles and responsibilities, including:
     - 1.2.1 key responsibilities
     - 1.2.2 support functions/responsibilities
     - 1.2.3 code of ethics
   - 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
2. **analyze personal performance in relation to established standards**
   - 2.1 evaluate application of competencies 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 policies and procedures related to health and safety
   - 2.4 evaluate the work environment in terms of:
     - 2.4.1 location
     - 2.4.2 floor plan of work area
     - 2.4.3 analysis of workflow patterns

2.5 evaluate a professional in a related occupation in terms of:
- 2.5.1 training and certification
- 2.5.2 interpersonal skills
- 2.5.3 technical skills
- 2.5.4 professional 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

COURSE ISA3900: APPRENTICESHIP SAFETY

Level: First Period Apprenticeship

Prerequisite: None

Description: Students develop knowledge, skills and attitudes in the practice of workshop health and safety, communication and career planning.

Parameters: Access to a materials work centre and to instruction from an individual with specialized training in occupational health and safety (and understanding of the instrumentation industry) and/or an instrumentation and control technician.

ILM Resources: Individual Learning Modules (ILM) have been developed for this apprenticeship area by Advanced Education. The ILMs are available for teachers and students on LearnAlberta.

Note: This course may promote discussions around sensitive topics (e.g., injury and death) in the context of student safety with respect to workplace hazards.

Outcomes: The student will:

1. **describe legislation, regulations and practices intended to ensure a safe workplace in the instrumentation and control technician apprenticeship trade**
   - 1.1 demonstrate the ability to apply the *Occupational Health and Safety (OHS) Act*, *Regulation* and *Code*, as well as the changes from Bill C-45
   - 1.2 explain the core requirements applicable to all industries, including:
     - 1.2.1 engineering controls
     - 1.2.2 administrative controls
     - 1.2.3 personal protective equipment (PPE)
   - 1.3 demonstrate an understanding of the 26 parts of the OHS Code requirements applicable to all industries
   - 1.4 demonstrate an understanding of the 12 parts of the OHS Code requirements applicable to specific industries and activities
   - 1.5 demonstrate an understanding of the 11 OHS Code Schedules that the Explanation Guide does not address
   - 1.6 explain the role of the employer and employee in regard to occupational health and safety legislation, considering:
     - 1.6.1 employer responsibilities (OHS Regulation)
     - 1.6.2 employee responsibilities (OHS Regulation)
     - 1.6.3 Workplace Hazardous Materials Information System (WHMIS)
     - 1.6.4 fire regulations
     - 1.6.5 Workers' Compensation Board (WCB)
     - 1.6.6 related advisory bodies and agencies; e.g., Alberta Construction Safety Association (ACSA), Construction Owners Association of Alberta (COAA), Occupational Health and Safety Council (OHSC), Work Safe Alberta, Safety Codes Council
   - 1.7 explain industry practices for hazard assessment and control procedures in four main hazard categories, including:
     - 1.7.1 biological
     - 1.7.2 chemical

1.7.3 ergonomic
1.7.4 physical hazards

1.8 identify and describe hazard assessment tools that both employees and employers must use in assessing and controlling work-site hazards, including:
1.8.1 work-site hazard identification and assessment
1.8.2 health and safety plan
1.8.3 joint work-site health and safety committee
1.8.4 emergency response plans
1.8.5 first-aid and incident reports

1.9 identify and describe employer engineering controls that provide the highest level of worker protection, including:
1.9.1 elimination
1.9.2 substitution
1.9.3 redesign
1.9.4 isolation
1.9.5 automation

1.10 identify and describe employer administrative controls that limit hazards to the lowest level possible, including:
1.10.1 safe work practices
1.10.2 job procedures, policies and rules
1.10.3 work/rest schedules to reduce exposure
1.10.4 limiting hours of work
1.10.5 scheduling hazardous work during non-peak times
1.10.6 using optional methods

1.11 describe the responsibilities of employees and employers to apply emergency procedures, including:
1.11.1 emergency response plans
1.11.2 first aid

1.12 describe positive tradesperson attitudes with respect to legal responsibilities for all workers, including:
1.12.1 housekeeping
1.12.2 lighting
1.12.3 personal protective equipment (PPE)
1.12.4 emergency procedures

1.13 describe the roles and responsibilities of employers and employees with respect to the selection and use of personal protective equipment (PPE), including:
1.13.1 eye protection; e.g., class 1 (spectacles), class 2 (goggles), class 3 (welding helmets), class 4 (welding hand shields), class 5 (hoods), class 6 (face shields), class 7 (respirator face pieces)
1.13.2 flame resistant clothing
1.13.3 foot protection; e.g., category 1, 2 or 3 footwear requirements
1.13.4 head protection; e.g., class G (general), class E (electrical), class C (conducting)
1.13.5 hearing protection; e.g., earplugs or earmuffs
1.13.6 life jackets and personal flotation devices (PFDs)
1.13.7 limb and body protection
1.13.8 respiratory protective equipment; e.g., particulate filters; chemical cartridges or canisters; airline respirators, hoods, helmets and suits; self-contained breathing apparatus (SCBA)
1.13.9 a combination of any of the above

2. describe the use of personal protective equipment (PPE) and safe practices for climbing, lifting, rigging and hoisting in the instrumentation and control technician apprenticeship trade

- 2.1 select, use and maintain specialized PPE and materials for climbing, lifting and loading, including:
  - 2.1.1 full body harness
  - 2.1.2 body belt
  - 2.1.3 ladders
  - 2.1.4 scaffold systems
  - 2.1.5 lifting and moving equipment
  - 2.1.6 PPE for lifting
  - 2.1.7 materials handling equipment; e.g., forklift, four-wheel dolly, chain hoist, overhead crane
- 2.2 describe manual lifting procedures, including correct body mechanics, considering:
  - 2.2.1 back safety
  - 2.2.2 general procedure for lifting
  - 2.2.3 employer and employee preventive actions to avoid back injuries
- 2.3 describe rigging hardware and the safe work load associated with:
  - 2.3.1 wire rope slings
  - 2.3.2 synthetic fibre web slings
  - 2.3.3 chain slings
  - 2.3.4 rigging hardware inspection
- 2.4 select the correct equipment for rigging typical loads, including:
  - 2.4.1 eye bolts
  - 2.4.2 shackles
  - 2.4.3 rings and links
  - 2.4.4 hooks
  - 2.4.5 swivels
  - 2.4.6 spreader bars and equalization beams
  - 2.4.7 blocks
  - 2.4.8 sheaves
  - 2.4.9 turnbuckles
- 2.5 describe hoisting and load-moving procedures
- 2.6 explain the most commonly used sling configurations to connect a load to a hook, including:
  - 2.6.1 vertical hitch
  - 2.6.2 bridle hitch
  - 2.6.3 single and double basket hitch
  - 2.6.4 wrap hitch
  - 2.6.5 single and double choker hitch
- 2.7 demonstrate the standard movement signals a signaler is required to know to signal a crane operator, including:
  - 2.7.1 hoist and lower load
  - 2.7.2 raise and lower boom
  - 2.7.3 swing boom
  - 2.7.4 stop
  - 2.7.5 emergency stop
  - 2.7.6 dog everything

3. describe the safety practices for hazardous materials and fire protection in the instrumentation and control technician apprenticeship trade

- 3.1 describe the roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program, including:
  - 3.1.1 suppliers', employers' and employees' responsibilities
  - 3.1.2 WHMIS classifications
  - 3.1.3 health effects from exposure to chemicals
- 3.2 describe the three key elements of WHMIS, including:
  - 3.2.1 worker education
  - 3.2.2 supplier and workplace product labelling
  - 3.2.3 material safety data sheets
- 3.3 describe handling, storage and transportation procedures when dealing with hazardous material, including:
  - 3.3.1 handling, storing and transporting flammable liquids
  - 3.3.2 handling, storing and transporting compressed gas
  - 3.3.3 storing incompatible materials
- 3.4 describe safe venting procedures when working with hazardous materials, including:
  - 3.4.1 mechanical general ventilation
  - 3.4.2 local ventilation
  - 3.4.3 portable smoke extractor
  - 3.4.4 working in a confined space
- 3.5 describe fire hazards, classes, procedures and equipment related to fire protection, including:
  - 3.5.1 elements of a fire
  - 3.5.2 classes of fires
  - 3.5.3 fire extinguisher labels
  - 3.5.4 extinguishing small fires
  - 3.5.5 the PASS method

4. demonstrate communication skills and workshop safety as they pertain to occupational health and safety standards

- 4.1 use various types of communication to provide trade-related information, employing standard terms for components and operations, including:
  - 4.1.1 personal appearance
  - 4.1.2 business appearance
  - 4.1.3 suppliers and sales representatives
  - 4.1.4 customers
  - 4.1.5 tradespeople
- 4.2 identify key areas of responsibility that an employee has in regards to shop and trade safety, including:
  - 4.2.1 housekeeping
  - 4.2.2 waste containers
  - 4.2.3 power tools and rotating machinery
  - 4.2.4 compressed air
  - 4.2.5 exhaust gases
  - 4.2.6 control of carbon monoxide (CO)
  - 4.2.7 hazardous materials, dangerous goods and controlled products
- 4.3 explain the correct use of fire extinguishers and explain fire prevention techniques

5. demonstrate an understanding of the instrumentation and control technician apprenticeship trade and of apprenticeship opportunities that exist by creating a personal career portfolio

- 5.1 demonstrate an understanding of the instrumentation and control technician apprenticeship trade and related job opportunities
- 5.2 describe the contractual responsibilities of the apprentice, employer and Alberta Apprenticeship and Industry Training
- 5.3 describe the purpose of the apprentice record book
- 5.4 describe the procedure for changing employers during an active apprenticeship
- 5.5 describe the purpose of the course outline
- 5.6 describe the advancement opportunities in the instrumentation and control technician trade
- 5.7 refine and present a personal career portfolio, showing evidence of strengths and competencies, including:
  - 5.7.1 application completion
  - 5.7.2 cover letter
  - 5.7.3 résumé with references
- 5.8 demonstrate knowledge of workplace requirements, rights and responsibilities and relate this knowledge to personal career/employment expectations
- 5.9 outline the educational requirements to move into the instrumentation and control technician apprenticeship trade and:
  - 5.9.1 conduct successful employment searches
  - 5.9.2 communicate in the language in which business is conducted
  - 5.9.3 prepare a personal employment search portfolio
  - 5.9.4 use technologies, tools and information systems appropriately for job preparation

6. demonstrate basic competencies

- 6.1 demonstrate fundamental skills to:
  - 6.1.1 communicate
  - 6.1.2 manage information
  - 6.1.3 use numbers
  - 6.1.4 think and solve problems
- 6.2 demonstrate personal management skills to:
  - 6.2.1 demonstrate positive attitudes and behaviours
  - 6.2.2 be responsible
  - 6.2.3 be adaptable
  - 6.2.4 learn continuously
  - 6.2.5 work safely
- 6.3 demonstrate teamwork skills to:
  - 6.3.1 work with others
  - 6.3.2 participate in projects and tasks

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

- 7.1 identify short-term and long-term goals
- 7.2 identify steps to achieve goals