Pre-Employment Plan of Training

Industrial Mechanic (Millwright)

March 2019

Newfoundland & Labrador

PLAN OF TRAINING

Industrial Mechanic (Millwright)

March, 2019

Government of Newfoundland and Labrador
Department of Advanced Education, Skills and Labour
Apprenticeship and Trades Certification Division

Approved by:

Chairperson, Provincial Apprenticeship and Certification Board

Date: March 20, 2019

Preface

This curriculum standard is aligned with the 2019 Level 1 Atlantic Apprenticeship Curriculum Standard (AACS) and the 2017 Red Seal Occupational Standard (RSOS) for the Industrial Mechanic (Millwright) trade. It describes the curriculum content for the Industrial Mechanic (Millwright) pre-employment training program.

Acknowledgements

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We offer a sincere thank you.

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Document Status	Date Approved	Mandatory Implementation Date	Comments
New	March 2019	Pre-employment September 2019	Pre-Employment harmonized with AACS Level I.
Approved	June 2020		Updated Essential Skills courses to 2019 versions. Applied accessibility formatting.

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A. RSOS Comparison Chart

A Red Seal Occupational Standard (RSOS) comparison chart is located in the Atlantic Apprenticeship Curriculum Standard (AACS) for this trade.

B. Program Structure

For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

The order of course delivery within each level can be determined by the training institution, as long as pre-requisite conditions are satisfied.

Upon completion of an entry level program, individuals may be required to complete other certifications (employer or job site specific) in order to gain employment.

A pre-employment student who becomes an apprentice will also be required to complete Levels 2, 3 & 4 in the Atlantic Apprenticeship Curriculum Standard.

Pre-Employment				
Course No.	**AACS No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
TS1510	-	OH&S	6	None
TS1520	IMM-105	WHMIS	6	None
TS1530	IMM-105	Standard First Aid	14	None
MS1230	IMM-105 IMM-110	Hand Tools	20	TS1510 TS1520 TS1530
MW1240	IMM-110	Portable Power Tools	20	MS1230
MW1251	-	Blueprint Reading and Sketching	15	-
MW1261	-	Equipment Assembly Blueprints	15	MW1251
MW1270	IMM-170	Mechanical Installation Blueprints	15	MW1261
MW1281	-	Schematics Advanced	15	MW1251
MW1291	IMM-120 IMM-150	Rigging	30	MW1240
MW1450	-	Drills, Taps and Reamers	30	MW1240

Pre-Employment				
Course No.	**AACS No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
MW1461	IMM-130	Measuring and Layout	54	MS1230
MW1621	IMM-115	Metal Lathe	60	MW1450
MW1630	IMM-115	Milling Machines	40	MW1620
MW1470	-	Piping Components	30	MW1460
MW1511	IMM-115	Power Metal Saws	15	MW1460
MW1521	IMM-115	Pedestal Grinders	15	MW1511
MW1530	-	Bearings	40	MW1580
MW1541	IMM-165	Fasteners	9	MS1230
MW1550	IMM-135	Metallurgy	30	WD1330
MW1580	-	Static and Dynamic Seals	30	MW1650
MW1591	-	Coupling and Clutches	20	MW1640
MW1360	-	Shafts and Shaft Alignment	20	MW1591
MW1610	-	Belt and Chain Drive Systems	45	MW1530
MW1640	-	Gear Drive Systems	50	MW1610
MW1650	IMM-125	Lubrication Practices	20	MS1230
MW1670	-	Non-Positive Displacement Pumps	40	MW1591
MW1690	-	Positive Displacement Pumps	50	MW1670
MW1730	-	Electrical Fundamentals	30	MW2150
MW2150	-	Hydraulics I	30	MW1690

Pre-Employment				
Course No.	**AACS No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
WD1330	IMM-140	Oxy-Fuel Welding	30	MS1230
MW2122	IMM-145	Plasma Arc Cutting	6	MS1230
OT1151	-	Workplace Exposure	80	None
AM1000		Introduction to Essential Skills	9	None
AM1101	-	Math Essentials	42	None
AM1181	-	Industrial Mechanic Math Fundamentals*	42	AM1101
CM2161	IMM-155	Communication Essentials	36	None
SD1761	IMM-155	Workplace Essentials	24	None
MC1062	-	Computer Essentials	15	None
AP1102	-	Introduction to Apprenticeship	12	None
Total Pre-Employment Hours			**1110**	

*A student who can meet the mathematics requirement through an ACUPLACER® test may be exempted from AM1101 - Math Essentials. Please check with your training institution.

Required Work Experience

Pre-Employment

TS1510 Occupational Health and Safety

Learning Outcomes:

- Demonstrate knowledge of interpreting the Occupational Health and Safety Act, laws and regulations.
- Demonstrate knowledge of understanding the designated responsibilities within the laws and regulations such as the right to refuse dangerous work; and the importance of reporting accidents.
- Demonstrate knowledge of how to prevent accidents and illnesses.
- Demonstrate knowledge of how to improve health and safety conditions in the workplace.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Interpret the Occupational Health and Safety Act laws and regulations.
   i. explain the scope of the act
      - application of the act
      - Federal/Provincial jurisdictions
      - Canada Labour Code
      - rules and regulations
      - private home application
      - conformity of the Crown by the Act

2. Explain responsibilities under the Act and Regulations.
   i. duties of employer, owner, contractors, sub-contractors, employees, and suppliers

3. Explain the purpose of joint health and safety committees.
   i. formation of committee
   ii. functions of committee
   iii. legislated rights
   iv. health and safety representation
   v. reporting endangerment to health
   vi. appropriate remedial action
   vii. investigation of endangerment
   viii. committee recommendation
   ix. employer's responsibility in taking remedial action

4. Examine right to refuse dangerous work.
   i. reasonable grounds for refusal
   ii. reporting endangerment to health
   iii. appropriate remedial action
   iv. investigation of endangerment
   v. committee recommendation
   vi. employer's responsibility to take appropriate remedial action
   vii. action taken when employee does not have reasonable grounds for refusing dangerous work
   viii. employee's rights
   ix. assigning another employee to perform duties
   x. temporary reassignment of employee to perform other duties
   xi. collective agreement influences
   xii. wages and benefits

5. State examples of work situations where one might refuse work.

6. Describe discriminatory action.
   i. definition
   ii. filing a complaint procedure
   iii. allocated period of time a complaint can be filed with the Commission
   iv. duties of an arbitrator under the Labour Relations Act
   v. order in writing inclusion
   vi. report to commission Allocated period of time to request Arbitrator to deal with the matter of the request
   vii. notice of application
   viii. failure to comply with the terms of an order
   ix. order filed in the court

7. Explain duties of commission officers.
   i. powers and duties of officers
   ii. procedure for examinations and inspections
   iii. orders given by officers orally or in writing
   iv. specifications of an order given by an officer to owner of the place of employment, employer, contractor, sub-contractor, employee, or supplier
   v. service of an order
   vi. prohibition of persons towards an officer in the exercise of his/her power or duties
   vii. rescinding of an order
   viii. posting a copy of the order
   ix. illegal removal of an order

8. Interpret appeals of others.
   i. allocated period of time for appeal of an order
   ii. person who may appeal order
   iii. action taken by Commission when person involved does not comply with the order
   iv. enforcement of the order
   v. notice of application
   vi. rules of court

9. Explain the process for reporting of accidents.
   i. application of act
   ii. report procedure
   iii. reporting notification of injury
   iv. reporting accidental explosion or exposure
   v. posting of act and regulations

Practical Requirements:

1. Conduct an interview with someone in your occupation on two or more aspects of the act and report results.

2. Conduct a safety inspection of shop area.

TS1520 Workplace Hazardous Materials Information System (WHMIS)

Learning Outcomes:

- Demonstrate knowledge of interpreting and applying the Workplace Hazardous Materials Information System (WHMIS) Regulation under the Occupational Health and Safety Act.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define WHMIS safety.
   - i. rational and key elements
   - ii. history and development of WHMIS
   - iii. WHMIS legislation
   - iv. WHMIS implementation program
   - v. definitions of legal and technical terms

2. Examine hazard identification and ingredient disclosure.
   - i. prohibited, restricted and controlled products
   - ii. classification and the application of WHMIS information requirements
   - iii. responsibilities for classification
     - the supplier
     - the employer
     - the worker - Classification: rules and criteria
     - information on classification
     - classes, divisions and subdivision in WHMIS
     - general rules for classification
       - class A - compressed gases
       - class B - flammable and combustible materials
       - class C - oxidizing material
       - class D - poisonous and infectious material
       - class E - corrosive material
       - class F - dangerously reactive material
   - iv. products excluded from the application of WHMIS legislation
     - consumer products
     - explosives
     - cosmetics, drugs, foods and devices
     - pest control products
     - radioactive prescribed substances
     - wood or products made of wood

- manufactured articles
- tobacco or products of tobacco
- hazardous wastes
- products handled or transported pursuant to the Transportation of Dangerous Goods (TDG) Act

v. comparison of classification systems - WHMIS and TDG
vi. general comparison of classification categories
vii. detailed comparison of classified criteria

3. Explain labeling and other forms of warning.
   i. definition of a WHMIS label
      - supplier label
      - workplace label
      - other means of identification
   ii. responsibility for labels
      - supplier responsibility
      - employer responsibility
      - worker responsibility
   iii. introduce label content, design and location
      - supplier labels
      - workplace labels
      - other means of identification

4. Introduce material safety data sheets (MSDS).
   i. definition of a material safety data sheet
   ii. purpose of the data sheet
   iii. responsibility for the production and availability of data sheets
      - supplier responsibility
      - employer responsibility
      - workers responsibility

Practical Requirements:

1. Locate WHMIS label and interpret the information displayed.

2. Locate a MSDS sheet for a product used in the workplace and determine what personal protective equipment and other precautions are required when handling this product.

TS1530 Standard First Aid

Learning Outcomes:

- Demonstrate knowledge of recognizing situations requiring emergency action.
- Demonstrate knowledge of making appropriate decisions concerning first aid.

Duration: 14 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Complete a **St. John Ambulance or Canadian Red Cross** Standard First Aid Certificate course.

MS1230 Hand Tools

Learning Outcomes:

- Demonstrate an understanding of safety practices in the use and care of hand tools.
- Demonstrate the ability to select, operate and maintain hand tools properly.

Duration: 20

Pre-Requisite(s): TS1510, TS1520, TS1530

Objectives and Content:

1. Describe hazards and safe work practices pertaining to the use of tools and equipment.

2. Describe and identify cutting and non-cutting hand tools.
   - i. proper tool selection
   - ii. open end, boxed end, and combination wrenches
   - iii. pliers and their use
   - iv. snips and their use
   - v. screwdrivers and their use
   - vi. ratchets, sockets and power bars
   - vii. allen wrenches
   - viii. torque wrenches and torque multipliers: hydraulic and mechanical
   - ix. hammers
   - x. hacksaws
     - blade selection
   - xi. file types, sizes and selection
   - xii. chisels and punches
   - xiii. oil and honing stones
   - xiv. scrapers

3. Explain two uses of arbour presses.
   i. arbour press classification
   ii. safe use
   iii. broach sets

4. Describe torque and its importance.
   i. definition of torque
   ii. purposes
   iii. torque wrench types
   iv. torque charts
   v. torque wrench adjustment
   vi. torque wrench accuracy

Practical Requirements:

1. Cut metal using a hacksaw.

2. Debur metal using proper file selection.

3. Cut metal using tin snips and chisels.

4. Torque bolts to specifications.

MW1240 Portable Power Tools

Learning Outcomes:

- Demonstrate an understanding of safe practices in the use and care of pneumatic and electric portable power tools.
- Demonstrate the ability to select, operate and maintain pneumatic and electric portable power tools properly.

Duration: 20 Hours

Pre-Requisite(s): MS1230

Objectives and Content:

1. Describe the procedures used to select the proper power tool for a specific task.
   i. proper tool selection based on job requirements
   ii. drill types and classification
   iii. portable grinders and grinding wheel types and classification
   iv. power screwdriver classification, and clutch mechanisms
   v. circular saw classification
   vi. reciprocating saw classification
   vii. pipe threading machines and their uses

2. Describe the procedures used to operate portable power tools.
   i. safe practices for the operation of shears, nibblers, drills, circular and reciprocating saws, power screwdrivers, grinders and impact tools
   ii. current flow through electric tools
   iii. over current protection and double insulated tools

3. Describe the procedures used to inspect and maintain portable power tools.
   i. operating principles of various electrical and pneumatic tools
   ii. proper methods of lubricating pneumatic tools
   iii. power cord inspection
   iv. airline inspection
   v. designed operating pressure
   vi. pressure loss in lines
   vii. filters, regulators and lubricators

4. Describe powder (explosive) actuated tools and their applications.
   i. power loads
   ii. fastener spacing
   iii. maintenance

Practical Requirements:

1. Replace a power cord on an electric portable tool.
2. Replace a disc on a portable grinder.
3. Replace power saw blades.
4. Operate power tools listed in objectives and content section.
5. Cut thread pipe.

MW1251 Blueprint Reading and Sketching

Learning Outcomes:

- Demonstrate an understanding of blueprint reading.
- Demonstrate the ability to make freehand sketches.
- Demonstrate the ability to extract pertinent information from basic blueprints.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe the principles of basic blueprint reading and the components involved.
   i. visualization
   ii. interpretation of the print

2. Describe the procedures used to develop freehand sketches.
   i. drawing production
   ii. accepted sketching methods
   iii. drawing to scale
   iv. proportion in sketching

3. Describe orthographic projection.
   i. definition of orthographic projection
   ii. projection and selection of views
   iii. rules of procedure for the visualization of objects
   iv. identification of lines and surfaces
   v. matching views
   vi. sketching orthographic views

4. Describe the use of different lines: visible, hidden, section, centre, dimension, extension, cutting plane, break and phantom lines.

5. Describe basic machining symbols used on blueprints.
   i. ANSI and ASME standards
   ii. welding/weld
   iii. surface finishes

6. Describe the methods of dimensioning.
   i. size and location dimensions
   ii. dimension and extension lines
   iii. placement of dimensions

7. Describe the procedures use to read drawings in order to extract relevant information.
   i. basis for interpreting drawings
   ii. sectional views
   iii. tolerances and allowances
   iv. removed and revolved sections
   v. inclined surfaces
   vi. circular features

8. Identify the functions of a CAD system.

Practical Requirements:

1. Develop freehand sketches as per instructor's directives.

2. Complete assignment drawings as per instructor's directives.

3. Operate a CAD system.

MW1261 Equipment Assembly Blueprints

Learning Outcomes:

- Demonstrate the ability to use blueprints to establish assembly procedures in order to install equipment and machinery.

Duration: 15 Hours

Pre-Requisite(s): MW1251

Objectives and Content:

1. Identify the procedures used to interpret and use equipment assembly blueprints, to determine the assembly procedures for equipment components.
   - i. purpose of detail drawings
   - ii. purpose of assembly drawings
   - iii. sub-assembly, working assembly, diagram assembly, installation assembly and exploded pictorial assembly drawings
   - iv. identify terms used in dimensioning
   - v. identifying various types of dimensions
   - vi. identifying spur, bevel and worm gears
   - vii. identifying splines and serrations
   - viii. recognizing basic weld and welding symbols

2. Identify various views and their arrangement.
   - i. auxiliary views
   - ii. sectional views
   - iii. full, half, offset, aligned, broken out, revolved, removed, partial and outlined
   - iv. sections

3. Identify steel specifications found on the blueprints.
   - i. ANSI and ASME methods of identifying steel by code

Practical Requirements:

1. Interpret and use equipment assembly blueprints as per instructor s directives.

2. Complete assignment drawings as per instructor’s directives.

MW1270 Mechanical Installation Blueprints

Learning Outcomes:

- Demonstrate the ability use mechanical drawings to determine the location, position and elevation of trade related pieces of equipment or one of its components.

Duration: 15 Hours

Pre-Requisite(s): MW1261

Objectives and Content:

1. Identify the procedures used to read and interpret mechanical drawings to determine the location, the position and the elevation of various pieces of equipment, electrical components, mechanical components or piping components.
   - i. purpose of blueprints
   - ii. purpose of schematics
   - iii. purpose of drawings
   - iv. partial views and their uses
   - v. piping components, valves and fittings
     - schematics and symbols

Practical Requirements:

1. Interpret and use mechanical blueprints to confirm equipment location and installation procedures.

MW1281 Schematics Advanced

Learning Outcomes:

- Demonstrate the ability to recognize schematic symbols for hydraulic and pneumatic systems.
- Demonstrate the ability to develop schematic drawings.
- Demonstrate the ability to use schematics to troubleshoot hydraulic and pneumatic systems.

Duration: 15 Hours

Pre-Requisite(s): MW1251

Objectives and Content:

1. Identify schematic symbols found on drawings and describe their use in troubleshooting hydraulic and pneumatic systems.
   i. types and uses of schematic symbols

2. Identify schematic symbols.
   i. understand the language of schematic symbols
   ii. sequence of operation of a system
   iii. understand what the system is supposed to do
   iv. follow oil/air flow through various components
   v. understand systems using schematic symbols

Practical Requirements:

1. Develop a hydraulic schematic by hand or by computer.

MW1291 Rigging

Learning Outcomes:

- Demonstrate the ability to safely use different rigging apparatus to lift and move equipment and machinery.
- Demonstrate the ability to erect ladders and scaffolding.
- Demonstrate the ability to use safety harnesses.

Duration: 30 Hours

Pre-Requisite(s): MW1240

Objectives and Content:

1. Describe proper method of erecting and installing ladders.
   i. 100% tie off

2. Describe proper use of safety harnesses and lanyards.

3. Describe proper method of erecting scaffolding.
   i. limits in accordance with regulations
   ii. 100 % tie off

4. Identify and describe the types, construction and use of fibre rope.
   i. construction of wire rope
      - lays
      - cores
   ii. grades of wire rope
   iii. preformed wire rope
   iv. classification of wire rope
   v. wire rope size
   vi. fleet angles
   vii. lubrication of wire rope
   viii. storing and handling
   ix. determining rope anchorage on a drum
   x. natural fibre ropes
   xi. synthetic fibre ropes
   xii. fibre rope size

5. Identify safety factors pertaining to rigging.
   i. determine safe working loads of ropes and slings at various angles
   ii. determine weight of lifted objects
   iii. determine of gravity

6. Identify various types of knots used in rigging equipment for lifting or moving.
   i. figure eight knot
   ii. reef knot
   iii. bowline
   iv. bowline on the bight
   v. clove hitch
   vi. rolling hitch
   vii. sheep shank
   viii. sheet bend

7. Describe the procedures used to select the appropriate sling to perform a given task.
   i. single vertical hitch
   ii. bridle hitch
   iii. single and double basket hitch
   iv. single and double choker hitch
   v. endless slings
   vi. synthetic web slings
   vii. metal mesh slings
   viii. chain slings

8. Describe the procedure for lifting, moving and securing equipment.
   i. safety considerations
   ii. hand signals
   iii. jacks

9. Describe the procedures used to select and use various chain blocks and come-a-longs.
   i. blocks and block types
   ii. mechanical advantage
   iii. snatch blocks
   iv. chain hoists
   v. inspection of chain hoists
   vi. wire winch
   vii. jacks

10. Describe the different types of lifting accessories and their uses.
   i. poured sockets
   ii. wedge sockets
   iii. swaged sockets
   iv. cable clips
   v. thimbles
   vi. hooks
   vii. shackles
   viii. eye bolts
   ix. turnbuckles

x. spreader and equalizer beams

11. Describe forklifts, mobile and overhead cranes and their uses.

Practical Requirements:

1. Erect ladders.

2. Erect scaffolding as per instructor's directives.

3. Demonstrate proper use of safety harnesses and lanyards.

4. Tie various types of knots used with rigging equipment.

5. Prepare rigging attachments for moving a piece of equipment and conduct safety inspection using hand signals.

6. Lift and move a piece of equipment using rigging methods and procedures, demonstrating hand signals.

7. Choose and install cable clips required to join a section of wire cable as listed in the manufacturer specifications.

MW1450 Drills, Taps, and Reamers

Learning Outcomes:

- Demonstrate the ability to operate and maintain drilling machines and reamers in a safe and efficient manner.
- Demonstrate the ability to sharpen twist drills.
- Demonstrate an understanding of proper speed and feed while using drilling machines and reamers.
- Demonstrate the ability to use dies.
- Demonstrate the ability to drill, ream, counter bore, countersink and tap hole.

Duration: 30 Hours

Pre-Requisite(s): MW1240

Objectives and Content:

1. Describe the different types of drilling machines and their uses.
   i. types and application of drilling machines

2. Identify accepted safety practices when operating drilling machines.

3. Describe the procedures used to calculate speeds and feeds for efficient drilling of different metals.
   i. definition of cutting speed
   ii. purpose of using recommended cutting speeds
   iii. factors governing cutting speeds
   iv. rpm
   v. definition of feed
   vi. expression of feed rates
   vii. feeds and feed charts

4. Describe the procedures used to select the proper cutting fluids used for machining various metals.
   i. purpose of cutting fluids
   ii. fluids for ferrous and non-ferrous metals

5. Describe the different parts of a twist drill and their purpose.
   i. shanks (straight and tapered)
   ii. body
      - flutes, margins, lands and cutting lips
   iii. point
      - cutting edge, heel, body clearance and chisel edge

6. Describe the procedures used to calculate the tap drill size using the formula.
   iv. purpose of the proper tap drill size
   v. tap drill formulas for imperial and metric sizes
   vi. tap drill charts

7. Describe the different taps in a set and the purpose of each.
   i. taper, plug and bottoming taps
   ii. tap extractors
   iii. tap handles
   iv. tapping procedures
   v. special tap attachments

8. Describe procedures to sharpen a twist drill for various materials.
   i. drill point characteristics
   ii. drill point angles for various materials
   iii. cutting lip length
   iv. web thickness
   v. clearance angles
   vi. chisel point
   vii. grinding procedures
   viii. web thinning
   ix. drill point angle measurement
   x. problems caused by improperly sharpened drills
   xi. relieving cutting for soft material

9. Describe the different types of threading dies.
   i. purpose of dies
   ii. solid die
   iii. adjustable split die
   iv. adjustable screw plate die
   v. die stocks
   vi. threading procedures

10. Describe the different types of hand and machine reamers and describe their purpose.
   i. purpose of reaming
   ii. solid hand reamer
   iii. expansion hand reamer
   iv. adjustable hand reamer
   v. taper reamers
   vi. straight and helical fluted reamers
   vii. rose reamers
   viii. shell reamers

11. Describe the procedures used to determine tolerances, speeds and feeds for reaming.
    i. reaming allowances for hand and machine reamers
    ii. cutting speeds for various metals
    iii. recommended feed rates for hand and machine reaming

12. Describe different types of drill bits and their purpose.
    i. straight and tapered shank twist drills
    ii. high helix drills
    iii. core drills
    iv. oil hole drills
    v. straight fluted drills
    vi. deep hole drills
    vii. spade drills
    viii. step drills
    ix. hole saws

13. Describe procedures to countersink, counterbore holes and spot face.
    i. purpose of countersinking and counterboring holes
    ii. counterbore styles
    iii. speeds and feeds procedures
    iv. countersink angles
    v. speeds and feeds for countersinking
    vi. spot facing

14. Describe pipe taps and dies and their uses.
    i. special tap attachments

Practical Requirements:

1. Drill, tap, ream, counterbore and countersink holes as directed by the instructor.

2. Sharpen a twist drill at various angles.

3. Mix cutting fluids.

MW1461 Measuring and Layout

Learning Outcomes:

- Demonstrate knowledge of the procedures used to level and align equipment.
- Demonstrate knowledge of the procedures used to maintain, calibrate and store precision measuring and layout tools.
- Demonstrate knowledge of measuring and layout and their applications.
- Demonstrate knowledge of the procedures used to perform layout operations.
- Demonstrate knowledge of precision measuring and layout tools, their applications and procedures.

Duration: 54 Hours

Pre-Requisite(s): MS1230

Objectives and Content:

1. Define terminology associated with equipment leveling and alignment, measuring and layout.

2. Identify hazards and describe safe work practices pertaining to leveling, alignment, measuring and layout procedures, and their use.

3. Identify measuring and layout tools and equipment and describe their application and procedures.
   - i. equipment leveling and alignment
     - theodolites
     - levels (optical, laser, spirit)
     - Piano wire
     - Plumb bob
   - ii. precision measuring tools
     - micrometers
     - calipers
     - dial indicators
     - protractors
     - Vernier height gauges
     - feeler gauges
     - plug, ring and snap gauges
     - gauge blocks
     - theodolites
     - transits
     - total station
   - iii. layout tools
     - straightedges

- squares
- combination sets
- surface plates
- scribers
- hermaphrodite calipers
- dividers
- trammels
- prick and centre punches
- angle plates
- parallels
- v-blocks
- surface gauges
- layout dye

4. Identify types of bases used and describe their applications.
   i. base plate
   ii. sole plate
   iii. fabricated
   iv. skid mounted

5. Describe the procedures used to level and align equipment.

6. Describe the procedures to inspect, maintain, calibrate and store precision measuring and layout tools.

7. Describe the procedures used to lay out equipment and components.

8. Describe the procedures used to transfer and document measurements.

9. Interpret information from precision measuring tools.

Practical Requirements:

1. Select and use measuring tools and equipment.

2. Read and interpret measurements.

3. Transfer measurements to components, work area and material.

4. Take inside and outside measurements.

MW1621 Metal Lathe

Learning Outcomes:

- Demonstrate the ability to identify parts and accessories, calculate correct speeds and feeds, calculate thread depth, and perform turning, facing, and boring / threading operations.

Duration: 60 Hours

Pre-Requisite(s): MW1450

Objectives and Content:

1. Describe procedures to perform basic lathe functions such as turning, facing, boring and threading.
   - i. lathe size and capacity
   - ii. lathe parts and their function
     - bed
     - head stock
       - spindle
       - feed reverse lever
     - quick change gear box
       - top lever
       - tumbler lever
       - lead screw and feed rod
     - carriage
       - saddle
       - cross-slide and compound rest
       - apron hand wheel, automatic feed lever and
       - feed change lever
     - tailstocks
       - tailstocks clamp lever, spindle and spindle lock, offsetting screw and centre
   - iii. work holding devices
     - spindle nose types
     - lathe centres
     - jaw, 4 jaw, collett, magnetic chucks, face plates and lathe dogs
     - mounting chucks
     - mounting jaws in chucks
     - mounting work in chucks
     - trueing work in a 4 jaw chuck with a dial indicator
       - steady rest and follow rest
   - iv. cutting tool holders
     - left and right hand offset tool holders

- parting tool holders
- boring bars
- standard tool post
- quick change tool holders

v. mounting, removing and aligning lathe centres
vi. facing and machining between centres and in chucks
vii. facing to accurate length
- rough and finish cut
- turning to a shoulder
- filing and polishing in a lathe
- knurling and form turning
- cutting off work in a chuck
- drilling, boring, reaming and tapping on the lathe

2. Describe the procedures used to calculate correct speeds and feeds.
   i. definition of speeds and feeds for lathes
   ii. formulas for speeds and feeds and depth of cut
   iii. sheer pins and slip clutches
   iv. graduated micrometer collars

3. Describe the procedures used to calculate thread depths and perform thread cutting operations.
   i. thread cutting on the lathe
   ii. terminology
   iii. thread forms
   iv. fits and classifications
   v. thread pitch and depth of cut calculations
   vi. thread chasing dial
   vii. set up procedures for thread cutting
   viii. thread cutting operations
   ix. resetting a threading tool
   x. thread measurement
   xi. multiple threads

4. Describe procedures to turn a taper.
   i. tapers and taper turning
   ii. types of tapers
   iii. taper calculations
   iv. taper turning methods
   v. tailstock offset, taper attachments and compound rest method

5. Describe a mandrel.

Practical Requirements:

1. Sharpen a tool bit.

2. Perform operations using a lathe.
   i. straight turning
   ii. facing
   iii. boring
   iv. threading
   v. taper

MW1630 Milling Machines

Learning Outcomes:

- Demonstrate the ability to calculate correct speeds and feeds, perform set up and safely, and execute basic milling operations.

Duration: 40 Hours

Pre-Requisite(s): MW1621

Objectives and Content:

1. Identify safety hazards involved in operating a milling machine.

2. Describe the principles of operation of milling machines.
   i. horizontal and vertical milling machines
   ii. knee and column mills
   iii. parts of the milling machine
   iv. milling machine attachments
      - vertical milling attachment
      - slotting attachment
      - arbors, collets and adapters
      - vises

3. Describe the procedures used to perform calculations involved in using a milling machine.
   i. definition of speed and feeds
   ii. calculations for feed, speed and depth of cut
   iii. keyseat depth calculations

4. Describe set-up procedures.
   i. direction of feed
   ii. climb and conventional milling

5. Describe the procedures used to select cutters in order to perform specific tasks.
   i. plain mill cutters
   ii. face mill cutters
   iii. end mills
   iv. woodruff keyseat cutter
   v. fly cutters

6. Describe the procedures for centering cutters on shafts.

Practical Requirements:

1. Complete a project using a milling machine, as assigned by instructor.

MW1470 Piping Components

Learning Outcomes:

- Demonstrate the ability to thread, install and maintain pipes, tubing, valves and fittings.

Duration: 30 Hours

Pre-Requisite(s): MW1460

Objectives & Content:

1. Identify various types of pipe fittings that are related to the Industrial Mechanic (Millwright) occupation and their uses.
   i. pressure ratings for valves and fittings
   ii. pipe fittings and joints

2. Describe procedures to cut, thread and assemble pipe and tubing.
   i. pipe sizing methods
   ii. pipe hangers and supports
   iii. cutting, reaming and threading pipe
   iv. cutting fluids
   v. pipe thread sealants
   vi. tubing and tube fittings

3. Identify various types and uses of valves.
   i. identification of codes on valves and fittings
   ii. gate valves
   iii. globe valves
   iv. check valves
   v. needle valves
   vi. relief valves
   vii. steam traps purpose
   viii. steam separators
   ix. low pressure steam control valve
   x. ball valve
   xi. butterfly
   xii. diaphragm valves
   xiii. wing valves
   xiv. disk valves

4. Describe procedures to maintain valves.
   i. gate valves

ii. globe valves
iii. check valves
iv. needle valves
v. relief valves
vi. steam traps
vii. steam separators
viii. low pressure steam control valve
ix. ball valves
x. butterfly valves
xi. bypass valves

5. Describe electrolysis.

6. Describe the detrimental effect of electrolysis on piping.
   i. dissimilar piping
   ii. incompatible pipe hanger
   iii. underground installations of liquid and gas lines

Practical Requirements:

1. Fabricate a screwed piping project as per instructor's directives.

2. Repack a valve.

3. Cut, thread by hand and by machines.

4. Complete a flared tubing project.

5. Assemble and disassemble valves.

MW1511 Power Metal Saws

Learning Outcomes:

- Demonstrate the ability to cut metal with band, reciprocating and abrasive wheel cut off saws.
- Demonstrate the ability to maintain power metal saws.

Duration: 15 Hours

Pre-Requisite(s): MW1460

Objectives and Content:

1. Describe the procedures used to cut metal with a band saw.
   i. methods of cutting off material
   ii. saw types and operation
   iii. speeds and feeds
   iv. contour saw operations

2. Describe the procedures used to select the proper band saw blade for a specific task.
   i. saw blade classification
   ii. speeds and feeds
   iii. set
   iv. blade pattern
   v. pitch
   vi. tooth form
   vii. width and gauge
   viii. blade length calculations
   ix. blade installation

3. Describe the procedures used to weld band saw blades.
   i. blade preparation
   ii. machine settings
   iii. annealing

4. Describe the procedures used to cut metal with a reciprocating saw.
   i. blade classification
   ii. blade installation

5. Describe the procedures used to cut metal with an abrasive wheel cut off saw.
   i. theory of operation
   ii. wheel selection
   iii. safety hazard

6. Describe maintenance procedures for power metal saws.
   i. lubrication methods
   ii. coolant systems

Practical Requirements:

1. Cut metal with a band saw and/or cut metal with a reciprocating saw.

2. Cut metal with an abrasive wheel cut off saw.

3. Weld band saw blade.

4. Layout and use a contour saw to complete a project as assigned by the instructor.

MW1521 Pedestal Grinders

Learning Outcomes:

- Demonstrate the ability to operate and maintain pedestal grinders in a safe, efficient and responsible manner.

Duration: 15 Hours

Pre-Requisite(s): MW1511

Objectives and Content:

1. Describe the procedures used to select the proper type of wheel to grind a specific metal.
   i. theory of operation of pedestal grinders
   ii. abrasive types
   iii. bonds
   iv. coarse and fine wheels
   v. hard and soft wheels
   vi. mounted grinding wheels
   vii. rotary files and burrs

2. Describe the procedures used to change, mount and dress wheels on a pedestal grinder.
   i. safe dismantling procedures
   ii. blotters and flanges and their purpose
   iii. ring test
   iv. safe operating speeds for wheels
   v. dressing tools and their purpose
   vi. adjustment of tool rest

3. Identify the code systems found on grinding wheels.

4. Describe the techniques used to sharpen different tools.
   i. techniques for grinding chisels, twist drills and punches

Practical Requirements:

1. Inspect, dress and true a grinding wheel.

2. Sharpen a cold chisel.

3. Sharpen a twist drill.

4. Dismantle and replace a grinding wheel.

MW1530 Bearings

Learning Outcomes:

- Demonstrate the ability to select, install, remove and maintain bearings.
- Demonstrate an understanding of the purpose of different types of bearings and their proper uses.
- Demonstrate the ability to determine the proper clearance and fits for bearings.

Duration: 40 Hours

Pre-Requisite(s): MW1580

Objectives and Content:

1. Identify the classification, uses, styles and purpose of friction bearings.
   - i. bearing housings
   - ii. dimensions of friction bearings
   - iii. styles of friction bearings
   - iv. joint design
   - v. liner materials
     - metallic and non-metallic liner material
     - babbitt
   - vi. keys
   - vii. mandrels
   - viii. pouring babbitt
   - ix. preformed liners
   - x. bushings
   - xi. thrust control
   - xii. Kingsbury thrust bearings
   - xiii. guide bearings

2. Describe friction bearing clearances and fits.
   - i. fitting process for contact
   - ii. chamfering, relieving and oil grooves
   - iii. clearance in a bearing
   - iv. shims

3. Describe the different types of anti-friction bearings (rolling elements) and their applications.
   - i. basic parts of a bearing
   - ii. common bearing types
   - iii. rolling elements
   - iv. shielded and sealed bearings
   - v. types of load for bearings

vi. service weight of a bearing
vii. separable and non-separable bearings
viii. non-aligning and self-aligning bearings
ix. straight and tapered bore bearings

4. Describe the numbering and lettering in the bearing code.
   i. information supplied in the code
   ii. four and five figure codes and their meanings
   iii. code prefixes and suffixes and their meaning
   iv. codes for tapered bore bearings
   v. definition of bearing clearance terms

5. Describe the procedures to remove and install anti-friction bearings.
   i. shaft and housing checks
   ii. push fit
   iii. creep
   iv. interference fit
   v. examples of fits and clearances
   vi. press fits
   vii. procedures for pressing bearings on shafts
   viii. shrink fits
   ix. methods of heating and chilling a bearing
   x. installing a hot bearing
   xi. installing bearing outer rings in split or bored housings
   xii. axial positioning
   xiii. positive positioning of the inner race
   xiv. positive positioning of the outer race
   xv. floating and fixed bearings
   xvi. methods of thrust adjustment
   xvii. arrangement of angular contact bearings
   xviii. mounting spherical roller bearings
   xix. non-destructive bearing removal methods
   xx. withdrawal sleeves
   xxi. adapter sleeves
   xxii. destructive bearing removal methods
   xxiii. hydraulic removal procedures
   xxiv. pillow block installation and removal methods
   xxv. mounting flange, needle and thrust bearings

6. Describe maintenance procedures for anti-friction bearings.
   i. keeping bearings clean
   ii. cleaning bearings
   iii. storing bearings
   iv. preventing contamination
   v. checking for bearing wear
   vi. checking for bearing failure

vii. choosing correct lubrication
viii. cooper split bearings

Practical Requirements:

1. Remove and install an anti-friction bearing.

2. Check a friction bearing for clearance.

3. Check a surface contact using machine blue.

4. Install and remove a taper bore bearing with taper lock.

MW1541 Fasteners

Learning Outcomes:

- Demonstrate the ability to select and install fastening devices.

Duration: 9 Hours

Pre-Requisite(s): MS1230

Objectives and Content:

1. Describe the types, sizes, classification and uses of threaded and non-threaded fastening devices.
   - i. purpose of threads
   - ii. screw thread terms and systems
   - iii. thread designation
   - iv. thread series
   - v. thread size
   - vi. thread measurement
   - vii. right and left hand threads
   - viii. nuts, bolts, cap screws and machine screws
   - ix. multiple threads keys
   - x. keyways
   - xi. splines
   - xii. class of fit
   - xiii. flat washers
   - xiv. lock washer styles and application
   - xv. lock nuts

2. Describe the procedures used to select the proper fastening device for use in metal, wood and concrete.
   - i. wood screw classification
   - ii. sheet metal screws
   - iii. self-drilling screws
   - iv. rivets
   - v. taper pins
   - vi. cotter pins
   - vii. dowel pins
   - viii. shear pins
   - ix. spring pins
   - x. clevis pins
   - xi. spring locking pins
   - xii. toggle bolt styles
   - xiii. expansion shields

xiv. concrete anchor types
xv. reasons for failure during installation
xvi. thread adhesives

3. Describe the procedures used to identify the grade of cap screws and nuts.
   i. classification methods for fasteners
   ii. tensile strength
   iii. grade markings

4. Describe the installation procedure for various fastening devices.
   i. threaded and non-threaded fasteners
   ii. hammer drill use
   iii. pop rivet installation
   iv. thread inserts
   v. broken stud removal methods
   vi. preloading fasteners
   vii. lock wires
   viii. resins

5. Describe the procedure to torque fastening devices to specifications.
   i. definition and purpose of torque
   ii. torque wrenches
   iii. torque multipliers
   iv. torque charts
   v. wet and dry torque
   vi. proper sequence

Practical Requirements:

1. Install various fastening devices.
   i. threaded and non-threaded fasteners
   ii. hammer drill
   iii. pop rivet tools

2. Torque fastening devices as per instructor’s directives.

3. Install fasteners using a powder (explosive actuated) actuated tool.

MW1550 Metallurgy

Learning Outcomes:

- Demonstrate an understanding of basic metallurgy principles.

Duration: 30 Hours

Pre-Requisite(s): WD1330

Objectives and Content:

1. Identify and describe the various properties of metals.
   i. chemical, physical and mechanical properties
   ii. brittleness, ductility, elasticity, hardness, malleability, tensile strength and toughness

2. Identify the classification of steel and describe the numbering system for steel.
   i. hot rolled and cold rolled steel
   ii. alloy steels
   iii. plain, medium and high carbon steels
   iv. Identifying steel using the SAE and ANSI classification systems

3. Define heat treatment terms.
   i. definition of heat treatment
   ii. upper and lower critical temperature
   iii. critical range
   iv. hardening
   v. tempering
   vi. annealing
   vii. normalizing
   viii. case hardening
   ix. induction hardening
   x. flame hardening

4. Describe the properties and uses of various non-ferrous metals.
   i. definition of non-ferrous metals
   ii. aluminum
   iii. copper and copper base alloys
   iv. lead and lead based alloys
   v. tin and tin alloys
   vi. zinc
   vii. leaded bronzes
   viii. Babbitt
   ix. magnesium

5. Define terms and describe methods and procedures used in hardness testing.
   i. definition of hardness
   ii. Rockwell Hardness Tester
   iii. Brinnell Hardness Tester
   iv. conversion charts

6. Identify structural steel shapes and how they are sized.
   i. angle iron
   ii. flat bar
   iii. channel
   iv. I beam
   v. H beam
   vi. structural tubing
   vii. sheet stock
   viii. expanded metal
   ix. perforated metal
   x. checker plate

Practical Requirements:

1. Fabricate, heat treat and sharpen a cold chisel as per instructor s directives.

2. Perform a hardness test.

3. Perform a spark test analysis.

MW1580 Static and Dynamic Seals

Learning Outcomes:

- Demonstrate the ability to select, install, remove and maintain gaskets, seals and packing.
- Demonstrate an understanding of different types of gaskets, seals and packing and identify their proper use.

Duration: 30 Hours

Pre-Requisite(s): MW1650

Objectives and Content:

1. Describe hazards and safe work practices pertaining to seals and gaskets.

2. Describe the principles of operation and classification of static and dynamic seals.
   - i. definition of static and dynamic seals
   - ii. using gaskets to seal housings
   - iii. gasket and flange arrangements
   - iv. gasket compression
   - v. O-rings used as gaskets
   - vi. dynamic seals
   - vii. contact and clearance seals
   - viii. packing
   - ix. inside and outside packed installations
   - x. compression packing removal and installation methods
   - xi. lantern rings
   - xii. V-ring packing uses, installation and adjustment procedures
   - xiii. U-ring packing uses, installation procedures
   - xiv. cup packing uses and installation procedures
   - xv. O-rings used as dynamic seals
   - xvi. anti-extrusion rings
   - xvii. piston rings
   - xviii. lip seal
     - inclusion and exclusive
     - installation procedures
   - xix. inclusion and exclusion seals
   - xx. lip seal installation procedures
   - xxi. emergency shaft repairs
   - xxii. wipers, boots, bellows and diaphragm seals
   - xxiii. mechanical seal theory of operation
   - xxiv. flushing and quenching mechanical seals

xxv. mechanical seal maintenance
xxvi. bushings
xxvii. annulus, slinger and labyrinth seals

3. Describe the procedures used to select the proper sealant for different applications.
   i. definition of sealants
   ii. hardening and non-hardening sealants
   iii. tapes

4. Describe the procedures used to select the proper gasket material for specific applications.
   i. requirements of gasket materials
   ii. metallic and non-metallic gaskets
   iii. making and installing gaskets

5. Describe the procedures used to inspect, remove, and replace gaskets, seals and packing.

Practical Requirements:

1. Make a gasket using gasket material and hand tools.

2. Remove and install components.
   i. mechanical seal
   ii. static seal
   iii. dynamic seal

3. Fabricate an O-ring.

MW1591 Couplings and Clutches

Learning Outcomes:

- Demonstrate the ability to remove, install and maintain couplings and clutches.
- Demonstrate an understanding of the different types of couplings and clutches and their proper use.

Duration: 20 Hours

Pre-Requisite(s): MW1640

Objectives and Content:

1. Describe the theory of operation of various types of couplings and clutches.
   i. purpose of couplings
   ii. types of couplings
   iii. purpose of clutches

2. Identify the various types of couplings and explain their application.
   i. rigid couplings
   ii. sleeve, flanged, compression and clamp couplings
   iii. flexible coupling
   iv. mechanically flexible couplings
   v. jaw and slider, gear, chain, metallic grid and metallic disc couplings
   vi. elastomeric couplings
   vii. jaw, clamped and unclamped doughnut, rubber tire and bushed pin couplings
   viii. failure of flexible couplings
   ix. universal joints
   x. centrifugal couplings
   xi. clutch style couplings
   xii. fluid couplings
   xiii. dry fluid couplings
   xiv. clutches and brakes
   xv. mechanical clutches: positive contact, friction, and over-running
   xvi. disc clutches and brakes
   xvii. torque limiting clutch
   xviii. drum clutches and brakes
   xix. cone clutches and brakes
   xx. over-running clutches
   xxi. sprag, wrap spring, roller ramp types
   xxii. electromagnetic clutches and brakes
   xxiii. actuation methods for clutches and brakes
   xxiv. mechanical, electrical, pneumatic, hydraulic and self-activating

3. Describe the procedures used to select the proper lubrication for the various clutches and couplings.
   i. types of couplings that require lubrication
   ii. lubricant choice criteria

Practical Requirements:

1. Broach a keyway in a hub and fit a key in the keyway.

2. Install a coupling or a clutch.

MW1360 Shafts and Shaft Alignment

Learning Outcomes:

- Demonstrate knowledge of shafts, their accessories and applications.
- Demonstrate knowledge of the procedures used to remove, install maintain and repair shafts and accessories.
- Demonstrate knowledge of the procedures for shaft alignment.

Duration: 20 Hours

Pre-Requisite(s): MW1591

Objectives and Content:

1. Identify the different types of keys and keyways and their purpose.
   - i. types and purpose of keys
     - parallel keys
     - square and rectangular keys
     - stepped keys
     - saddle keys
     - boxed keys
     - gib headed keys
     - tapered keys
     - woodruff keys
   - ii. ANSI code numbering system for woodruff keys
   - iii. keyseats in shafts
     - parallel and boxed keyseats
   - iv. measurement of keyseats and keys
     - woodruff keyseats
   - v. keyways in attachments
   - vi. tapered key
   - vii. cutting keyseats
     - end mills
     - broach and arbor press
   - viii. installing and fitting keys
   - ix. securing keys with adhesives and setscrews
     - types of set screws for various applications
     - set screw location
   - x. types of adhesive
   - xi. removing keys

2. Describe the specific use of various types of shafts and attachments.
   - i. terms and definitions relating to shafts
   - ii. types of shafting
   - iii. uses of shafts

iv. identifying shafting
v. shaft stresses and their sources
vi. stress reduction
vii. bearing replacement
viii. shaft maintenance
- alignment
- shaft centres
- critical speed
- types of run-out
- shaft repair methods

ix. shaft attachment
- bearings, hubs, couplings and gears

x. installing attachments
xi. definition of tolerances and fits
- types of tolerance
- types of fit
- methods of assembly
- shrink, forced and expansion fitting

xii. assembly and disassembly equipment
- presses
- pullers and bearing splitters

3. Identify the different types of misalignment.
   i. parallel
   ii. angular
   iii. combination

4. Describe pre-alignment checks.

5. Describe soft foot.

6. Describe the procedure to align a coupling using a straight edge and feeler gauges.

Practical Requirements:

1. Perform alignment using straight edge and feeler gauges.

MW1610 Belt and Chain Drive Systems

Learning Outcomes:

- Demonstrate an understanding of the operation of belt and chain drive systems.
- Demonstrate the ability to install and maintain belt and chain drive systems.

Duration: 45 Hours

Pre-Requisite(s): MW1530

Objectives and Content:

1. Describe the principles of operation of belt and chain drive systems.
   - i. belt drive principles
   - ii. area of contact
   - iii. belt and pulley materials
   - iv. definition of installed and effective tension
   - v. methods for checking tension
   - vi. slip and creep in belts
   - vii. v-belt advantages and construction
     - standard, heavy duty and double angle belts
     - straight and concave sidewalls
     - notched belt
     - endless and joined belts
   - viii. pulleys and sheaves
     - diameters and rim speed
   - ix. idler purpose and location
   - x. pulley and sheave hubs
   - xi. determining pulley width

2. Describe the various classifications of belts and chains.
   - i. v-belt types, sizes and codes
     - conventional and high capacity belts
     - light duty and double angle belts
     - wide belts
     - positive drive belts
     - linked belts
     - poly belts
     - power band belts
     - matched belts
   - ii. crowned and flanged pulleys
   - iii. V-flat drives
   - iv. variable speed belt drives
     - adjustable and fixed centres

- sheave action

v. chain drive components
   - types of links
   - standard roller chain
   - connecting links
   - offset links

vi. definition of roller chain dimensions
   - pitch, width, roller and pin diameter, and link plate thickness

vii. roller chain code numbers
   - ANSI code number interpretation
   - ISO code numbers

viii. types of roller chain and their application
   - multiple strand chain
   - double pitch chain
   - silent chain

ix. sprocket types and their application
   - type A, B, C, and D sprockets
   - sprocket sizing
   - sprockets for double pitch chain
   - single and double cut sprockets

x. advantages of roller chain drives

xi. drive design
   - shaft centre distances
   - drive and driven sprockets

xii. determining proper amounts of chain slack for horizontal and vertical drives

xiii. idler sprocket purpose and location

3. Describe the procedures used to perform calculations required for the installation and maintenance of belt and chain drive systems.
   i. approximate and exact belt length calculations
   ii. arc of contact calculations
   iii. recommended speed ratios for sheaves and sprockets
   iv. rim speed calculation for belt drives
   v. chain pitch, width, roller and pin diameter calculations
   vi. calculating chain length in inches and pitches
   vii. chain speed calculations

4. Describe the procedures to remove, install and align sheaves and sprockets.
   i. installation and alignment methods
   ii. belt storage
   iii. sheaves for V-belts
   iv. groove angle
   v. troubleshooting belt drives
   vi. aligning shafts and sprockets for chain drives
   vii. roller chain lubrication

- oil grades
- lubrication methods

viii. chain drive misalignment
ix. chain wear due to stretch and pin wear
x. sprocket wear
xi. causes of excessive slack
xii. procedures for roller chain replacement
- sprocket condition
- new chain length
- breaking and joining the chain

xiii. troubleshooting tips for chain drives
xiv. chain maximum speed

Practical Requirements:

1. Remove, install and align v-belts, sheaves and chain, sprockets.

MW1640 Gear Drive Systems

Learning Outcomes:

- Demonstrate the ability to calculate correct speeds and feeds.
- Demonstrate the ability to perform repair and maintenance on gear drive units.
- Demonstrate the ability to operate gear drive units.

Duration: 50 Hours

Pre-Requisite(s): MW1610

Objectives and Content:

1. Describe principle of operation of gear drive units.
   - i. purpose of gears
   - ii. gear terminology
     - addendum and dedundum
     - circular pitch and diametral pitch
     - working depth and clearance
   - iii. conditions for gear meshing
   - iv. tooth profile and action
   - v. backlash
   - vi. gear material
   - vii. shaft arrangement
   - viii. gear types
     - internal and external spur gears
     - helical gears
       - single and double helical gears
       - left and right hand gears
       - thrust
     - girth gears
   - ix. bevel and angular and spiral bevel gears
     - mounting distance
   - x. mitre gears
   - xi. hypoid gears
   - xii. worm and worm gears
     - non-throated, single and double throated worm and worm gear sets
   - xiii. gear types and shaft arrangements

2. Describe the procedures used to perform gear calculations.
   - i. formulas used for drive system calculations
     - speed of driver or driven
     - calculating for reducer ratio
     - single and compound gear reductions

3. Describe speed reducers, their various designs, their uses and their operation.
   i. overdrive and reduction units
      - PIV drives
      - worm gear reduction units
        - internal parts and their purpose
        - shimming for bearing clearance
        - fitting for proper mesh
        - single and multiple reduction and recommended speed ranges for each
      - helical and herringbone reducers
        - fitting
      - planetary gear reduction units
        - sun gears, ring gear and carrier
      - installing and maintaining drive units
      - lubrication methods used in reducers

4. Describe the procedures used to commission gear drives.

Practical Requirements:

1. Dismantle, inspect and reassemble speed reducers to specifications.

MW1650 Lubrication Practices

Learning Outcomes:

- Demonstrate the ability to select the proper lubricant and lubrication methods and apply proper lubricants where required.

Duration: 20 Hours

Pre-Requisite(s): MS1230

Objectives and Content:

1. Identify the purpose and use of lubricants.
   i. sliding, rolling and fluid friction

2. Define lubrication related terminology.
   i. boundary and full film lubrication
   ii. hydraulic lock

3. Describe various lubrication systems.
   i. once through lubricating systems
   ii. enclosed lubricating systems
      - ring oiler lubrication
      - splash lubrication
      - oil bath lubrication
      - recirculating lubrication
      - pressurized system
      - oil mist lubrication
   iii. visual oil quality checks
   iv. pour point and flash point

4. Describe different properties of lubricants.
   i. adhesion and cohesion
   ii. oiliness
   iii. viscosity and its effects on lubrication
   iv. viscosity measurement
   v. viscosity index
   vi. oil wedge theory of lubrication
   vii. additives and inhibitors
      - air, water and load capacity control
   viii. properties of grease
   ix. grease types
      - simple, mixed and complex soap greases
      - extreme pressure grease

x. penetration numbers for grease
xi. dropping point
xii. grease lubricating systems
- hand packing bearings
- greasing with a grease gun
- greasing with a spring compression cup
- automatic lubricators
- lubricating open and enclosed gears

xiii. oil and grease comparison
xiv. cutting oils
xv. safe storage handling and disposal of lubricants

5. Identify the classifications of lubricants and their specific uses.

6. Describe the procedures used to select the proper lubricant for specific applications.
   i. technical manuals
   ii. manufacturers specifications

Practical Requirements:

1. Apply the proper lubricant for a specific application.

2. Repack a bearing.

3. Drain and refill an oil reservoir according to manufacturer's specifications.

MW1670 Non-Positive Displacement Pumps

Learning Outcomes:

- Demonstrate the ability to inspect, maintain, repair and assemble non-positive displacement pumps.

Duration: 40 Hours

Pre-Requisite(s): MW1591

Objectives and Content:

1. Identify and describe the parts of dynamic pumps and their purpose.
   - i. casing styles
   - ii. impeller styles
   - iii. stuffing box
   - iv. packing
   - v. mechanical seals
   - vi. shaft sleeves
   - vii. packing glands
   - viii. wear rings and plates
   - ix. suction strainer

2. Describe the principles of operation of centrifugal pumps.
   - i. non-positive displacement pump theory
   - ii. pump types and their use
   - iii. centrifugal and axial flow
   - iv. terms and definitions
   - v. volute and diffuser pumps
   - vi. multi-stage pumps and their purpose

3. Identify the different terms associated with the operation of the pump.
   - i. pump head
   - ii. suction head
   - iii. suction lift
   - iv. velocity head
   - v. internal and external sealing
   - vi. slip
   - vii. displacement
   - viii. pump speed (rpm)
   - ix. pump capacity
   - x. outlet pressure
   - xi. discharge head
   - xii. total static head

xiii. operating life

4. Describe the procedures used to troubleshoot and correct problems encountered with pumps.
   i. vapour binding
   ii. cavitation
   iii. failure to deliver product
   iv. reduced capacity or pressure
   v. pump vibration
   vi. casing wear/damage
   vii. excessive packing wear
   viii. over speeding
   ix. storage requirements
   x. start-up and shut-down procedures

5. Describe procedures to disassemble, inspect, repair and reassemble centrifugal pumps.
   i. pump isolation and lock out
   ii. pump casings
   iii. impeller design and mounting
   iv. wear rings and plates
   v. hydraulic balancing devices
   vi. seals and packing
   vii. bearings

Practical Requirements:

1. Disassemble, inspect, repair and reassemble centrifugal pumps.

MW1690 Positive Displacement Pumps

Learning Outcomes:

- Demonstrate the ability to inspect, maintain, repair, and assemble positive displacement pumps.

Duration: 40 Hours

Pre-Requisite(s): MW1670

Objectives and Content:

1. Describe the principles of operation of a positive displacement pump.
   - i. theory of operation of positive displacement pumps
   - ii. classification and uses of positive displacement pumps
   - iii. volumetric efficiency
   - iv. positive displacement
   - v. variable displacement
   - vi. pressure, volume, velocity
   - vii. pressure compensation
   - viii. valve operation
   - ix. determine capacity

2. Describe the different types of positive displacement pumps.
   - i. plunger and piston pumps
   - ii. diaphragm pumps
   - iii. metering pumps
   - iv. rotary pumps
   - v. axial and radial piston pumps
   - vi. gear and vane pumps
   - vii. cavitation
   - viii. pump calibration
   - ix. storage requirements
   - x. gear backlash

3. Identify safety precautions when working with positive displacement pumps.
   i. achieve zero energy state
   ii. pressure relief valves
   iii. accumulators

4. Identify parts of the pump and state their purpose.
   i. packing and seals

5. Describe the procedures used to troubleshoot and repair common positive displacement pumps.
   i. external leakage
   ii. pressure and flow loss
   iii. noisy pump operation
   iv. describe start up and shut down procedures
      - checking for rotation
      - priming
      - checking for proper operating temperature
      - draining before maintenance

6. Describe the procedures used to maintain positive displacement pumps.
   i. dismantling procedures
   ii. visual inspection
   iii. packing procedures

Practical Requirements:

1. Disassemble, inspect, reassemble and align positive displacement pumps.

2. Troubleshoot problems with positive displacement pumps.

MW1730 Electrical Fundamentals

Learning Outcomes:

- Demonstrate an understanding of basic electrical principles.
- Demonstrate an understanding of basic PLC s (Programmable Logic Controllers).
- Demonstrate an understanding of the Provincial Public Safety Act as it relates to electrical work.

Duration: 30 Hours

Pre-Requisite(s): MW2150

Objectives and Content:

1. Define electron theory, Ohms Law and associated formulae.

2. Define electrical terminology.
   - i. cycle
   - ii. hertz
   - iii. wattage
   - iv. AC voltage
   - v. AC current
   - vi. ampere
   - vii. resistance
   - viii. ohm
   - ix. DC voltage
   - x. DC current
   - xi. circuits
     - series
     - parallel
     - series parallel

3. Describe the characteristics of conductors and insulators and their applications.

4. Describe the causes of excessive current.

5. Describe overload protection circuits.

6. Describe the procedures used for troubleshooting and repair of electric motors.

7. Describe procedures to follow when using a multi meter.

8. Describe and identify basic PLC’s.
   i. introduction to PLC’s
   ii. fundamentals

Practical Requirements:

1. Write a synopsis of the Public Safety Act as it relates to electrical work.

MW2150 Hydraulics I

Learning Outcomes:

- Demonstrate an understanding of basic hydraulic principles of operation and hydraulic formulae.
- Demonstrate the ability to identify components, parts and accessories.

Duration: 30 Hours

Pre-Requisite(s): MW1690

Objectives and Content:

1. Describe Pascal's Law as it applies to hydraulics.
   i. pressure
   ii. force
   iii. area
   iv. work and power
   v. horsepower and torque

2. Describe Bernoulli's Principle as it applies to hydraulics.
   i. velocity
   ii. pressure drop and flow

3. Describe the procedures used to solve problems using hydraulic formulas.
   i. force, pressure and area formula
   ii. cylinder rod speed formula
   iii. sizing hydraulic reservoirs
   iv. mechanical advantage

4. Identify the basic components used to make up a hydraulic system.

5. Describe the operation of various components used in hydraulic systems and safety considerations that would apply to them.
   i. reservoirs
   ii. hydraulic fluid
   iii. piping and sealing
   iv. pumps
   v. cylinders
   vi. filters and strainers
   vii. motors
   viii. accumulators
   ix. intensifiers
   x. pressure switches

xi. hydraulic hose and fittings
xii. pipe and tubing
xiii. solenoids
xiv. cavitation
xv. deceleration valves
xvi. relief valves
xvii. schematics
xviii. poppet valves
xix. gauges and flow meters
xx. counterbalance valves
xxi. heat exchangers
xxii. flow control valves
xxiii. actuator rods and pistons
xxiv. sequence valves

Practical Requirements:

1. Build a simple hydraulic circuit as per instructors' specifications.

WD1330 Oxy-Fuel Welding

Learning Outcomes:

- Demonstrate the ability to operate oxy-fuel equipment to cut metals, perform basic welding procedures, and perform basic brazing and soldering procedures.

Duration: 30 Hours

Pre-Requisite(s): MS1230

Objectives and Content:

1. Describe the purpose of various safety devices and the precautions to follow when using oxy-fuel equipment.
   - i. safety
     - transportation of oxy-fuel equipment
     - handling and storage
     - operating pressure
   - ii. regulators and gauges (single stage and two stage)
   - iii. fusible plugs
   - iv. flashback arresters
   - v. properties of oxygen and fuel

2. Describe proper procedures to set up oxy-fuel equipment.
   - i. regulator installation
     - left and right hand threads
     - hazards of oil or grease in contact with oxy-fuel equipment
   - ii. different gases
   - iii. securing cylinders
   - iv. proper order of operations when opening cylinder valves
   - v. proper regulator adjustment

3. Describe the procedures used to select the proper tips for various cutting and welding jobs on different metals.
   - i. numbering system for tips
   - ii. heating tips

4. Describe the procedures used to perform basic burning operations using oxy-fuel equipment.
   - i. safety hazards present when using oxy-fuel equipment
   - ii. check torch valves and regulator pressure screws
   - iii. open cylinder valves and adjust regulator pressures
   - iv. checking for leaks

v. torch lighting procedures
vi. types of oxy-acetylene flames and their purpose
- proper torch use

5. Describe brazing techniques.
   i. brazing rods
   ii. purpose of fluxes and pastes

6. Describe soldering techniques.
   i. soft solder
   ii. purpose of fluxes and pastes

7. Describe procedures for cutting metal with oxy-fuel equipment.

8. Describe procedures to prepare a hot work permit.

Practical Requirements:

1. Properly set up oxy-acetylene equipment for the purpose of cutting metal.

2. Perform cutting operations and shut down equipment.

3. Solder a cap on the end of a copper pipe.

4. Braze a lap joint.

5. Prepare a hot work permit.

MW2122 Plasma Arc Cutting

Learning Outcomes:

- Demonstrate knowledge of plasma arc equipment and accessories.
- Demonstrate knowledge of the procedures used to cut with plasma arc equipment.
- Demonstrate knowledge of safety practices related to plasma arc cutting.

Duration: 6 Hours

Pre-Requisite(s): MS1230

Objectives and Content:

1. Define terminology associated with plasma arc cutting.

2. Identify hazards and describe safe work practices pertaining to plasma arc cutting.

3. Interpret jurisdictional regulations pertaining to plasma arc cutting.

4. Interpret information pertaining to plasma arc cutting found on drawings and specifications.

5. Describe the plasma arc cutting process and its applications.

6. Describe the procedures used to prepare materials when plasma arc cutting.

7. Identify plasma arc equipment and accessories and describe their application.

8. Describe the procedures used to set up, adjust and shut down plasma arc equipment.

9. Describe the procedures used to inspect and maintain plasma arc equipment

Practical Requirements:

1. Demonstrate safe use of plasma arc equipment**.**

OT1151 Workplace Exposure

Learning Outcomes:

- Demonstrate knowledge of theory and practical application of trade skills, safe work practices, appropriate workplace behavior, and time management through exposure to the trade in an authentic work environment.

NOTE: The pre-apprentice must be supervised at the workplace. Supervision staff must be appropriately qualified to undertake that role – preferably a certified Journeyperson for the trade.

Duration: 80 Hours

Pre-Requisite(s): None

AM1000 Introduction to Essential Skills

Learning Outcomes:

- Demonstrate knowledge of the nine nationally recognized essential skills.
- Demonstrate knowledge of the essential skills levels of complexity.
- Demonstrate knowledge of the essential skills required for the learners chosen trade.
- Demonstrate an awareness of essential skills assessments.

Duration: 9 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify and describe the essential skills recognized by the Government of Canada through the Office of Literacy and Essential Skills (OLES).
   i. reading
   ii. document use
   iii. numeracy
   iv. writing
   v. oral communication
   vi. working with others
   vii. thinking
   viii. computer use
   ix. continuous learning

2. Describe the Levels of Complexity measurement assigned to essential skills.

3. Identify the essential skills, along with their complexity level, identified as necessary for the learner's trade.
   i. RSOS / NOA content[1]
   ii. OLES Essential Skills Profiles[2]
   iii. OLES tools and support for apprentices and tradespersons[3]

4. Describe the nature and purpose of essential skills assessment.
   i. self-assessment & formal assessment tools
   ii. indicators of deficiencies
   iii. suggestions for improvement

5. Describe the benefits of essential skills improvement.
   i. confidence at work
   ii. employability
   iii. success in apprenticeship

iv. wage & job advancement

Practical Requirements:

1. Complete an essential skills self-assessment addressing numeracy, document use and reading. The online **Government of Canada Essential Skills Indicator**[4] and **Essential Skills Self-Assessment for the Trades**[5] are to be used unless the instructor provides a similar assessment tool or tools.

2. Participate in a group discussion about the impact of gaps in essential skills that may be revealed by the self-assessments completed, and the value of improving essential skills.

Students are graded complete or incomplete on this practical work, no grade is permitted for self-assessment performance. However, completion of the practical requirements is mandatory for completion of this unit.

Resources:

All footnotes are in the companion document, Resources for Introduction to Essential Skills, which is available online from Apprenticeship and Trades Certification.

AM1101 Math Essentials

Note: It is recommended that AM1101 be delivered in the first semester of the Pre-employment program.

Learning Outcomes:

- Demonstrate knowledge of essential numeracy skills.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of mathematical principles in trade problem solving situations.
- Demonstrate the ability to solve simple mathematical word problems.

Duration: 42 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Describe whole number operations.
   i. read, write, count, round off, add, subtract, multiply and divide whole numbers

2. Describe the application of the order of operations in math problems.

3. Describe fraction and mixed number operations.
   i. read, write, add, subtract, multiply and divide fractions

4. Describe decimal operations.
   i. read, write, round off, add, subtract, multiply and divide decimals

5. Describe percent/decimal/fraction conversion and comparison.
   i. convert between fractions, decimals and percents

6. Identify percentage operations.
   i. read and write percentages
   ii. calculate base, rates and percentages

7. Identify ratio and proportion operations.
   i. use a ratio comparing two quantities with the same units

ii. use a proportion comparing two ratios

8. Describe the use of the imperial measurement system in math problems.
   i. identify units of measurement
      - length
      - mass
      - area
      - volume
      - capacity

9. Describe the use of the metric measurement system in math problems.
   i. identify units of measurement
      - length
      - mass
      - area
      - volume
      - capacity

10. Identify angles, lines and geometric shapes.
   i. use a protractor to measure angles
   ii. determine whether an angle is right, acute or obtuse
   iii. identify parallel, perpendicular, horizontal and vertical lines
   iv. identify types of triangles, quadrilaterals, and 3-dimensional shapes

11. Describe estimation strategies.
   i. estimate a linear measure using a referent
   ii. estimate length, area and volume of objects in metric and imperial systems

12. Describe problem solving that involves linear measurement using instruments such as rulers or tape measures, in the metric and imperial systems.

Practical Requirements:

1. To emphasize or further develop specific knowledge objectives, students will be required to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

AM1181 Industrial Mechanic Math Fundamentals

Learning Outcomes:

- Demonstrate knowledge of mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Solve mathematical word problems
- Demonstration knowledge of mathematical principles for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

Duration: 42 Hours

Pre-Requisite(s): AM1101

Objectives and Content:

The instructor is required to use trade specific examples to reinforce the course objectives.

1. Describe percent/decimal/fraction conversions and comparisons in trade specific situations.

2. Describe ratios and proportions as they relate to trade specific problems.

3. Describe the use of the Imperial and Metric measurement systems in trade specific applications.

4. Describe Imperial and Metric conversions in trade specific situations.
   i. convert between imperial and metric measurements
   ii. convert to another unit within the same measurement system

5. Describe how to manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems.
   i. right angle triangles
   ii. area
   iii. volume
   iv. perimeter
   v. density

6. Identify calculations involving geometry that are relevant to the trade.
   i. angle calculations

ii. circle calculations

7. Identify math processes used to complete administrative trade tasks.
   i. material estimation
   ii. material costing
   iii. time & labour estimates
   iv. taxes & surcharges
   v. markup & projecting revenue

Practical Requirements:

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

Note: This course is **non-transferable** to other trades programs, and **not eligible for prior learning assessment**. Students completing training in this trade program are required to complete this math course. Apprentice transfers under Provincial / Territorial Mobility agreements may be exempt from this requirement.

CM2161 Communication Essentials

Learning Outcomes:

- Demonstrate knowledge of the importance of well-developed writing and oral communication skills in the workplace.
- Demonstrate knowledge of the principles of effective workplace writing.
- Demonstrate knowledge of the purpose of various types of workplace documentation and workplace meetings.
- Demonstrate knowledge of the importance of effective interpersonal skills in the workplace.
- Demonstrate knowledge of effective job search techniques

Duration: 36 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Define communications terminology used in the trade.

2. Identify the principles of effective workplace writing.
   i. grammar, punctuation, mechanics
   ii. sentence and paragraph construction
   iii. tone, language, and word choice
   iv. the writing process
      - planning
      - writing
      - editing/revising

3. Identify sources of information used to communicate in the workplace.
   i. regulations
   ii. codes
   iii. OH&S requirements
   iv. prints, drawings and specifications
   v. company and client documentation

4. Identify types and purposes of informal workplace documents.
   i. reports
      - incident
      - process
      - progress

ii. common trade specific forms
iii. primary and secondary methods of information gathering
iv. accuracy and completeness in reports and forms

5. Demonstrate an understanding of interpersonal communications in the workplace.
   i. recognize group dynamics
   ii. contribute information and expertise
   iii. individual learning styles
      - audible
      - visual
      - experiential
      - theoretical
   iv. recognize respectful and open communication
   v. accept and provide feedback
   vi. interpret non-verbal communication cues
      - body language
      - signals

6. Demonstrate an understanding of effective oral communication skills.
   i. listening
      - receiving, understanding, remembering, reflecting, evaluating, paraphrasing, and responding
   ii. speaking
      - using clear and proper words
      - tone, style, and vocabulary
      - brevity
   iii. common workplace oral communication situations
      - introducing self and others
      - telephone conversations
      - tool box/safety talks
      - face-to-face conversations
      - communicating with co-workers, supervisors, clients, and other trades people

7. Identify common practices related to workplace meetings.
   i. meeting formats
   ii. meeting preparation
   iii. agendas and minutes
   iv. roles, responsibilities, and etiquette of meeting participants

8. Identify acceptable workplace use of communication technologies
   i. cell / smart phone etiquette
   ii. voice mail
   iii. e-mail
   iv. texting / messaging through social media

v. teleconferencing / videoconferencing for meetings and interviews
vi. social networking
vii. other emerging technologies

9. Demonstrate an understanding of effective job search techniques
   i. employment trends, opportunities, and sources of employment
   ii. job ads and the importance of fitting qualifications to job requirements
   iii. resumes
      - characteristics of effective resumes
      - types of resumes
      - principles of resume formatting
   iv. effective cover letters
   v. job interview process
      - pre-interview preparation
      - interview conduct
      - post-interview follow up

Practical Requirements:

1. Write a well-developed, coherent, unified paragraph.

2. Complete a trade-related form.

3. Prepare an agenda for a toolbox safety talk.

4. Participate in a simulated oral workplace communication situation.

5. Prepare a resume.

SD1761 Workplace Essentials

Note: It is recommended that SD1761 be delivered in the second half of pre-employment training.

Learning Outcomes:

- Demonstrate a knowledge of workplace requirements in the areas of personal responsibility, unions, workers compensation, workers' rights, and human rights.
- Demonstrate a knowledge of quality customer service.

Duration: 24 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify personal responsibilities and attitudes that contribute to on-the-job success.
   i. asking questions
   ii. working safely
   iii. accepting constructive feedback
   iv. time management & punctuality
   v. respect for authority
   vi. stewardship of materials, tools and properties

2. Define unions and identify their role in the workplace.
   i. purpose of unions
   ii. common union structure
   iii. unions in this trade

3. Demonstrate an understanding of the Worker's Compensation process.
   i. aims, objectives, and benefits of the Workplace Health, Safety and Compensation Commission
   ii. role of the workers advisor
   iii. internal review process

4. Demonstrate an understanding of worker's rights.
   i. labour standards
   ii. regulations, including:
      - hours of work & overtime
      - termination of employment

- minimum wages & allowable deductions
- statutory holidays, vacation time, and vacation pay

5. Demonstrate an understanding of human rights issues.
   i. awareness of the Human Rights Code and the role of the Human Rights Commission
   ii. categories of discrimination and strategies for prevention
      - direct
      - systemic
      - adverse effect
   iii. types of discrimination
      - race
      - ethnic origin
      - colour
      - religion
      - age
      - gender identify
      - sexual orientation
      - marital status
      - family status
      - disability
      - criminal conviction that has been pardoned
   iv. conduct that constitutes harassment and discrimination
      - objectionable conduct
      - comments or displays made either on a one-time or continuous basis that demeans, belittles, or causes personal humiliation or embarrassment to the recipient
   v. the value of diversity in the workplace
      - culture
      - gender identify
      - sexual orientation

6. Demonstrate an understanding of quality customer service.
   i. importance of quality service
   ii. barriers to quality service
      - physical and physiological
      - cultural
      - technological
   iii. customer needs & common methods for meeting them
   iv. characteristics & importance of a positive attitude
   v. interactions with challenging customers
   vi. addressing complaints and resolve conflict

Practical Requirements:

None

MC1062 Computer Essentials

Course Outcomes:

- Demonstrate knowledge of desktop/laptop and mobile computers and their operation.
- Demonstrate knowledge of word processing and spreadsheet software, internet browsers and their applications.
- Demonstrate knowledge of e-mail applications and procedures.
- Demonstrate an awareness of security issues related to computers.
- Demonstrate an awareness of online learning using computers.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

When possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify computer types used in the workplace, and the characteristics of each.
   i. desktop/laptop computers
   ii. tablets
   iii. smartphones

2. Identify common desktop and mobile operating systems.
   i. Windows
   ii. Mac OS
   iii. iOS
   iv. Android

3. Describe the use of Windows operating system software.
   i. start and end a program
   ii. use the help function
   iii. use the find function
   iv. maximize and minimize a window
   v. open and scroll through multiple windows
   vi. use the task bar
   vii. adjust desktop settings such as screen savers, screen resolution, and backgrounds
   viii. shut down a computer

4. Identify the skills necessary to perform file management commands.
   i. create folders

ii. copy files and folders
iii. move files and folders
iv. rename files and folders
v. delete files and folders

5. Describe the use of word processing software to create documents.
   i. enter & edit text
   ii. indent and tab text
   iii. change text attributes
      - bold
      - underline
      - font
   iv. change layout format
      - margins
      - alignment
      - line spacing
   v. spell check and proofread
   vi. save, close & reopen a document
   vii. print document

6. Describe the use of spreadsheet software to create documents.
   i. enter data in cells
   ii. format data in cells
   iii. create formulas to add, subtract, multiply and divide
   iv. save, close & reopen a spreadsheet
   v. print spreadsheet

7. Describe the use of the internet in the workplace.
   i. web browsers
   ii. search engines
   iii. security issues
   iv. personal responsibility for internet use at work

8. Describe the role of e-mail.
   i. e-mail etiquette
      - grammar and punctuation
      - privacy issues when sharing and forwarding e-mail
      - work appropriate content
      - awareness of employer policies
   ii. managing e-mail
      - using folders
      - deleting, forwarding, replying
   iii. adding attachments to e-mail
   iv. view e-mail attachments
   v. printing e-mail

9. Describe computer use for online learning.
    i. online training
    ii. level exams
    iii. study guides
    iv. practice exams

Practical requirements:

1. Create, save and print a document using word processing software.

2. Create, save and print a document using spreadsheet software.

3. Send and receive an e-mail with an attachment.

AP1102 Introduction to Apprenticeship

Learning Outcomes:

- Demonstrate knowledge of how to become a registered apprentice.
- Demonstrate knowledge of the steps to complete an apprenticeship program.
- Demonstrate knowledge of various stakeholders in the apprenticeship process.
- Demonstrate knowledge of the Red Seal Program.

Duration: 12 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with apprenticeship.
   - i. apprentice
   - ii. registered apprentice
   - iii. trade qualifier
   - iv. journeyperson
   - v. certified journeyperson
   - vi. Certificate of Apprenticeship
   - vii. Certificate of Qualification
   - viii. dual certification
   - ix. compulsory trades

2. Explain the roles and responsibilities of those involved in the apprenticeship system in Newfoundland and Labrador.
   - i. registered apprentice
   - ii. training institution
   - iii. employer
   - iv. journeyperson
   - v. mentor
   - vi. Department of Jobs, Immigration and Growth
     - Industrial Training section
     - Standards and Curriculum section
   - vii. Provincial Trade Advisory Committees (PTAC)
   - viii. Provincial Apprenticeship and Certification Board (PACB)

3. Describe the training components of an apprenticeship.
   - i. in-school
     - pre-employment / Level 1
     - advanced levels
   - ii. workplace experience

4. Explain the steps in the registered apprenticeship process.
   i. meet entrance requirements
      - education
      - employment
      - Recognition of Prior Learning (RPL) - if applicable
   ii. complete the registration process
      - application
      - required documents
   iii. complete the Memorandum of Understanding (MOU)
      - contract responsibilities
      - probation period
      - cancellation
   iv. maintain Record of Occupational Progress (Logbook)
      - sign off skills
      - record hours
      - update Apprenticeship Program Officer (APO) on progress
   v. class calls
      - hour requirements
      - EI eligibility
      - training schedule
   vi. level examinations - if applicable
   vii. progression schedule
      - apprenticeship level
      - wage rates
   viii. certification examinations
      - Provincial
      - Red Seal
        - written
        - practical - if applicable
   ix. certification
      - Certificate of Apprenticeship
      - Certificate of Qualification
      - Provincial journeyperson - Blue Seal
      - Interprovincial journeyperson - Red Seal endorsement (RSE)

5. Identify the Conditions Governing Apprenticeship.

6. Discuss cancellation of apprenticeship.
   i. failure to notify of address change
   ii. extended periods of unemployment
   iii. lack of contact with an APO for an extended period
   iv. failure to respond to class calls
   v. declining of multiple class calls

7. Explain the Red Seal program.
   i. designated Red Seal trades

ii. the Red Seal Occupational Standard (RSOS)
iii. relationship of RSOS to Red Seal examination
iv. national qualification recognition and mobility

8. Identify the current financial incentives available to apprentices.
   i. Federal
   ii. Provincial

9. Explain the Provincial / Territorial Apprentice Mobility Guidelines.
   i. temporary mobility
   ii. permanent mobility

10. Describe Atlantic and National Harmonization initiatives.

Practical Requirements:

1. Use the Provincial Apprenticeship and Trades Certification website at
2. www.gov.nl.ca/atcd.
   i. locate, download, and complete the Application for Apprenticeship and Memorandum of Understanding (MOU)
   ii. locate the address of the Industrial Training office closest to this campus
   iii. locate the training schedule and identify the start date of the next class call for this trade
   iv. locate and review the learning resources applicable to this trade
      - Study Guide
      - Exam Preparation Guide
      - Plan of Training

3. Use the Plan of Training applicable to this trade.
   i. locate the hours for the trade
      - total in-school
      - total required for certification
   ii. locate the number of levels
   iii. locate the courses in each level
   iv. locate the hours required for progression to a Level II apprentice and the wage percentage of that level

C. Conditions Governing Apprenticeship Training

1.0 General

The following general conditions apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board (PACB) in accordance with the **Apprenticeship and Certification Act (1999).** If an occupation requires additional conditions, these will be noted in the specific Plan of Training for the occupation. In no case should there be a conflict between these conditions and the additional requirements specified in a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

2.0 Entrance Requirements

2.1 Entry into the occupation as an apprentice requires:

Indenturing into the occupation by an employer who agrees to provide the appropriate training and work experiences as outlined in the Plan of Training.

2.2 Notwithstanding the above, each candidate must have successfully completed a high school program or equivalent, and in addition may be required to have completed certain academic subjects as specified in a particular Plan of Training. Mature students, at the discretion of the Director of Apprenticeship and Trades Certification, may be registered. A mature student is defined as one who has reached the age of 19 and who can demonstrate the ability and the interest to complete the requirements for certification.

2.3 At the discretion of the Director of Apprenticeship and Trades Certification, credit toward the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.

2.4 An Application for Apprenticeship form must be duly completed along with a Memorandum of Understanding as applicable to be indentured into an Apprenticeship. The Memorandum of Understanding must contain signatures of an authorized employer representative, the apprentice and an official representing the Provincial Apprenticeship and Certification Board to be valid.

2.5 A new Memorandum of Understanding must be completed for each change in an employer during the apprenticeship term.

3.0 Probationary Period

The probationary period for each Memorandum of Understanding will be six months or 900 employment credit hours. Within that period the memorandum may be terminated by either party upon giving the other party and the PACB one week notice in writing.

4.0 Termination of a Memorandum of Understanding

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated in Section14.

5.0 Apprenticeship Progression Schedule and Wage Rates

Progression Schedule

Industrial Mechanic (Millwright) - 7200 Hours			
Apprenticeship Level and Wages			
Level	Wage Rate	Requirements for Progression to Next Level	Next Level
1st	60%	▪ Completion of Pre-Employment training ▪ Registration as an apprentice ▪ Minimum 1800 hours of combined relevant work experience and training	2nd Year
2nd	70%	▪ Completion of Level 2 training ▪ Pass Level 2 exam* ▪ Minimum 3600 hours of combined relevant work experience and training	3rd Year
3rd	80%	▪ Completion of Level 3 training ▪ Pass Level 3 exam* ▪ Minimum 5400 hours of combined relevant work experience and training	4th Year
4th	90%	▪ Completion of Level 4 training ▪ Pass Level 4 exam* ▪ Minimum 7200 hours of combined relevant work experience and training ▪ Sign-off of all workplace skills in apprentice logbook ▪ Pass certification exam	Journeyperson Certification

Wage Rates

- Rates are percentages of the prevailing journeyperson's wage rate in the place of employment of the apprentice.
- Rates must not be less than the wage rate established by the Labour standards Act (1990), as now in force or as hereafter amended, or by other order, as amended from time to time replacing the first mentioned order.
- Rates must not be less than the wage rate established by any collective agreement which may be in force at the apprentice's workplace.
- Employers are free to pay wage rates above the minimums specified.

*Level Exams

- This program may not currently contain level exams, in which case this requirement will be waived until such time as level exams are available.

Industrial Mechanic (Millwright) - 7200 Hours		
Class Calls (After Apprenticeship Registration)		
Call Level	Requirements for Class Call	Hours Awarded for In-School Training
Direct Entry Level 1	▪ Minimum of 1800 hours of relevant work experience ▪ Prior Learning Assessment (PLA) at designated college (if applicable)	240
Level 2	▪ Minimum of 3000 hours of relevant work experience and training	210
Level 3	▪ Minimum of 5000 hours of relevant work experience and training	210
Level 4	▪ Minimum of 7020 hours of relevant work experience and training	180
Class calls at Minimum Hours ▪ Class calls may not always occur at the minimum hours indicated. Some variation is permitted to allow for the availability of training resources and apprentices.		

6.0 Tools

Apprentices shall be required to obtain their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

7.0 Periodic Examinations and Evaluation

7.1 Every apprentice shall submit to such occupational tests and examinations as the PACB shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her apprenticeship level and rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Apprenticeship and Trades Certification and his/her date of completion shall be deferred accordingly. Persistent failure to pass required tests shall be a cause for revocation of his/her Memorandum of Understanding.

7.2 Upon receipt of reports of accelerated progress of the apprentice, the PACB may shorten the term of apprenticeship and advance the date of completion accordingly.

7.3 For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

7.4 Course credits may be granted through the use of a PACB approved matrix which identifies course equivalencies between designated trades and between current and historical Plans of Training for the same trade.

8.0 Granting of Certificates of Apprenticeship

Upon the successful completion of apprenticeship, the PACB shall issue a Certificate of Apprenticeship.

9.0 Hours of Work

Any hours employed in the performance of duties related to the designated occupation will be credited towards the completion of the term of apprenticeship. Appropriate documentation of these hours must be provided.

10.0 Copies of the Registration for Apprenticeship

The Director of Apprenticeship and Trades Certification shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

11.0 Ratio of Apprentices to Journeypersons

Under normal practice, the ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed. Other ratio arrangements would be determined and approved by the PACB.

12.0 Relationship to a Collective Bargaining Agreement

Where applicable in Section 5 of these conditions, Collective Agreements take precedence.

13.0 Amendments to a Plan of Apprenticeship Training

A Plan of Training may be amended at any time by the PACB.

14.0 Employment, Re-Employment and Training Requirements

14.1 The Plan of Training requires apprentices to regularly attend their place of employment.

14.2 The Plan of Training requires apprentices to attend training for that occupation as prescribed by the PACB.

14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by

the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.

14.4 Cancellation of the Memorandum of Understanding to challenge journeyperson examinations, if unsuccessful, would require an apprentice to serve a time penalty of two (2) years before reinstatement as an apprentice or qualifying to receive a class call to training as a registered Trade Qualifier. Cancellation must be mutually agreed upon by the employer and the apprentice.

14.5 An employer shall ensure that each apprentice is under the direct supervision of an approved journeyperson supervisor who is located at the same worksite as the apprentice, and that the apprentice is able to communicate with the journeyperson with respect to the task, activity or function that is being supervised.

14.6 Under the Plan of Training the employer is required to keep each apprentice employed as long as work is available, and if the apprentice is laid off due to lack of work, to give first opportunity to be hired before another is hired.

14.7 The employer will permit each apprentice to attend training programs as prescribed by the PACB.

14.8 Apprentices who cannot acquire all the workplace skills at their place of employment will have to be evaluated in a simulated work environment at a PACB authorized training institution and have sign-off done by instructors to meet the requirements for certification.

15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training

Persons wishing to appeal any decisions based on the above conditions must do so in writing to the Minister of Education and Early Childhood Development within 30 days of the decision.

D. Requirements for Red Seal Endorsement

1. Evidence the required work experiences outlined in this Plan of Training have been obtained. This evidence must be in a format clearly outlining the experiences and must be signed by an appropriate person or persons attesting that these experiences have been obtained to the level required.

2. Successful completion of all required courses in the program.

3. A combination of training from an approved training program and suitable work experience totaling 7200 hours.

   Or

   A total of 10800 hours of suitable work experience.

4. Completion of a National Red Seal examination, to be set at a place and time determined by the Apprenticeship and Trades Certification Division.

E. Roles and Responsibilities of Stakeholders in the Apprenticeship Process

The apprenticeship process involves a number of stakeholders playing significant roles in the training of apprentices. This section outlines these roles and the responsibilities resulting from them.

The Apprentice:

- completes all required technical training courses as approved by the PACB.
- finds appropriate employment.
- completes all required work experiences in combination with the required hours.
- ensures work experiences are well documented.
- approaches apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyperson.
- obtains the required hand tools as specified by the PACB for each period of training of the apprenticeship program.

The Employer:

- provides high quality work experiences in an environment conducive to learning.
- remunerates apprentices as set out in the Plan of Training or Collective Agreements.
- provides feedback to training institutions, Apprenticeship and Trades Certification Division and apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, releases apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- ensures work experiences of the apprentice are documented.
- ensures a certified journeyperson is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Education and Early Childhood Development.

The Training Institution:

- provides a high quality learning environment.
- provides the necessary student support services that will enhance an apprentice's ability to be successful.
- participates with other stakeholders in the continual updating of programs.

The Apprenticeship and Trades Certification Division:

- establishes and maintains program advisory committees under the direction of the PACB.
- promotes apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- establishes and maintains a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- ensures all apprentices are appropriately registered and records are maintained as required.
- schedules all necessary technical training periods for apprentices to complete requirements for certification.
- administers level, provincial and Red Seal examinations.

The Provincial Apprenticeship and Certification Board:

- sets policies to ensure the provisions of the **Apprenticeship and Certification Act (1999)** are implemented.
- ensures advisory and examination committees are established and maintained.
- accredits institutions to deliver apprenticeship training programs.
- designates occupations for apprenticeship training and/or certification.

Department of Education and Early Childhood Development
Apprenticeship and Trades Certification Division

Newfoundland & Labrador