
Plan of Training

PROCESS OPERATOR



Government of Newfoundland and Labrador
Department of Education
Institutional and Industrial Education Division

June 2011

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Approved by:

A handwritten signature in cursive script that reads "Paula Flood".

Chairperson, Provincial Apprenticeship and Certification Board

Date: June 14, 2011

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Program Structure

Entry Level Courses - Block I			
NL Course No.	Course Name	Hours	Pre-Requisite
TS1510	Occupational Health & Safety	6	None
TS1520	WHMIS	6	None
TS1530	Standard First Aid	14	None
OR1100	Safety	18	None
OR1110	Environmental Awareness	12	None
LA1110	Fall Protection Awareness	6	None
LA1100	Confined Space Awareness	6	None
OR1150	Hoisting, Lifting and Rigging	30	OR1100, TS1520, TS1530, LA1110
OR1160	Tools and Equipment	12	OR1100, TS1520, TS1530, LA1110, LA1100
MA1060	Basic Mathematics	60	None
PH1020	Physics	72	MA1060
OR1200	Electrical Fundamentals	30	OR1160
CH1020	Chemistry	72	MA1060
OR1210	Process Measurement	90	OR1160, PH1020
OR1220	Process Analyzers	60	CH1020, OR1100, TS1520, TS1530
OR1230	Final Control Elements	60	None
OR1300	Basic Process Control	150	OR1230
OR1310	HMI and Process Control Systems	28	OR1300
OR1320	Pumps	18	PH1020
OR1330	Introduction to Process Operations	30	OR1100, OR1300, TS1520, TS1530
AP1100	Introduction to Apprenticeship	15	None

Entry Level Courses - Block I			
NL Course No.	Course Name	Hours	Pre-Requisite
CM2150	Workplace Communications	45	None
MR1220	Customer Service	30	None
SP2330	Quality Assurance/Quality Control	30	None
MC1050	Introduction to Computers	30	None
SD1700	Workplace Skills	30	None
SD1710	Job Search Techniques	15	None
SD1720	Entrepreneurial Awareness	15	None
Total Hours		990	

Entry Level – Block 1

TS1510 Occupational Health and Safety

Learning Outcomes:

Upon successful completion of this unit, the apprentice will be able to:

- Demonstrate knowledge of the prevention of accidents and illnesses.
- Demonstrate knowledge of how to improve health and safety conditions in the workplace.

Course Duration: 6 Hours

Pre-Requisites: 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 & 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
 - ii. 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:

Upon successful completion of this course, the apprentice will be able to:

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

Course Duration: 6 Hours

Pre-Requisites: 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.

SUGGESTED RESOURCES:

1. WHMIS Regulation
2. Sample MSDS sheets

TS1530 Standard First Aid

Description:

This course is designed to give the apprentice the ability to recognize situations requiring emergency action and to make appropriate decisions concerning first aid.

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

Course Duration: 14 Hours

Pre-Requisites: None

OR1100 Safety

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of safety equipment, its applications, maintenance and procedures for use.
- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulatory requirements pertaining to safety.

Course Duration: 18 Hours

Pre-Requisites: None

Objectives and Content:

1. Identify types of personal protective equipment (PPE) and clothing and describe their applications, limitations and procedures for use.
2. Describe the procedures used to care for, maintain and store PPE.
3. Identify hazards and describe safe work practices.
 - i. personal
 - ii. workplace
 - electrical
 - fixed motorized equipment
 - isolation and de-energizing procedures
 - tag out/lockout
 - confined space
 - trenches
 - fire
 - heights
 - asbestos

- iii. environment
 - iv. hotwork
4. Identify and describe workplace safety and health regulations and certification requirements.
- i. provincial
 - ii. federal
5. Describe the safe use of motorized equipment such as:
- i. overhead crane
 - ii. forklift
 - iii. skid steer loader
 - iv. aerial lifts

Practical Requirements:

No Practical

OR1110 Environmental Protection Awareness

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of Federal and jurisdictional environmental protection regulations.
- Demonstrate knowledge of environmental contamination.
- Demonstrate knowledge of environmental practices.

Course Duration: 12 Hours

Pre-Requisites: None

Objectives and Content:

1. Describe Federal regulations to protect environment.
 - i. employer responsibilities
 - ii. employee responsibilities
2. Describe jurisdictional requirements and regulations.
 - i. employer responsibilities
 - ii. employee responsibilities
3. Describe environmental protection management.
 - i. implementation and operation
4. Explain preventative measures.
 - i. planning
 - ii. auditing
 - iii. sampling

5. Explain environmental contamination.
 - i. air
 - ii. water
 - iii. soil
 - iv. waste disposal

6. Explain environmental impact if there is an incident.
 - i. incident response
 - ii. reporting and investigation

Practical Requirements:

No Practical

LA1110 Fall Protection Awareness

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of various types of fall protection and their components.
- Demonstrate knowledge of the proper use of fall protection equipment and personal fall arrest systems.
- Demonstrate knowledge of fall hazards in the workplace and take corrective measures to eliminate them through the selection of appropriate fall protection systems.

Course Duration: 6 Hours

Pre-Requisites: None

Objectives and Content:

1. Define the term fall protection.
2. Explain why fall protection is important in the workplace.
3. Determine when to use fall protection.
4. List the A, B, C, D's of a complete fall protection system.
5. Describe the basic function of a travel restrict system.
 - i. permanent and temporary guard rails
 - ii. personal travel restrict systems
6. Describe the basic function of a fall arrest system.
 - i. identify the components of a personal fall arrest system
 - full body harness
 - shock absorbers

- lanyards
 - lifelines
 - vertical
 - horizontal
 - rope grabs
 - anchors
 - ii. explain how to put on a full body harness
- 7. Describe the basic function of a work positioning system.
 - i. list the components of a personal work positioning system
- 8. Explain when inspections on equipment must be conducted and what action must be taken if defects or damage is discovered.
 - i. list components of equipment that require inspection

Practical Requirements:

To be determined by instructor.

LA1100 Confined Space Awareness

Learning Outcomes:

- Demonstrate knowledge of properly preparing a confined space for entry.
- Demonstrate knowledge of entering a confined space safely.
- Demonstrate knowledge of performing their duties as an attendant.
- Demonstrate knowledge of dealing with an emergency.

Course Duration: 6 Hours

Pre requisites: None

Objectives and Content:

1. Recognize confined space hazards.
 - i. define a confined space
 - ii. identify types of hazards in confined spaces
2. Identify proper controls for confined space entries.
 - i. list steps to protect yourself from confined space hazards
 - ii. define an entry permit
 - iii. list information included on a confined space entry permit
 - iv. explain what action must be taken if a permit expires before work is completed
3. Preparing for confined space entry.
 - i. state the first step in entry preparation
 - ii. list examples of proper entry preparation
 - iii. list types of personal protective equipment used in confined spaces
4. Determine testing techniques for confined spaces.
 - i. list the necessary steps of air testing
 - ii. state the correct order for testing gases

5. Identify confined space entry procedures.
 - i. identify the attendants responsibilities
 - ii. identify the area where the attendant should be stationed
 - iii. identify the entrants responsibilities

6. Explain confined space rescue techniques.
 - i. list three types of confined space rescues
 - ii. explain non-entry rescue
 - iii. list the requirements of an on-site rescue team

Practical Requirements:

To be determined by instructor.

OR1150 Hoisting, Lifting and Rigging

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of hoisting, lifting and rigging equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of the procedures used to perform hoisting and lifting operations.
- Demonstrate knowledge of calculations required when performing hoisting and lifting operations.

Course Duration: 30 Hours

Pre-Requisites: OR1100, TS1520, TS1530, LA1110

Objectives and Content:

1. Define terminology associated with hoisting, lifting and rigging.
2. Identify hazards and describe safe work practices pertaining to hoisting, lifting and rigging.
3. Identify hazards and describe safe work practices pertaining to mobile and overhead cranes.
4. Identify codes and regulations pertaining to hoisting, lifting and rigging.
5. Identify types of rigging equipment and accessories and describe their
 - i. applications and procedures for use
6. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.
 - i. overhead crane

7. Describe the procedures used to inspect, maintain and store rigging, hoisting and lifting equipment.
8. Identify types of knots, hitches and bends and describe their applications and the procedures used to tie them.
9. Describe the procedures used to rig material/equipment for lifting.
10. Describe the procedures used to ensure the work area is safe for lifting.
 - i. supervision of lift
 - ii. securing work area
 - iii. communication
11. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.
 - i. hand signals
 - ii. electronic communications
 - iii. audible/visual
12. Explain sling angle when preparing for hoisting and lifting operations.
13. Describe the procedures used to determine the weight and weight distribution of loads.
 - i. reference load charts
 - ii. determine types of loads
 - iii. engineered lifts
14. Identify the factors to consider when selecting rigging equipment.
 - i. load characteristics
 - ii. environment
15. Describe the procedures used to perform a lift.
 - i. load determination
 - ii. communication methods
 - iii. pre-lift checks
 - iv. placement of load
 - v. post-lift inspection

Practical Requirements:

1. Conduct pre-inspection of mobile overhead crane and rigging material.
2. Calculate a load for mobile overhead crane.
3. Select rigging material for mobile overhead crane.
4. Perform rigging and hoisting techniques with a mobile overhead crane.

OR1160 Tools and Equipment

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of tools and equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of installation and mounting hardware and their applications.

Course Duration: 12 Hours

Pre-Requisites: OR1100, TS1520, TS1530, LA1110, LA1100

Objectives and Content:

1. Identify types of hand tools and describe their applications and procedures for use.
2. Describe the procedures used to inspect and maintain hand tools.
3. Identify types of portable power tools and describe their applications and procedures for use.
 - i. electric
 - ii. hydraulic
 - iii. pneumatic
4. Describe the procedures used to inspect and maintain portable power tools.
5. Identify types of stationary power tools and describe their applications and procedures for use.
 - i. electric
 - ii. hydraulic
 - iii. pneumatic

6. Describe the procedures used to inspect and maintain stationary power tools.
7. Identify types of powder actuated tools and describe their applications.
8. Identify types of shop equipment
 - i. overhead crane
 - ii. forklifts
 - iii. skid steer loader
 - iv. aerial lifts

Practical Requirements:

1. Demonstrate safe use and application of various hand and power tools
2. Demonstrate safe use and application of various pieces of motorized equipment.

MA1060 Basic Math

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of how to develop numeracy skills and knowledge required for institutional and on-the job learning.
- Demonstrate knowledge of how to develop the capability to apply mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of how to develop an appreciation for mathematics as a critical element of the learning environment.
- Demonstrate knowledge of how to use mathematical principles accurately for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

Course Duration: 60 Hours

Pre-Requisites: None

Objectives and Content:

1. Define and calculate using whole number operations.
2. Define and demonstrate use of correct orders of operations.
3. Demonstrate examples of operations with fractions and mixed numbers.
4. Demonstrate examples of operations with decimals.
5. Demonstrate examples of operations with percentages.

6. Employ percent/decimal/fraction conversion and comparison.
7. Define and calculate with ratios and proportions.
8. Use the Imperial Measurement system in relevant trade applications.
9. Use the Metric Measurement system in relevant trade applications.
10. Perform Imperial/Metric conversions.
11. Define and demonstrate the formulation of variables.
12. Demonstrate and define the various properties of angles and make relevant calculations.

Practical Requirements:

Note: To emphasize or further develop specific knowledge objectives, apprentices may be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

PH1020 Physics

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of the nature of physics.
- Demonstrate knowledge of motion; kinematics in one dimension.
- Demonstrate knowledge of kinematics in two dimension: vectors.
- Demonstrate knowledge of motion and force: dynamics.
- Demonstrate knowledge of circular motion: gravitation.
- Demonstrate knowledge of bodies in equilibrium.
- Demonstrate knowledge of work and energy.
- Demonstrate knowledge of linear momentum.
- Demonstrate knowledge of fluid mechanics.

Course Duration: 72 Hours

Pre-Requisites: MA1060

Objectives and Content:

1. The nature of physics.
 - i. the practice of science
 - distinguish between scientific facts and theories
 - explain the use of the scientific method in the study of physics
 - ii. physics and its relation to other fields
 - explain the relationship of physics to the other basic sciences
 - iii. models, theories and laws

- iv. measurement and uncertainty
 - v. standards and units: the S.I.
 - list the fundamental units of length, mass and time in the S.I.
 - five examples of derived units in the S.I.
2. Describing motion: kinematics in one dimension.
- i. speed
 - define speed
 - calculate the average speed of an object
 - ii. reference frames and co-ordinate systems
 - locate a point by using a rectangular co-ordinate system
 - give examples of different reference frames
 - iii. conversion of units
 - convert the values of physical quantities within the S.I. (eg. km/h to m/s)
 - solve problems involving dimensional analysis
 - iv. linear velocity: displacement
 - define displacement and linear velocity
 - distinguish between displacement and distance
 - distinguish between velocity and speed
 - calculate the average velocity of an object
 - v. instantaneous velocity
 - define instantaneous velocity
 - distinguish between instantaneous velocity and average velocity
 - vi. vector and scalar quantities
 - define vector quantities
 - define scalar quantities
 - give examples of vector quantities and scalar quantities
 - vii. acceleration
 - define acceleration
 - calculate the average acceleration of an object
 - viii. uniformly accelerated motion
 - write the equations of motion for an object undergoing uniformly accelerated motion
 - calculate the displacement, acceleration, initial and final velocities of an object undergoing uniformly accelerated motion
 - ix. problem solving
 - examine techniques and hints for problem solving

- x. acceleration under the action of gravity
 - explain Galileo's postulate
 - calculate the position and velocity of an object moving freely in a vertical path, given initial conditions of position, velocity and
 - explain the terms "air friction" and "terminal velocity"
 - xi. graphical analysis of linear motion
 - describe linear motion by graphical analysis
3. Kinematics in two dimensions: vectors.
- i. addition and subtraction of vector quantities
 - add or subtract two vector quantities whose directions are at 0, 180, 90, with respect to each other
 - add two vector quantities using the parallelogram method
 - add two or more vectors by the polygon method
 - add or subtract two or more vectors using the law of cosines and the law of sines
 - add or subtract two or more vectors using the component method.
 - ii. relative velocity
 - add or subtract the velocities of several moving objects within a fixed reference frame
 - iii. projectile motion
 - determine the horizontal and vertical position of a projectile given its initial velocity
 - determine the time after its release it will attain any horizontal or vertical distance given
 - determine the distance and time it will intersect a given horizontal surface
4. Motion and force: dynamics.
- i. force
 - define force and give examples of forces
 - ii. Newton's first law of motion
 - state in words and by practical example the principle of inertia
 - iii. mass
 - explain the concept of mass in terms of Newton's first law
 - Newton's second law of motion

- state in words and by practical example, Newton's second law of motion
 - calculate the force required to produce an observed acceleration of an object of given mass
 - iv. Newton's third law of motion
 - state in words and by practical example the meaning of an action-reaction pair of forces
 - given a force, determine its appropriate reaction force
 - v. Weight: The force of gravity
 - explain the difference between the mass of an object and its weight
 - determine the weight of a given mass at the earth's surface
 - determine the mass of a given weight at the earth's surface
 - vi. applications of Newton's Laws: vector forces
 - apply Newton's Laws to problems involving the motion of an object or system of objects when a number of vector forces are acting
 - analyze the forces acting on an object resting or moving on an inclined plane
 - vii. friction
 - distinguish between static friction and kinetic friction
 - determine the coefficient of friction between two surface from given forces and masses
 - apply the appropriate value of the coefficient of friction to determine the magnitude of the frictional force
- 5. Circular Motion: Gravitation.
 - i. uniform circulation motion
 - define centripetal acceleration and centripetal force
 - determine the speed and/or acceleration of an object moving in uniform circular motion from its period of motion and the radius of its motion
 - ii. Newton's Law of Universal Gravitation
 - state the Law of Universal
 - solve simple two body problems involving the law
 - iii. gravity near the earth's surface
 - calculate the acceleration caused by the earth at a given point in space above the earth's surface
 - iv. satellites and "weightlessness"
 - explain why a satellite is capable of staying in orbit

- calculate the velocity and orbital radius for an object moving in a circular orbit
6. Bodies of equilibrium.
- i. statics: the conditions for equilibrium
 - state the first condition for equilibrium and the second condition for equilibrium in words and mathematically
 - apply the conditions of equilibrium to problems involving firstly, a particle and secondly, a rigid body
 - ii. simple machine: levers and pulleys
 - explain the operation of the lever and pulley
 - solve simple problems involving levers and pulley systems
 - iii. stability and balance
 - use examples to explain objects in stable, unstable and neutral equilibrium
7. Work and energy.
- i. work done by a constant force
 - define work
 - calculate the work done by a given force acting on a body through a specified displacement
 - ii. kinetic energy and the work energy theorem
 - define kinetic energy
 - state the work energy theorem
 - calculate the kinetic energy of specified objects moving at a given speed
 - apply the work-energy theorem to problems with and without non-conservative forces acting
 - iii. potential energy
 - define potential energy
 - calculate gravitational potential energy of objects
 - calculate the elastic potential energy of spring like systems from the spring constant and displacement
 - iv. the law of conservation of energy
 - state the law of conservation of energy
 - solve simple problems involving potential - kinetic energy transformations
 - v. power
 - define power

- solve simple problems involving the expending of energy over a time interval
8. Linear momentum.
- i. momentum and force
 - define linear momentum
 - ii. conservation of momentum
 - state the law of conservation of momentum
 - iii. impulse: collisions
 - define impulse
 - determine the change in momentum from the impulses
 - solve simple problems involving the momentum of a two body system during collision
 - iv. conservation of energy and momentum in collisions
 - distinguish between elastic and inelastic collisions
 - solve simple problems involving the conservation of energy and momentum during collisions
 - solve problems involving collisions in two dimensions
 - center of mass
 - explain the concepts "centre of mass" and "centre of gravity"
 - calculate the position of the centre of mass of a system of bodies
9. Fluid mechanics.
- i. density and specific gravity
 - distinguish between density and specific gravity
 - calculate the density of a substance in kg/m³.
 - given the density or specific gravity of a substance, calculate the other quantity
 - ii. pressure in fluids
 - calculate pressure as a function of depth in a fluid of known density
 - atmospheric pressure and gauge pressure
 - distinguish between gauge pressure and absolute pressure
 - calculate the absolute pressure, given a gauge pressure
 - iii. Pascal's principle
 - state Pascal's principle
 - solve simple problems involving Pascal's principle
 - iv. measurement of pressure: gauges and the barometer

- describe the use of the open manometer and mercury barometer
- v. buoyancy and Archimedes' principle
 - define buoyancy
 - state Archimedes' principle
 - calculate the buoyant force on an object immersed in a fluid
- vi. fluid dynamics
 - state Bernoulli's principle
 - apply the work-energy equation to a fluid system to yield the Bernoulli equation
 - examine some applications of Bernoulli's principle in everyday life
 - discuss Torricelli's theorem

Practical Requirements:

Labs to be determined by instructor.

OR1200 Electrical Fundamentals

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of direct current (DC) electricity, its characteristics and associated principles.
- Demonstrate knowledge of Ohm's law.
- Demonstrate knowledge of units of measure and symbols relating to DC electricity.
- Demonstrate knowledge of the instruments and procedures used to measure electricity.

Course Duration: 30 Hours

Pre-Requisites: OR1160

Objectives and Content:

1. Define terminology associated with DC electricity.
2. Define alternating current.
3. Define direct current.
4. Identify hazards and describe safe work practices pertaining to DC electricity.
5. Explain atomic structure of matter and electron theory.
 - i. conductors
 - ii. semi-conductors
 - iii. insulators

6. Identify the forms of energy that produce electricity and describe their associated principles.
 - i. chemical action
 - ii. piezoelectric effect
 - iii. mechanical/magnetism
 - iv. heat
 - v. light and solar
 - vi. friction

7. Describe basic electric circuits.
 - i. electron path (conductors)
 - ii. load
 - iii. source
 - iv. control

8. Identify basic components found in DC electric circuits and describe their characteristics and purpose.

9. Identify units of measure and symbols pertaining to DC electricity.

10. Explain Ohm's Law.

11. Identify the basic electrical properties and describe their relationship.
 - i. voltage
 - ii. current
 - iii. resistance
 - iv. power

12. Identify instruments used for measuring electricity and describe their applications and procedures for use.

13. Perform calculations to determine electricity related values.

14. Use instruments to troubleshoot DC components.
 - i. closed circuit
 - ii. open circuit
 - iii. short circuit

15. Demonstrate knowledge of solid state DC and variable frequency drives (VFDs), their applications and operation.

SINGLE PHASE

16. Describe the generation of alternating current.
 - i. direction of induced voltage
 - ii. left-hand generator rule
 - iii. alternation/revolution
 - iv. cycle
 - v. sine wave/plotting
 - vi. electrical and mechanical degrees

17. Define different values and terms of alternating current.
 - i. alternating current values
 - ii. instantaneous values
 - iii. maximum (peak) values
 - iv. peak to peak values
 - v. effective (RMS) values
 - vi. average values
 - vii. Terminology of alternating current circuits
 - viii. frequency / hertz
 - ix. period
 - x. phase (in phase, lagging, leading)

THREE-PHASE THEORY

18. Describe the generation of three-phase voltages.
 - i. characteristics of three-phase
 - ii. voltage generation of three-phase voltages
 - iii. phase sequence

Practical Requirements:

1. Compute values of electrical energy and power.
2. Use electrical measuring instruments.
3. Determine the properties of an AC circuit.

CH1020 Chemistry

Learning Outcomes

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of Atomic Structure.
- Demonstrate knowledge of the Periodic Table.
- Demonstrate knowledge of Chemical Bonding and Nomenclature.
- Demonstrate knowledge of Mole Calculations.
- Demonstrate knowledge of Chemical Reactions.
- Demonstrate knowledge of Kinetic Molecular Theory and Gas Laws.

Course Duration: 72 Hours

Pre-Requisites: MA1060

Objectives and Content:

1. Atomic structure.
 - i. fundamentals of measurement
 - define the Canadian System of Measurements (SI)
 - define accuracy, precision and significant figures
 - perform calculations involving significant figures
 - ii. composition of matter
 - elements and compounds
 - distinguish between elements and compounds
 - describe how a chemical symbol is written
 - state the chemical symbol given the name and name given the symbol for the following elements of the Period Table: H, He, Li, Be, B, C, N, O, F, NE, Na, Mg, Al, Si, P, S, Cl, Ar, K, Ca, Cr, Mn, Fe, Co, Ni, Cu, Zn,

Ge, Ag, Br, Pd, Cd, I, Cs, Ba, W, Pt, Hg, Pb, Rn, Sn,
Au, U

- Law of Constant Composition
 - state the Law of Constant Composition
 - Law of Multiple Proportion
 - state the Law of Multiple Proportion
 - define atom
- iii. subatomic particles
- state that an atom is composed of protons, electrons and neutrons
 - state that the protons are positively charged with a relative mass = 1
 - state that the neutrons are neutral, with a relative mass = 1
 - state that the electrons are negatively charged with negligible mass
 - state that an atom is composed of an extremely small central nucleus containing protons and neutrons by electrons
 - state that an atom has an equal number of protons and electrons and is therefore electrically neutral
- iv. atomic number and mass
- define atomic number as the number of protons in the nucleus
 - define mass number as the total number of protons and neutrons in the nucleus
 - use the periodic table to determine the atomic number of an element
 - use any suitable combination of atomic number, mass number, number of protons, electrons and neutrons to deduce the others
 - define average atomic mass
 - calculate average atomic mass from given values of percent abundance
- v. isotopes
- illustrate the occurrence of isotopes
 - explain what makes a nucleus stable
 - give examples of uses of isotopes
- vi. quantum mechanical model of the atom
- state that electrons can be found in energy levels and sub-levels

- define s, p, d and f suborbitals
- apply Aufbau principle to the concept of orbitals
- state that in the quantum mechanical model of the atom, electrons can be grouped according to their ease of removal from the atom, which depends on their distance from the nucleus
- write the simple electronic configuration of an atom in terms of electrons based in sub-levels, given the atomic number concerned
- define valence electrons
- predict the number of valence electrons in an atom
- define ion
- list two types of ions
- name positive ions as cations
- name negative ions as anions

2. Periodic Table.

i. structure of the Periodic Table

- state that elements are arranged in the Periodic Table in order of increasing atomic number
- state that horizontal rows of elements are called periods and vertical columns are called groups or families, and that elements in the same group have similar properties
- state that Groups IA through VIIIA are called main groups; that elements in Groups IB through VIIIB are called transition metals; and that the two rows of elements placed below the main part of the table are called lanthanons and actinons
- state that Groups IA are known as the alkali metals, Group IIA are known as the alkaline earth metals, Groups VIIA are known as the halogens, and that Group VIIIA are known as the noble gases
- classify elements as main group or transition elements
- classify main group elements to a particular group or family

ii. metals and nonmetals

- state that all elements can be classified as either metals, non-metals, or semimetals (metalloids)
- state the properties of metals, non-metals and semimetals
- classify elements as metals, nonmetals or semimetals based on their position in the Periodic Table, or on given properties

- relate the state of the elements to the degree of metallic character
 - define semiconductor
 - state which semimetals are semiconductors
 - iii. families of elements
 - state basic physical and chemical properties of the alkali metals, alkaline earth metals, halogens and noble gases
 - periodic variation
 - define density
 - describe periodic trends in density
 - relate simple electronic configuration to position in the Periodic Table.
 - realize that an electronic configuration ending in s^2p^6 portrays a stable noble gas configuration
 - describe how metals lose valence electrons and nonmetals gain valence electrons to obtain ions with a stable electron configuration
 - define atomic radius
 - define ionic radius
 - define ionization energy
 - define electron affinity
 - describe and explain the trends in valence electrons, metallic/nonmetallic character, ionic radius, atomic radius, ionization energy and electron affinity across a period and within a group of the Periodic Table
 - predict physical properties of elements based on trends within a group
3. Chemical bonding and nomenclature.
- i. states of matter
 - define solids, liquids, and gases
 - define phase change
 - define melting, freezing, and melting and freezing points
 - define vapour and vapour pressure
 - define boiling and boiling point
 - explain evaporation, condensation, sublimation, deposition, melting, freezing, and boiling in terms of kinetic molecular theory

- ii. Octet rule
 - state that atoms bond in such a way as to obtain a stable electron configuration
 - define the Octet rule
- iii. ionic bonding
 - ions - charge on main group elements and common transition elements
 - describe how atoms form ions through electron transfer and how ions are held together in the crystal lattice
 - definition of the ionic bond
 - state that ionic bonds are formed by the transfer of electrons from a metallic element to a non-metallic element
 - state that compounds formed between metals and nonmetals are generally ionic compounds
 - state that the smallest unit of an ionic compound is the formula unit
 - ionic trends
 - describe and explain the trends in melting point, boiling point and conductivity of ionic compounds
 - electron-dot formula of ionic compounds
 - draw electron-dot formulae for atoms
 - draw electron-dot formulae for binary ionic compounds
 - chemical formulae and nomenclature of ionic compounds
 - write formulae for binary ionic compounds given the systematic name and give the names knowing the formulae
 - name common polyatomic ions
 - write formulae for compounds containing polyatomic ions, using appropriate prefixes and suffixes
 - define hydrate
 - write formulae and names for hydrates
- iv. covalent bonding
 - definition of the covalent bond
 - describe the covalent bond in terms of mutual attraction of nuclei for shared electrons

- state that covalent bonds form between nonmetallic elements, and that compounds formed between non-metallic elements are known as covalent compounds
- v. state that the smallest unit of a covalent compound is a molecule
 - electron-dot formulae of covalent compounds
 - draw electron-dot formulae for covalent compounds
 - chemical formulae and nomenclature of covalent compounds
 - write formulae for binary covalent compounds given the systematic name and give names knowing formulae
 - multiple bonds
 - identify covalent bonds as single (one shared pair of electrons), double (two shared pairs of electrons), or triple (three shared pairs of electrons)
 - write electron-dot structures for covalent compounds with multiple bonds
 - covalent trends
 - describe and explain trends in melting points, boiling points and conductivity of covalent compounds
 - polar covalent bonding
 - define electronegativity and describe the trends in electronegativity within the Periodic Table
 - depending on the electronegativity, explain why a bond is purely ionic, purely covalent or polar covalent
 - identify the atoms which are partially negative and which are partially positive in a binary covalent bond
- vi. polarity of molecules
 - state molecular polarity may be determined by
 - the presence of lone pairs of electrons on the central atom in a molecule, or
 - the presence of different elements surrounding the central atom, or
 - binary molecules involving two different elements
 - sketch molecular shapes for binary covalent compounds using VSEPR theory
- vii. intermolecular forces
 - distinguish between intermolecular and intramolecular forces

- describe:
 - dispersion forces
 - dipole-dipole forces
 - hydrogen bonding forces
 - determine the type of intermolecular forces that exist between molecules
 - explain trends in physical properties, such as melting and boiling points, by considering the type of intermolecular forces between molecules
 - explain, using hydrogen bonding, why water has unique properties such as its density as a solid, high melting and boiling points and thermal properties
- viii. acids and bases
- properties of acids and bases
 - list properties of acids and bases
 - explain the properties of acids in terms of hydrogen ions
 - explain the properties of bases in terms of hydroxide ions
 - nomenclature of acids and bases
 - write formulas and names of common acids and bases
4. Mole calculations.
- i. Avogadro's number - the mole
- define atomic mass relative to 12 C
 - define the Avogadro constant as the number of atoms in 12g of 12 C
 - define the mole as the amount of substance containing the number of particles equal to Avogadro constant
 - molecular and Formula Mass, Molar Mass
 - calculate the masses of moles of elements and compounds.
 - calculate the number of moles in a given mass of pure compound.
 - calculate the number of particles (atoms, molecules or formula units) in a given mass of a pure substance.
- ii. types of solutions
- explain the nature of unsaturated, saturated and supersaturated solutions
 - describe how to distinguish one from the other by addition of a seed crystal

- state that solutions may be in one of three phases: gases, liquids or solids
- state that the most common type of solid-in-solid solutions are called alloys, and that the most common type of liquid-in-solid solutions are called amalgams
- use the terms miscible and immiscible to describe the solubility of a liquid in a liquid
- explain that the miscibility of liquids, and solubility of solids and gases in liquids, depends on intermolecular attractive forces
- iii. factors affecting solubility
 - define solubility in terms of mass of solute and mass of solvent
 - state that the solubility of solids in liquids depends on the temperature
 - state that the solubility of a gas in a liquid depends on the pressure of the gas above the liquid and temperature
 - predict whether an ionic compound will dissolve or mix in water using a solubility table
- iv. concentration of solutions
 - concentration
 - define concentration
 - define, solute, solvent, solution
 - standard solutions
 - define a standard solution as containing a precise mass of solute in a precise volume of solution
 - calculate molarity, given the mass of solute and volume of solvent
 - calculate mass, volume or molarity, given any two of these
 - percent by mass and PPM
 - express the concentration of a solution in terms of percent by mass (mass/mass, mass/volume and volume/volume) and parts per million (mass/mass and mass/volume)
 - ion concentrations
- v. state that ionic substances dissociate into ions when dissolved in water and that some molecular substances ionize when dissolved in water

- calculate the concentration of each ion in salt or acid solutions knowing the concentration of the salt
5. Chemical reactions.
- i. Law of Conservation of Mass
 - state the Law of Conservation of Mass
 - ii. Chemical Reactions
 - writing and balancing chemical equations
 - define chemical reaction
 - iii. list the changes that indicate a chemical reaction has taken place
 - define chemical equation
 - define reactants and products
 - write chemical equations for simple reactions, given names of reactants and products
 - use appropriate subscripts to indicate physical states of reactants and products
 - balance simple reactions, given the name of formulae of the reactants and products
 - reaction types
 - identify a chemical reaction as combination, decomposition, single or double replacement, neutralization, precipitate formation and combustion
 - iv. write the products for the complete combustion of hydrocarbons
 - write the product for combination reactions involving:
 - two elements
 - formation of hydrates
 - nonmetal and metal oxide with water
 - write the products for decomposition reactions of:
 - a compound into its elements
 - a hydrate
 - carbonates
 - use the activity series to determine whether or not single replacement reactions will occur, and write the products of the reaction
 - write the products for neutralization reactions
 - predict the formation of a precipitate in a double replacement reaction given solubility rules
 - predict the products for the addition of acids to carbonates and bicarbonates
 - net ionic reactions

- write total ionic equations from molecular equations
 - identify spectator ions
 - write net ionic equations from molecular equations
 - v. oxidation and reduction reactions
 - recognize examples of redox reactions that affect materials
 - define oxidation and reduction in terms of electron transfer
 - define oxidation number
 - state the range for oxidation numbers is from -4 to +7
 - state that the oxidation number of atoms in a polar covalently bonded molecule depends on the electronegativity values of each atom
 - deduce the oxidation number of an element in a given compound or ion using the rules for assigning oxidation numbers
 - define a redox reaction in terms of both change in oxidation number and electron transfer
 - vi. select examples of redox reactions from a given set of equations
 - define an oxidizing agent as an element that undergoes reduction
 - define a reducing agent as an element that undergoes oxidation
 - identify, in given redox reactions, which reactants are oxidizing agents and which are reducing agents
 - vii. stoichiometry
 - perform mole-mole and mass-mass calculations using a balanced equation.
 - perform calculations involving limiting reagents using a balanced equation.
 - calculate percent yield given experimental yield.
 - explain why experimental yield is different from theoretical yield.
6. Kinetic molecular theory and gas laws.
- i. characteristics and properties of gases
 - list and describe general characteristics of gases.
 - describe the kinetic theory of gases.
 - define pressure and list the most common units of pressure
 - define Boyle's Law
 - use Boyle's Law in calculations
 - Define and calculate Kelvin temperatures

- define Charles's Law
- use Charles's Law in calculations
- explain the relationship between Boyle's and Charles's Laws
- use the combined gas law in calculations
- ii. gas mixtures and partial pressure
 - explain Dalton's Law of Partial Pressure
 - calculate partial pressure of gases
 - explain Avogadro's Hypothesis
 - define standard temperature and pressure
 - define and calculate the molar volume of a gas
- iii. ideal gas law
 - define and derive the ideal gas law
 - define the universal gas constant
 - perform calculations based on gas laws and stoichiometry

Practical Requirements:

Labs to be determined by instructor.

OR1210 Process Measurement

Learning Outcomes:

- Demonstrate knowledge of process measurement and its associated principles.
- Demonstrate knowledge of process measuring and indicating devices, their components and operation.

Course Duration: 90 Hours

Pre-Requisites: OR1160, PH1020

Objectives and Content:

1. Define terminology associated with process measurement.
2. Identify hazards and describe safe work practices pertaining to process measurement.
3. Identify tools and equipment relating to process measuring and indicating devices and describe their applications and procedures for use.
4. Interpret information pertaining to process measuring and indicating devices found on drawings, specifications and nameplates.
5. Identify units of measure used to express process measurement values.
6. Identify forms of process measurement and explain their associated principles.
 - i. pressure
 - ii. temperature
 - iii. level
 - iv. flow

7. Identify types of process measuring and indicating devices and describe their characteristics and applications.
 - i. process switches
 - ii. indicators
 - iii. conventional transmitters
 - pneumatic
 - electronic
 - iv. smart transmitters
 - v. recorders and data loggers

Practical Requirements:

1. Application of process measurement.

OR1220 Process Analyzers

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of process analyzers, their components and operation.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot process analyzers.
- Demonstrate knowledge of process sample conditioning.

Course Duration: 60 Hours

Pre-Requisites: CH1020, OR1100, TS1520, TS1530

Objectives and Content:

1. Define terminology associated with process analyzers.
2. Identify hazards and describe safe work practices pertaining to process analyzers.
3. Identify tools and equipment relating to process analyzers and describe their applications and procedures for use.
4. Interpret information pertaining to process analyzers found on drawings and specifications.
5. Explain the principles of operation for process analyzers.
6. Identify types of process analyzers and describe their characteristics and applications:

Solids and Liquids

- i. pH
- ii. oxidation reduction potential (ORP)
- iii. conductivity
- iv. dissolved oxygen (D.O.)
- v. mass and density
- vi. viscosity
- vii. consistency
- viii. turbidity
- ix. chromatography
- x. environmental
 - waste water
- xi. nuclear
 - solids composition
 - liquids composition

Gases

- i. chromatography
- ii. spectrographic
- iii. lue gas analyzers
- iv. environmental
 - gas
 - noise

7. Identify process analyzer components and describe their purpose and operation.
8. Describe the procedures used to maintain and troubleshoot process analyzers and their components.
9. Describe process sample conditioning and its importance to process analysis.
10. Describe the procedures and equipment used to obtain and condition samples for process analysis.

Practical Requirements:

1. Measure the PH of a liquid.
2. Measure the ORP of a liquid
3. Measure the conductivity of a liquid.

OR1230 Final Control Elements

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of final control elements, their accessories, components and operation.
- Demonstrate knowledge of basic troubleshooting final control elements, their accessories and components.

Course Duration: 60 Hours

Pre-Requisites: None

Objectives and Content:

1. Define terminology associated with final control elements.
2. Identify hazards and describe safe work practices pertaining to final control elements.
3. Identify tools and equipment relating to final control elements and describe their applications and procedures for use.
4. Interpret information pertaining to final control elements found on drawings, specifications and nameplates.
5. Identify types of final control elements and describe their components applications and operation.
 - i. valves
 - ii. dampers
 - iii. louvres
 - iv. positive displacement metering pumps
 - v. motors
 - vi. process regulators

6. Identify types of energy systems used to operate final control elements and describe their characteristics and applications.
 - i. hydraulic
 - ii. pneumatic
 - iii. electric
 - iv. manual operation
 - v. failsafe operation

7. Identify final control element accessories and describe their components, purpose and operation.
 - i. actuators
 - hydraulic
 - pneumatic
 - electric
 - ii. boosters
 - volume
 - pressure
 - iii. positioners
 - electric
 - pneumatic
 - smart
 - iv. regulators
 - v. switches
 - vi. hand wheels
 - vii. variable speed drives

8. Describe the procedures used to basic, troubleshoot final control

Practical Requirements:

1. Demonstrate various final control element operations.
2. Perform troubleshooting techniques.

OR1300 Basic Process Control

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of basic process control and its purpose.
- Demonstrate knowledge of basic process controllers, their components and operation.
- Demonstrate knowledge of the procedures used to configure, calibrate, maintain, and troubleshoot basic process controllers.
- Demonstrate knowledge of the procedures used to maintain, troubleshoot and tune basic process control systems.
- Demonstrate knowledge of the procedures used to commission basic process controllers and their systems.

Course Duration: 150 Hours

Pre-Requisites: OR1230

Objectives and Content:

1. Define terminology associated with process control.
2. Identify hazards and describe safe work practices pertaining to process control.
3. Identify tools and equipment used to configure and calibrate process controllers and describe their applications and procedures for use.
4. Interpret codes and regulations pertaining to process control.
5. Interpret information pertaining to basic process control found on drawings and specifications.

6. Explain basic process control and its purpose.
7. Identify methods of basic process control and describe their applications.
 - i. on-off
 - ii. feedback
 - iii. cascade
 - iv. auto selection (override)
8. Identify modes of process control and describe their characteristics, operation and combinations.
 - i. on-off
 - ii. proportional (P)
 - iii. integral (I)
 - iv. derivative (D)
 - v. P, I, PI, PD, PID
9. Explain process dynamics and their impact on process control.
10. Describe the procedures used to select and install process controllers.
11. Describe the procedures used to configure and calibrate process controllers.
12. Describe the procedures used to tune control loops.
 - i. closed loop methods
 - ii. open loop methods
13. Describe the procedures used to maintain and troubleshoot process controllers.
14. Describe the procedures used to maintain and troubleshoot process control loops.
15. Describe the procedures used to commission process controllers and their loops.

Practical Requirements:

1. Interpret P&ID blueprints.

OR1310 HMI and Process Control Systems

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of process control systems.
- Demonstrate knowledge of Human Machine Interfaces.

Course Duration: 28 Hours

Pre-Requisites: OR1300

Content and Objectives:

Process Control Systems

1. Define process control systems
 - i. Distributed Control Systems (DCS)
 - define a DCS
 - describe the basic DCS functions
 - describe the overall structure
 - identify applications of DCS
 - ii. Programmable Logic Controllers (PLC)
 - define a PLC
 - describe the basic PLC functions
 - describe the overall structure
 - identify applications of PLC
 - iii. Supervisory Control and Data Acquisition (SCADA)
 - define a SCADA
 - describe the basic SCADA functions
 - describe the overall structure
 - identify applications of SCADA

Human Machine Interfaces for Process Control Systems

2. Describe types of Operator Interfaces associated with the following hardware:
 - i. operator panels
 - ii. engineering / operator workstations

3. Define generic HMI development terminology, as follows:
 - i. panels and windows
 - ii. objects and symbols
 - iii. connections and links
 - iv. events and alarms
 - v. real-time and historical trending

4. Introduction to different HMI software packages.
 - i. tags
 - define tag types
 - define data sources
 - ii. graphic displays
 - describe graphical displays that include the following objects:
 - buttons
 - indicators
 - gauges
 - navigation
 - define the following:
 - visibility animation
 - motion animation
 - color animation
 - fill animation
 - slider animation
 - iii. trends

5. Define HMI trends.
 - i. define following key concepts of trends:
 - trend object
 - data source
 - pens
 - shading
 - control tags

- trends X and Y axis
 - ii. configure trends
 - iii. configure pens
 - iv. configure real-time trends
 - v. configure historical trends

- 6. Alarms.
 - i. define different alarm types
 - ii. define following terms:
 - alarm severity
 - alarm messages
 - alarm log
 - alarm acknowledgement and suppression
 - safety related alarms
 - prioritization of alarms
 - iii. create alarm summary
 - iv. create alarm log file
 - v. define activity logging

- 7. Security
 - i. define HMI security
 - ii. analyze security features of HMI software related to user accounts

Practical Requirements:

1. Perform Process Control Operations using HMI software.

OR1320 Pumps

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of centrifugal and positive displacement pumps their components and operation.
- Demonstrate knowledge of the procedures used to troubleshoot, centrifugal and positive displacement pumps.

Course Duration: 18 Hours

Pre-Requisites: PH1020

Objectives and Content:

1. Define terminology associated with centrifugal and positive displacement pumps.
2. Identify hazards and describe safe work practices associated with centrifugal and positive displacement pumps.
 - i. achieve zero energy state
3. Identify types of centrifugal and positive displacement pumps and their components and describe their applications and operation.
4. Identify the types of seals and packing and describe their applications.
5. Identify tools and equipment used to troubleshoot centrifugal and positive displacement pumps and describe their applications and procedures for use.
6. Describe the procedures used to inspect centrifugal and positive displacement pumps.
7. Describe the procedures used to troubleshoot centrifugal and positive displacement pumps.

8. Identify considerations for determining if centrifugal and positive displacement pump maintenance is required.

Practical Requirements:

1. Adjust gland seal packing in a pump.
2. Perform pre-start and running checks on various pumps.

OR1330 Introductions to Process Operations

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Demonstrate knowledge of process operations and troubleshooting procedures in accordance with various plants.

Course Duration: 30 Hours

Pre-Requisites: OR1100, OR1300, TS1520, TS1530

Objectives and Content:

1. Explain start up and shut down process operations within various processing plants.
2. Describe troubleshooting procedures on process operations.
3. Define monitor process equipment.
4. Identify poor equipment performance.
 - i. corrective maintenance
 - ii. equipment instrument anomalies
5. Describe processes for unloading raw materials.
 - i. starting and stopping pumps
 - ii. opening and closing valves
6. Describe control transfer of component materials.
 - i. from locations within the manufacturing operation to processing
 - ii. from manufacturing lines
 - iii. from one line to another
7. Explain loading finished products.

8. Describe maintenance of processing equipment and components such as:
 - i. distillation units
 - ii. filters
 - iii. valves
 - iv. pumps and controls
 - v. heat exchangers
 - vi. piping systems
 - vii. electrical systems
 - viii. vacuum systems
 - ix. related field instrumentation

9. Describe vessel maintenance.
 - i. storage
 - ii. mixing
 - iii. blending
 - iv. decanting
 - v. oxidation
 - vi. hydrogenation
 - vii. pressure
 - viii. vacuum

10. Define chemical composition control.
 - i. chemical properties
 - ii. chemical analyses
 - iii. handling
 - iv. storing
 - v. transferring chemicals
 - vi. preparing chemicals
 - vii. monitoring yields and balances

11. Carry out product quality and statistical process control.
 - i. sampling products
 - ii. performing tests
 - iii. recording data
 - iv. completing required documentation

Practical Requirements:

1. Tour and observe an operating processing plant.
2. Write a detailed report.

AP1100 Introduction to Apprenticeship

Learning Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- Identify the requirements for registering in an Apprenticeship Program.
- Describe the registration process.
- Explain the steps to complete the Apprenticeship Program.
- Articulate the roles of the Apprentice, Journeyperson, Training Institutions, Industry and Governing Bodies in the Apprentice Program.
- Explain the significance of the Red Seal Program.

Course Duration: 15 Hours

Pre-Requisites: None

Objective and Content:

1. Define apprenticeship.
 - i. define Apprenticeship and Red Seal Certification
 - ii. discuss the definition of Apprenticeship and Red Seal Certification
 - iii. distinguish between Red Seal and Provincial Certification
2. Explore how apprenticeship is governed and administered.
 - i. explain who is responsible for administering apprenticeship
 - Department of Education
 - Provincial Apprenticeship and Certification Board
 -
3. Explore the roles and responsibilities of those involved in the apprenticeship process.
 - i. apprentice
 - ii. employer/journeyperson

- iii. Industrial Training Division
 - explain when and where to take the in-class portion of advance training
 - discuss class calls
 - iv. Training Institutions
 - various delivery methods
 - v. Provincial Apprenticeship and Certification Board
4. List and explain the steps in the apprenticeship process.
- i. explain the registration process
 - ii. describe apprenticeship as an agreement between employee, employer and Provincial government
 - iii. review a Memorandum of Understanding
 - iv. legal document
 - v. review an application of apprenticeship
 - original high school certificate or equivalent
 - original transcript from the applicant's training institution
 - vi. describe the roles of Institutional and Industrial Education Division of the Department of Education in apprenticeship
 - vii. explain the role of the Program Development Officer
 - define probation period
 - discusses what constitutes a cancellation of apprenticeship
 - explain the consequences of an apprenticeship cancellation
 - discuss the purpose of the Record of Occupational Progress (Log Book)
 - explore how to maintain your log book
 - discuss who is responsible for tracking and signing-off on trade skills
 - explain how and where to record hours worked
 - identify the importance of updating your file with the Program Development Officer
 - viii. differentiate between provincial and interprovincial exams
5. Describe the training and education requirements.
- i. discuss the factors affecting on-the-job and in class portions of your training
 - ii. define in school and on the job training
 - review a Plan of Training
 - identify the percentage of on-the-job and in class training time

- current labour market implications on completing an apprenticeship program
6. Explain Plans of Training.
 - i. identify what is included in the Plan of Training
 - entrance requirements
 - duration of in-school and on-the-job training
 - course content
 - entry level or advanced level
 - ii. explain how a Journeyperson Certificate is achieved
 - discuss Certificate of Qualification.
 - discuss Certificate of Apprenticeship.
 - discuss Red Seal endorsement
 7. Discuss the Red Seal Program.
 - i. define designated trade
 - ii. explore the National Occupational Analysis for your trade
 - iii. explain Interprovincial Standards Red Seal Program and how it works
 - labor mobility
 - qualification recognition
 - iv. discuss the range of careers possible in your chosen trade
 8. Explain apprenticeship progression schedule and wage rates.
 - i. review a Record of Occupational Progress (Log Book)
 - ii. hours per program
 - iii. requirements for progression
 - iv. wage rates per year of apprenticeship
 9. Identify the examinations and evaluation process used in Apprenticeship.
 - i. discuss occupational tests and examinations as directed by the Provincial Apprenticeship and Certification Board
 - theory
 - practical
 - ii. explain formal assessment and the pass mark of 70%
 10. Examine some of the financial incentives available to apprentices.
 - i. Employment Insurance (E.I.) Benefits
 - ii. government sponsored student loans
 - iii. apprenticeship incentive Federal and Provincial

- iv. scholarships
11. Continuing training outside the Province of Newfoundland Labrador.
- i. training in other provinces and territories
 - procedure for registration and recognition of hours and skills in other provinces
 - ii. options for dual certification
 - transfer of credits
12. Review and define the following terms:
- i. Apprenticeship Program Accreditation
 - ii. Cancellation of Apprenticeship
 - iii. Certificate of Apprenticeship
 - iv. Certificate of Qualification
 - v. Certification Renewal
 - vi. Criteria for Eligibility
 - vii. Journeyperson
 - viii. Practical Examination
 - ix. Prior Learning
 - x. Record of Occupational Progress (Logbook)
 - xi. Red Seal Certification
 - xii. Registered Apprentice
 - xiii. Theoretical Examination
 - xiv. National Occupational Analysis (NOA)
 - xv. Class Call
 - xvi. Dual certification

Practical Requirements:

1. Review the Provincial Apprenticeship web site: www.gov.nl.ca/app
- i. identify the requirements for registering as an apprentice and the registration process
 - ii. explain the steps to complete an apprenticeship program
 - i. identify who is responsible for tracking and signing-off on trade skills
 - iii. identify the nearest Industrial Training Office to your community
 - iv. identify the current incentives available to apprentices

2. Review a plan of training on the Provincial Apprenticeship web site.
 - i. identify the hours for your trade (in-school and on-the-job)
 - i. explain the roles and responsibilities of the following stakeholders in the apprenticeship process: employer, apprentice, training institution and the Industrial Training Division

3. Visit the Red Seal Web site <http://www.red-seal.ca>, review the National Occupational Analyses for your trade.
 - i. review the scope of work for your occupation and identify the industry sectors and job types requiring your trade
 - ii. identify the trends of your trade
 - iii. provide a list of Personal Protective Equipment required for your trade

CM2150 Workplace Communications

Learning Outcomes:

Upon completion of the course, apprentices will be able to:

- Understand and apply communication skills as outlined in the Employability Skills 2000, Conference Board of Canada.
- Understand the importance of well-developed writing skills in business and in career development.
- Understand the purpose of the various types of business correspondence.
- Examine the principles of effective business writing.
- Examine the standard formats for letters and memos.
- Write effective letters and memos.
- Examine the fundamentals of informal reports and the report writing procedure.
- Produce and orally present an informal report.
- Examine effective listening skills and body language in communication.

Course Duration: 45 Hours

Pre-Requisites: None

Objectives and Content:

1. Apply rules and principles for writing clear, concise, complete sentences which adhere to the conventions of grammar, punctuation, and mechanics.
2. Explain the rules of subject-verb agreement.
3. Define and describe the major characteristics of an effective paragraph.

4. Examine the value of business writing skills.
 - i. describe the importance of effective writing skills in business
 - i. describe the value of well-developed writing skills to career success as referenced in the Employability Skills

5. Examine principles of effective business writing.
 - i. discuss the rationale and techniques for fostering goodwill in business communication, regardless of the circumstances
 - ii. review the importance of revising and proofreading
 - iii. differentiate between letter and memo applications in the workplace and review samples
 - iv. identify the parts of a business letter and memo
 - v. review the standard formats for business letters and memos
 - vi. examine samples of well-written and poorly written letters and memos
 - vii. examine guidelines for writing sample letters and memos which convey: acknowledgment, routine request, routine response, complaint, refusal, persuasive request and letters of appeal

6. Examine the fundamentals of informal business reports.
 - i. identify the purpose of the informal report
 - ii. identify the parts and formats of an informal report
 - iii. identify methods of information gathering
 - iv. describe the methods of referencing documents
 - v. review the importance of proof reading and editing

7. Examine types of presentations.
 - i. review and discuss components of an effective presentation
 - ii. review and discuss delivery techniques
 - iii. review and discuss preparation & use of audio/visual aids
 - iv. discuss and participate in confidence building exercises used to prepare for giving presentations

8. Interpersonal communications.
 - i. examine and apply listening techniques
 - ii. discuss the importance of body language

Practical Requirements:

1. Write well-developed, coherent, unified paragraphs which illustrate the following: a variety of sentence arrangements; conciseness and clarity; and adherence to correct and appropriate sentence structure, grammar, punctuation and mechanics.
2. Write sample letters and memos which convey: acknowledgment, routine request, routine response, complaint, refusal, persuasive request and letters of appeal.
3. Gather pertinent information, organize information into an appropriate outline and write an informal report with documented resources.
 - i. edit, proofread, and revise the draft to create an effective informal report and present orally using visual aids
 - ii. participate in confidence building exercises
4. Present an effective presentation.
5. Evaluate presentations.

MR1220 Customer Service

Learning Outcomes:

Upon successful completion of this course, apprentices will be able to:

- Define customer service.
- Explain why service is important.
- Describe the relationship between “service” and “sales.”
- Demonstrate an understanding of the importance of a positive attitude.
- Demonstrate methods of resolving customer complaints.

Course Duration: 30 Hours

Pre-Requisites: None

Objectives and Content:

1. Define quality service.
 - i. identify and discuss elements of customer service
 - ii. explain the difference between service vs. sales or selling
 - iii. explain why quality service is important
 - iv. identify the various types of customers and challenges they may present
 - v. describe customer loyalty
 - vi. examine barriers to quality customer service
2. Explain how to determine customer’s wants and needs.
 - i. identify customer needs
 - ii. explain the difference between customer wants and needs
 - iii. identify ways to ensure repeat business

3. Demonstrate an understanding of the importance of having a positive attitude.
 - i. identify and discuss the characteristics of a positive attitude
 - ii. explain why it is important to have a positive attitude
 - iii. explain how a positive attitude can improve a customer's satisfaction
 - iv. define perception and explain how perception can alter us and customers
 - v. describe methods of dealing with perception

4. Communicating effectively with customers.
 - i. describe the main elements in the communication process
 - ii. identify some barriers to effective communication
 - iii. explain why body language is important
 - iv. define active listening and state why it is important
 - v. identify and discuss the steps of the listening process
 - vi. identify and discuss questioning techniques

5. Demonstrate using the telephone effectively.
 - i. explain why telephone skills are important
 - ii. describe the qualities of a professional telephone interaction

6. Demonstrate an understanding of the importance of asserting oneself.
 - i. define assertiveness
 - ii. discuss assertive techniques
 - iii. explain the use of assertiveness when dealing with multiple customers

7. Demonstrate techniques for interacting with challenging customers in addressing complaints and resolving conflict.
 - i. examine and discuss ways to control feelings
 - ii. examine and discuss ways to interact with an upset customer
 - iii. examine and discuss ways to resolve conflict/customer criticism
 - iv. examine and discuss ways to prevent unnecessary conflict with customers

Practical Requirements:

1. Participate in activities to demonstrate knowledge of the course objectives.

SP2330 Quality Assurance/Quality Control

Learning Outcomes:

Upon completion of this course, apprentices will be able to:

- Develop the skills and knowledge required to apply quality assurance/quality control procedures as related to the trade.
- Develop an awareness of quality principles and processes.
- Apply quality assurance/quality control procedures in a shop project.

Course Duration: 30 Hours

Pre-Requisites: None

Objectives and Content:

1. Describe the reasons for quality assurance and quality plans.
2. Explain the relationship between quality assurance and quality control.
3. Describe quality control procedures as applied to the production and checking of specifications and processes in applicable occupations.
4. Describe quality control procedures as applied to the acceptance and checking of raw materials.
5. Explain the role of communications in a quality environment.
6. Explain why it is important for all employees to understand the structure of the company and its production processes.
7. Explain how human resource effectiveness is maximized in a quality managed organization.
8. Explain the role of company policy in quality management.

9. Explain the purpose of codes and standards in various occupations.
10. Explain the concepts of quality.
 - i. cost of quality
 - ii. measurement of quality
 - iii. elements of quality
 - iv. elements of the quality audit
 - v. quality standards
 - vi. role expectations and responsibilities
11. Explain the structure of quality assurance and quality control.
 - i. describe organizational charts
 - ii. identify the elements of quality assurance system such as ISO, CSA, WHMIS, Sanitation Safety Code (SSC)
 - iii. explain the purpose of the quality assurance manual
 - iv. describe quality assurance procedures
12. Examine quality assurance/quality control documentation.
 - i. describe methods of recording reports in industry
 - ii. describe procedures of traceability (manual and computer-based recording)
 - iii. identify needs for quality control procedures

Practical Requirements:

1. Apply quality control to a project
 - i. follow QA/QC procedures for drawings, plans and specifications in applicable occupations
 - ii. calibrate measuring instruments and devices in applicable occupations.
 - iii. interpret required standards
 - iv. follow QA/QC procedures for accepting raw materials
 - v. carry out the project
 - vi. control the quality elements (variables)
 - vii. complete QA/QC reports

MC1050 Introduction to Computers

Learning Outcomes:

Upon completion of this course, apprentices will have a basic understanding of:

- Computer systems and their operation.
- Popular software packages, their applications.
- Security issues of computers.

Course Duration: 30 Hours

Pre-Requisites: None

Objectives and Content:

1. Identify the major components of microcomputer system hardware and software system.
2. Describe the functions of the microprocessor.
 - i. describe and give examples of I/O DEVICES
 - ii. describe primary storage (RAM, ROM, Cache)
 - iii. define bit, byte, code and the prefixes k.m. and g.
 - iv. describe secondary storage (diskettes and hard disks, CD ROMS, Zip drives, etc.)
 - v. describe how to care for a computer and its accessories
3. Describe microcomputer software.
 - i. define software
 - ii. describe types of operational and application software
 - iii. define file and give the rules for filenames and file extensions
4. Describe windows software.
 - i. start and quit a program
 - ii. demonstrate how to use the help function
 - iii. locate a specific file using the find function

- iv. identify system settings: wall paper, screen saver, screen resolution, background
 - v. start a program by using the run command
 - vi. shutting down your computer
5. Identify file management commands.
- i. create folders
 - ii. maximize and minimize a window
 - iii. describe windows task bar
6. Describe keyboards.
- i. identify and locate alphabetic and numeric keys
 - ii. identify and locate function key and special keys
7. Describe word processing.
- i. describe windows components
 - ii. menu bar
 - iii. menu indicators
 - iv. document window
 - v. the status bar
 - vi. the help feature
 - vii. insertion point movements
8. Describe the procedure used to develop a document.
- i. enter text
 - ii. change the display
9. Describe the procedure for opening, saving and exiting documents.
- i. saving a document
 - ii. closing a document
 - iii. starting a new document Window
 - iv. opening a document
 - v. exiting word processor
10. Describe the procedure for editing a document.
- i. adding new text
 - ii. deleting text
 - iii. using basic format enhancement (split and join paragraphs, insert text)

11. Describe the main select features.
 - i. identify a selection
 - ii. moving a selection
 - iii. copying a selection
 - iv. deleting a selection
 - v. saving a selection

12. Explain how to change layout format.
 - i. changing layout format: (margins, spacing, alignment, paragraph indent, tabs, line spacing, page numbering)

13. Explain how to change text attributes.
 - i. changing text attributes: (bold, underline, font, etc.)

14. Describe the auxiliary tools.
 - i. using spell check and thesaurus

15. Describe print features.
 - i. selecting the print feature: (i.e. number of copies and current document)
 - ii. identifying various options in print screen dialogue box

16. Examine and discuss electronic spreadsheet.
 - i. spreadsheet basics
 - ii. the worksheet window

17. Describe menus.
 - i. menu bar
 - ii. control menu
 - iii. shortcut menu
 - iv. save, retrieve form menus

18. Describe the components of a worksheet.
 - i. entering constant values and formulas
 - ii. using the recalculation feature

19. Describe use ranges.
 - i. typing a range for a function
 - ii. pointing to a range for a function
 - iii. selecting a range for toolbar and menu commands

20. Describe how to print a worksheet.
 - i. printing to the screen
 - ii. printing to the printer
 - iii. printing a selected range

21. Describe how to edit a worksheet.
 - i. replacing cell contents
 - ii. inserting and deleting rows and columns
 - iii. changing cell formats
 - iv. changing cell alignments
 - v. changing column width
 - vi. copying and moving cells

22. State major security issues in using computers.
 - i. pass words
 - ii. accessing accounts
 - iii. viruses and how they can be avoided
 - iv. identity theft and ways to protect personal information
 - v. demonstrate how to view directory structure and folder content
 - vi. organize files and folders
 - vii. copy, delete, and move files and folders

23. Describe how to use electronic mail.
 - i. e-mail etiquette
 - ii. e-mail accounts
 - iii. e-mail messages
 - iv. e-mail message with attachments
 - v. e-mail attachments
 - vi. print e-mail messages
 - vii. deleting e-mail messages

24. Explain the internet and its uses.
 - i. the world wide web(www)
 - ii. accessing web sites
 - iii. internet web browsers
 - iv. internet search engines
 - v. searching techniques
 - vi. posting documents on-line

Practical Requirements:

1. Create a document using word processing.
2. Complete word processing exercises to demonstrate proficiency in word processing.
3. Prepare and send e-mails with attachments.
4. Retrieve documents and e-mail attachments and print copies.
5. Develop and print a spread sheet.
6. Post a document on-line.

SD1700 Workplace Skills

Learning Outcomes:

Upon completion of this course, apprentices will be able to:

- Participate in meetings.
- Define and discuss basic concepts of:
 - unions
 - workers' compensation
 - employment insurance
 - workers' rights
 - human rights
 - workplace diversity
 - gender sensitivity

Course Duration: 30 Hours

Pre-Requisites: None

Objectives and Content:

1. Meetings.
 - i. identify and discuss meeting format and preparation required for a meeting
 - ii. explain the purpose of an agenda
 - iii. explain the roles and responsibilities of meeting participants
 - iv. explain the purpose of motions and amendments and withdrawals
 - v. explain the procedure to delay discussion of motions
 - vi. explain the voting process
2. Unions.
 - i. state why unions exist
 - ii. give a concise description of the history of Canadian labour
 - iii. explain how unions function
 - iv. explain labour's structure
 - v. describe labour's social objectives

- vi. describe the relationship between Canadian labour and the workers
 - vii. describe the involvement of women in unions
3. Worker's Compensation.
- i. describe the aims, objectives, benefits and regulations of the Workplace Health, Safety and Compensation Commission
 - ii. explain the internal review process
4. Employment Insurance.
- i. explain employment insurance regulations
 - ii. describe how to apply for employment insurance
 - iii. explain the appeal process
 - iv. identify the components of a letter of appeal
5. Worker's rights.
- i. define labour standards
 - ii. explain the purpose of the Labour Standards Act
 - iii. identify regulations pertaining to:
 - hours of work
 - minimum wages
 - employment of children
 - vacation pay
 - iv. explain the purpose of the Occupational Health & Safety Act as it refers to workers' rights
6. Human Rights.
- i. describe what information cannot be included on an employment application
 - ii. describe what information cannot be included in an interview
 - iii. examine the Human Rights Code and explain the role of the Human Rights Commission
 - iv. define harassment in various forms and identify strategies for prevention
7. Workplace diversity.
- i. define and explore basic concepts and terms related to workplace inclusively including age, race, culture, religion, socio-economic, sexual orientation with an emphasis on gender issues and gender stereotyping

8. Gender sensitivity.
 - i. explore gender and stereotyping issues in the workplace by identifying strategies for eliminating gender bias

Practical Requirements:

1. Prepare an agenda.
2. Participate in a meeting.
3. Analyze a documented case of a human rights complaint with special emphasis on the application, time frame, documentation needed, and legal advice available.

SD1710 Job Search Techniques

Learning Outcomes:

Upon completion of this course, apprentices will be able to:

- Demonstrate effective use of job search techniques.

Course Duration: 15 Hours

Pre-Requisites: None

Objectives and Content:

1. Identify and examine employment trends and opportunities.
2. Identify sources that can lead to employment.
3. Access and review information on the Newfoundland and Labrador Apprenticeship and Certification Web site and the Apprenticeship Employment Gateway.
4. Analyze job ads and discuss the importance of fitting qualifications to job requirements.
5. Identify and discuss employability skills as outlined by the Conference Board of Canada.
6. Discuss the necessity of fully completing application forms.
7. Establish the aim/purpose of a resume.
8. Explore characteristics of effective resumes, types of resumes, and principles of resume format.
9. Explore characteristics of an effective cover letter.

10. Identify commonly asked questions in an interview.
11. Explore other employment related correspondence.
12. Explore the job market to identify employability skills expected by an employer.
13. Conduct a self-analysis and compare with general employer expectations.
14. Discuss the value of establishing and maintaining a portfolio.

Practical Requirements:

1. Complete sample application forms.
2. Write a resume.
3. Write an effective cover letter.
4. Establish a portfolio.
5. Write out answers to commonly asked questions asked during interviews.
6. Identify three potential employers from the Apprenticeship Employment Gateway, Apprenticeship and Certification website.

SD1720 Entrepreneurial Awareness

Learning Outcomes:

Upon completion of this course, the apprentice will be able to:

- Identify the various types of business ownership, the advantages and disadvantages of self-employment and identify the characteristics of an entrepreneur.
- State the purpose and identify the main elements of a business plan.

Course Duration: 15 Hours

Pre-Requisites: None

Objectives and Content:

1. Explore self-employment: An alternative to employment.
 - i. identify the advantages and disadvantages of self-employment vs. regular employment
 - ii. differentiate between an entrepreneur and a small business owner
 - iii. evaluate present ideas about business people
2. Identify and discuss various types of business ownership.
 - i. explore the characteristics of entrepreneurs
 - ii. identify characteristics common to entrepreneurs
 - iii. compare one's own personal characteristics with those of entrepreneurs
 - iv. examine one's present ideas about business people
3. Identify business opportunities.
 - i. distinguish between an opportunity and an idea
 - ii. examine existing traditional and innovative business ventures
 - iii. identify and summarize the role of various agencies that support business development

4. Review the entrepreneurial process.
 - i. explain the entrepreneurial process
 - ii. describe the purpose of a business plan