Plan of Training

INSTRUMENTATION & CONTROL TECHNICIAN

Newfoundland Labrador

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

December 2011

PLAN OF TRAINING

Instrumentation and Control Technician

December 2011

Newfoundland Labrador

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

Approved by:

Chairperson, Provincial Apprenticeship and Certification Board

Date: December 13/11

The Joint Planning Committee (JPC) recognizes this Interprovincial Program Guide as the national curriculum for the occupation of Instrumentation and Control Technician.

Preface

This Apprenticeship Standard is based on the **2010** edition of the National Occupational Analysis for the Instrumentation and Control Technician trade.

This document describes the curriculum content for the Instrumentation and Control Technician apprenticeship training program and outlines each of the technical training units necessary for the completion of apprenticeship.

Acknowledgements

Advisory committees, industry representatives, instructors and apprenticeship staff provided valuable input to the development of this Apprenticeship Curriculum Standard. Without their dedication to quality apprenticeship training, this document could not have been produced.

We offer you a sincere thank you.

Contact Information

Department of Advanced Education and Skills
Apprenticeship and Trades Certification Division
Tel: 709-729-2729 / 1-877-771-3737
Email: app@gov.nl.ca
Web: www.gov.nl.ca/app

Document Status	Date Approved	Mandatory Implementation Date	Comments
Approved		September 2012	

Table of Contents

A. Profile Chart 5

B. NOA Comparison Chart 7

C. Program Structure 13

ENTRY LEVEL – BLOCK I 18
TS1510 Occupational Health and Safety 18
TS1520 Workplace Hazardous Materials Information System (WHMIS) 21
TS1530 Standard First Aid 24
ER1390 Safety 25
ER1111 Tools and Equipment 27
ER1490 Material Handling Equipment 29
ER1500 Communication and Trade Documentation 31
ER1201 Drawings, Schematics and Specifications 33
ER1140 DC Theory 35
ER1150 Series and Parallel DC Circuits 38
ER1170 Voltage Drop and Power Loss 40
ER1510 Conductors and Cables 42
ER1460 Wireways, Conduit, Electrical Metallic Tubing (EMT) and Fittings 44
ER2470 Pneumatic Supply Systems I 46
ER2480 Pneumatic Supply Systems II 48
ER1420 Introduction to Pressure Measurement and Calibration 49
ER1520 Tubing and Piping Systems 52
ER1530 Introduction to Fluids 54
ER1430 Flow Measurement 55
ER1440 Level and Density Measurement 58
ER1450 Temperature Measurement 61
ER1711 Signal Transmission Systems 64
ER1733 Electronics (Circuits and Components) 66
CM2150 Workplace Communications 68
MR1220 Customer Service 71
SP2330 Quality Assurance / Quality Control 73
MC1050 Introduction to Computers 75
SD1700 Workplace Skills 80
SD1710 Job Search Techniques 83
SD1720 Entrepreneurial Awareness 85
AP1100 Introduction to Apprenticeship 87
MA1060 Basic Math 92

BLOCK II 94
ER2430 Hydraulic Supply Systems I 94
ER2450 Hydraulic Supply Systems II 96
ER2460 Compressors 97
ER1741 On-Off Control Devices 99
ER2490 Final Control Elements 101
ER2530 Single-Phase Theory 103
ER2540 Power Supplies 105
BLOCK III 106
ER2550 Job Planning 106
ER2560 Process Analyzers I (Solids and Liquids) 107
ER2570 Process Analyzers II (Gases) 109
ER2580 Equipment Monitoring Devices 111
ER2670 Safety and Security Systems 114
ER2590 Drives and Motors 116
ER2600 Trade Related Computer Use 118
ER2610 Human Machine Interface Systems 119
BLOCK IV 121
ER2620 Basic Process Control 121
ER2630 Advanced Process Control 123
ER2640 Programmable Logic Controller Systems 125
ER2650 Distributed Control Systems 127
ER2660 Supervisory Control and Data Acquisition Systems 129

D. Conditions Governing Apprenticeship Training 131

E. Requirements for Red Seal Certification for Apprentices 138

F. Roles and Responsibilities of Stakeholders in the Apprenticeship Process 139

A. Profile Chart

COMMON OCCUPATIONAL SKILLS			
ER1201 Drawings, Schematics and Specifications	ER2550 Job Planning	TS1520 WHMIS	ER1390 Safety
ER1111 Tools and Equipment	ER1490 Material Handling Equipment	ER1500 Communication and Trade Documentation	ER2600 Trade Related Computer Use
PROCESS MEASURING AND INDICATING DEVICES			
ER1420 Introduction to Pressure Measurement and Calibration	ER1440 Level and Density Measurement	ER1430 Flow Measurement	ER1450 Temperature Measurement
ER2580 Equipment Monitoring Devices	ER2560 Process Analyzers I (Solids and Liquids)	ER2570 Process Analyzers II (Gases)	
SAFETY AND SECURITY SYSTEMS AND DEVICES			
ER2670 Safety and Security Systems			
HYDRAULIC, PNEUMATIC AND ELECTRICAL SYSTEMS			
ER2470 Pneumatic Supply Systems I	ER2460 Compressors	ER1140 DC Theory	ER1151 Series and Parallel DC Circuits
ER1170 Voltage Drop and Power Loss	ER2530 Single-Phase Theory	ER1510 Conductors and Cables	ER1460 Wireways, Conduit, Electrical Metallic Tubing (EMT) and Fittings
ER2540 Power Supplies	ER2590 Drives and Motors	ER2430 Hydraulic Supply	ER2450 Hydraulic Supply

		Systems I	Systems II
ER2480 Pneumatics Supply Systems II			
FINAL CONTROL DEVICES			
ER2490 Final Control Elements	ER2590 Drives and Motors		
COMMUNICATION SYSTEMS AND DEVICES			
ER1711 Signal Transmission Systems			
CONTROL SYSTEMS AND PROCESS CONTROL			
ER2620 Basic Process Control	ER2630 Advanced Process Control	ER2640 Programmable Logic Controller Systems	ER1733 Electronics (Circuits and Components)
ER2650 Distributed Control Systems	ER2660 Supervisory Control and Data Acquisition Systems	ER2610 Human Machine Interface Systems	

B. NOA Comparison Chart

NOA 2010 Tasks		2011 POT
Task 1 - Organizes work		**Task 1 - Organizes work**
1.01	Uses drawings and schematics	ER1201 – Drawings, Schematics and Specifications
1.02	Plans tasks	ER2550 - Job Planning
1.03	Maintains safe work environment	ER1390 - Safety, TS1520 – WHMIS
Task 2 - Performs routine trade activities		**Task 2 - Performs routine trade activities**
2.01	Uses personal protective equipment (PPE) and safety equipment	ER1390 - Safety
2.02	Performs de-energizing lockout and tag-out procedures	
2.03	Maintains calibration, configuration and test equipment	ER1111 - Tools and Equipment
2.04	Maintains tools	
2.05	Operates material handling equipment	ER1490 - Material Handling Equipment
Task 3 -Installs and services pressure, temperature, level and flow measuring and indicating devices		**Task 3 -Installs and services pressure, temperature, level and flow measuring and indicating devices**
3.01	Installs pressure, temperature, level and flow measuring and indicating devices	ER1420 - Introduction to Pressure Measurement and Calibration, ER1440 - Level and Density Measurement, ER1430 - Flow Measurement, ER1450 - Temperature Measurement
3.02	Maintains pressure, temperature, level and flow measuring and indicating devices	
3.03	Diagnoses pressure, temperature, level and flow measuring and indicating devices	
3.04	Repairs pressure, temperature, level and flow measuring and indicating devices	
Task 4 - Installs and services motion, speed, position and vibration measuring and indicating devices		**Task 4 - Installs and services motion, speed, position and vibration measuring and indicating devices**
4.01	Installs motion, speed, position and vibration measuring and indicating devices	ER2580 - Equipment Monitoring Devices
4.02	Maintains motion, speed, position and	

NOA 2010 Tasks		2011 POT
	vibration measuring and indicating devices	
4.03	Diagnoses motion, speed, position and vibration measuring and indicating devices	
4.04	Repairs motion, speed, position and vibration measuring and indicating devices	
Task 5 - Installs and services mass, density and consistency measuring and indicating devices		**Task 5 - Installs and services mass, density and consistency measuring and indicating devices**
5.01	Installs mass, density and consistency measuring and indicating devices	ER2560 - Process Analyzers I (Solids and Liquids), ER2570 - Process Analyzers II (Gases)
5.02	Maintains mass, density and consistency measuring and indicating devices	
5.03	Diagnoses mass, density and consistency measuring and indicating devices	
5.04	Repairs mass, density and consistency measuring and indicating devices	
Task 6 - Installs and services process analyzers		**Task 6 - Installs and services process analyzers**
6.01	Installs process analyzers	ER2560 - Process Analyzers I (Solids and Liquids), ER2570 - Process Analyzers II (Gases)
6.02	Maintains process analyzers	
6.03	Diagnoses process analyzers	
6.04	Repairs process analyzers	
Task 7 - Installs and services flow computing devices		**Task 7 - Installs and services flow computing devices**
7.01	Installs flow computing devices	ER1430 - Flow Measurement
7.02	Maintains flow computing devices	
7.03	Diagnoses flow computing devices	
7.04	Repairs flow computing devices	
Task 8 - Installs and services safety systems and devices		**Task 8 - Installs and services safety systems and devices**
8.01	Installs safety systems and devices	ER2670 - Safety and Security Systems
8.02	Maintains safety systems and devices	
8.03	Diagnoses safety systems and devices	
8.04	Repairs safety systems and devices	
Task 9 - Installs and services security systems (NOT COMMON CORE)		**Task 9 - Installs and services security systems (NOT COMMON CORE)**
9.01	Installs services security systems **(NOT COMMON CORE)**	**Not Applicable**

NOA 2010 Tasks		2011 POT
9.02	Maintains services security systems **(NOT COMMON CORE)**	
9.03	Diagnoses services security systems **(NOT COMMON CORE)**	
9.04	Repairs services security systems **(NOT COMMON CORE)**	
Task 10 - Installs and services hydraulic equipment		**Task 10 - Installs and services hydraulic equipment**
10.01	Installs hydraulic equipment **(NOT COMMON CORE)**	**Not Applicable**
10.02	Maintains hydraulic equipment	ER2430 - Hydraulic Supply Systems I, ER2450 - Hydraulic Supply Systems II
10.03	Diagnoses hydraulic equipment	
10.04	Repairs hydraulic equipment	
Task 11 - Installs and services pneumatic equipment		**Task 11 - Installs and services pneumatic equipment**
11.01	Installs pneumatic equipment	ER2470 - Pneumatics Supply Systems I, ER2480 - Pneumatics Supply Systems II, ER2460 - Compressors
11.02	Maintains pneumatic equipment	
11.03	Diagnoses pneumatic equipment	
11.04	Repairs pneumatic equipment	
Task 12 - Installs and services electrical equipment		**Task 12 - Installs and services electrical equipment**
12.01	Installs electrical equipment	ER1140 - DC Theory, ER1151 - Series and Parallel DC Circuits, ER1170 – Voltage Drop and Power Loss, ER2530 - Single-Phase Theory, ER1510 - Conductors and Cables, ER2540 - Power Supplies, ER2590 - Drives and Motors, ER1460 - Wireways, Conduit, Electrical Metallic Tubing (EMT) and Fittings
12.02	Maintains electrical equipment	
12.03	Diagnoses electrical equipment	
12.04	Repairs electrical equipment	
Task 13 - Installs and services valves		**Task 13 - Installs and services valves**
13.01	Installs valves	ER2490 - Final Control Elements
13.02	Maintains valves	
13.03	Diagnoses valves	
13.04	Repairs valves	
Task 14 - Installs and services actuators		**Task 14 - Installs and services actuators**
14.01	Installs actuators	ER2490 - Final Control Elements
14.02	Maintains actuators	
14.03	Diagnoses actuators	
14.04	Repairs actuators	
Task 15 - Installs and services positioners		**Task 15 - Installs and services**

NOA 2010 Tasks		2011 POT
		positioners
15.01	Installs positioners	ER2490 - Final Control Elements
15.02	Maintains positioners	
15.03	Diagnoses positioners	
15.04	Repairs positioners	
Task 16 - Services variable speed drives (VSD)		**Task 16 - Services variable speed drives (VSD)**
16.01	Installs VSDs **(NOT COMMON CORE)**	**Not Applicable**
16.02	Maintains VSDs	ER2590 - Drives and Motors, ER2490 - Final Control Elements
16.03	Diagnoses VSDs	
16.04	Repairs VSDs **(NOT COMMON CORE)**	**Not Applicable**
Task 17 - Installs and services network and signal transmission systems		**Task 17 - Installs and services network and signal transmission systems**
17.01	Installs network and signal transmission systems	ER1711 - Signal Transmission Systems
17.02	Configures network and signal transmission systems	
17.03	Maintains network and signal transmission systems	
17.04	Diagnoses network and signal transmission systems	
17.05	Repairs network and signal transmission systems	
Task 18 - Installs and services signal converters		**Task 18 - Installs and services signal converters**
18.01	Installs signal converters	ER1711 - Signal Transmission Systems
18.02	Maintains signal converters	
18.03	Diagnoses signal converters	
18.04	Repairs signal converters	
Task 19 - Installs and services data converters and gateways		**Task 19 - Installs and services data converters and gateways**
19.01	Installs data converters and gateways	ER1711 - Signal Transmission Systems
19.02	Configures data converters and gateways	
19.03	Maintains data converters and gateways	
19.04	Diagnoses data converters and gateways	
19.05	Repairs data converters and gateways	
Task 20 - Establishes process control strategies		**Task 20 - Establishes process control strategies**
20.01	Determines process control strategies	ER2620 - Basic Process Control, ER2630 - Advanced Process Control
20.02	Optimizes process control	
Task 21 - Installs and services stand-alone		**Task 21 - Installs and services stand-**

NOA 2010 Tasks		2011 POT
controllers (SACs)		**alone controllers (SACs)**
21.01	Installs SACs	ER2620 - Basic Process Control
21.02	Configures SACs	
21.03	Maintains SACs	
21.04	Diagnoses SACs	
21.05	Repairs SACs	
Task 22 - Installs and services programmable logic controllers (PLCs)		**Task 22 - Installs and services programmable logic controllers (PLCs)**
22.01	Installs PLCs	ER2640 - Programmable Logic Controller Systems
22.02	Configures PLCs	ER2640 - Programmable Logic Controller Systems, ER1733 - Electronics (Circuits and Components)
22.03	Maintains PLCs	ER2640 - Programmable Logic Controller Systems
22.04	Diagnoses PLCs	
22.05	Repairs PLCs	
Task 23 - Installs and services distributed control systems (DCSs)		**Task 23 - Installs and services distributed control systems (DCSs)**
23.01	Installs DCSs	ER2650 - Distributed Control Systems
23.02	Configures DCSs	ER2650 - Distributed Control Systems, ER1733 - Electronics (Circuits and Components)
23.03	Maintains DCSs	ER2650 - Distributed Control Systems
23.04	Diagnoses DCSs	
23.05	Repairs DCSs	
Task 24 - Installs and services Supervisory Control and Data Acquisition (SCADA) systems		**Task 24 - Installs and services Supervisory Control and Data Acquisition (SCADA) systems**
24.01	Installs SCADA systems	ER2660 - Supervisory Control and Data Acquisition Systems
24.02	Configures SCADA systems	
24.03	Maintains SCADA systems	
24.04	Diagnoses SCADA systems	
24.05	Repairs SCADA systems	
Task 25 - Installs and services human machine interfaces (HMIs)		**Task 25 - Installs and services human machine interfaces (HMIs)**
25.01	Installs HMIs	ER2610 - Human Machine Interface Systems
25.02	Configures HMIs	
25.03	Maintains HMIs	

NOA 2010 Tasks		2011 POT
25.04	Diagnoses HMIs	
25.05	Repairs HMIs	

C. 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.

The order of course delivery within each block can be determined by the educational agency, as long as pre-requisite conditions are satisfied.

Entry Level – Block I				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
TS1510		Occupational Health & Safety	6	-
TS1520		WHMIS	6	-
TS1530	ICT-100	Standard First Aid	14	-
ER1390		Safety	30	-
ER1111	ICT-105	Tools and Equipment	45	ER1390
ER1490	ICT-110	Material Handling Equipment	15	ER1390 TS1520
ER1500	ICT-115	Communication and Trade Documentation	9	-
ER1201	ICT-120	Drawings, Schematics and Specifications	30	ER1500
ER1140	ICT-125	DC Theory	30	-
ER1151	ICT-130	Series and Parallel DC Circuits	45	ER1140
ER1170	ICT-135	Voltage Drop and Power Loss	30	ER1151
ER1510	ICT-140	Conductors and Cables	30	ER1170
ER1460	ICT-150	Wireways, Conduit, Electrical Metallic Tubing (EMT) and	15	-

Entry Level – Block I				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
		Fittings		
ER2470	ICT-225	Pneumatic Supply Systems I	25	ER1460
ER2480	ICT-230	Pneumatic Supply Systems II	25	ER2470
ER1420	ICT-155	Introduction to Pressure Measurement and Calibration	70	ER1201
ER1520	ICT-160	Tubing and Piping Systems	30	ER1420
ER1530	ICT-205	Introduction to Fluids	25	-
ER1430	ICT-255	Flow Measurement	110	ER1420 ER1530 ER1201
ER1440		Level and Density Measurement	50	ER1420 ER1201
ER1450		Temperature Measurement	60	ER1201
ER1711	ICT-405	Signal Transmission Systems	30	ER1420
ER1733	ICT-240	Electronics (Circuits and Components)	90	ER1140
CM2150		Workplace Communications	45	-
MR1220		Customer Service	30	-
SP2330		Quality Assurance / Quality Control	30	-
MC1050		Introduction to Computers	30	-
SD1700		Workplace Skills	30	-
SD1710		Job Search Techniques	15	-
SD1720		Entrepreneurial Awareness	15	-
AP1100		Introduction to Apprenticeship	15	-

Entry Level – Block I				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
MA1060		Basic Math	60	-
		Total Hours	**1090**	

Required Work Experience

Block 2				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
ER2430	ICT-210	Hydraulic Supply Systems I	30	Completion of all Entry Level Courses
ER2450	ICT-215	Hydraulic Supply Systems II	30	ER2430
ER2460	ICT-220	Compressors	25	Completion of all Entry Level Courses
ER1741	ICT-145	On-Off Control Devices	40	Completion of all Entry Level Courses
ER2490	ICT-235	Final Control Elements	50	Completion of all Entry Level Courses
ER2530	ICT-245	Single Phase Theory	45	Completion of all Entry Level Courses

ER2540	ICT-250	Power Supplies	10	Completion of all Entry Level Courses
	Total Hours		**230**	

Required Work Experience

Block 3				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
ER2550	ICT-200	Job Planning	6	Block II
ER2560	ICT-325	Process Analyzers I (Solids and Liquids)	40	Block II
ER2570	ICT-430	Process Analyzers II (Gases)	20	ER2560
ER2580	ICT-400	Equipment Monitoring Devices	40	Block II
ER2670	ICT-425	Safety and Security Systems	24	Block II
ER2590	ICT-320	Drives and Motors	40	Block II
ER2600	ICT-305	Trade Related Computer Use	10	Block II
ER2610	ICT-420	Human Machine Interface Systems	30	ER2600
	Total Hours		**210**	

Required Work Experience

Block 4				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
ER2620	ICT-300	Basic Process Control	65	Block III
ER2630	ICT-410	Advanced Process Control	65	ER2620
ER2640	ICT-310	Programmable Logic Controller Systems	50	ER2630
ER2650	ICT-315	Distributed Control Systems	45	ER2630
ER2660	ICT-415	Supervisory Control and Data Acquisition Systems	15	ER2640 ER2650

Total Hours	**240**

Total Course Credit Hours	**1770**

***A student who can meet the Mathematics requirement through an ACUPLACER® test may be exempted from Mathematics 1060. Please check with your training institution.**

ENTRY LEVEL – BLOCK I

TS1510 Occupational Health and Safety

Learning Outcomes:

- Demonstrate knowledge of identifying how to prevent accidents and illnesses
- Demonstrate knowledge of improving 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 & 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.

Course 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 form 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

Practical Requirements:

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

ER1390 Safety

Learning Outcomes:

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

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify types of personal protective equipment (PPE) and clothing and describe their applications and limitations.

2. Describe the procedures used to care for and maintain PPE.

3. Identify hazards and describe safe work practices.
   i) personal
   ii) workplace
      - energy state awareness
      - isolation and de-energizing procedures
      - tag out/lockout
      - confined space
      - fire
      - heights
      - nuclear
      - chemical/gas
      - arc flash
      - temperature extremes
      - high pressure
      - high voltage
      - fire and gas equipment

iii) environmental
- discharge/spills

4. Identify and describe workplace safety, environmental and health regulations.
   i) federal
      - Atomic Energy Control Act and Regulations
   ii) provincial/territorial
   iii) municipal

ER1111 Tools and Equipment

Learning Outcomes:

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

Duration: 45 Hours

Pre-Requisite(s): ER1390

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 calibration, configuration and test equipment and describe their applications.
8. Identify types of powder actuated tools and describe their applications.

9. Identify types of installation and mounting hardware and describe their applications.

Practical Requirements:

1. Selection and proper use of various hand tools.

2. Selection and proper use of various power tools.

3. Demonstrate proper use of powder actuated tools.

ER1490 Material Handling Equipment

Learning Outcomes:

- Demonstrate knowledge of material handling equipment and accessories, their applications and limitations.

Duration: 15 Hours

Pre-Requisite(s): ER1390, TS1520

Objectives and Content:

1. Define terminology associated with material handling equipment and accessories.
   - i) mechanical advantage
   - ii) safety factor
   - iii) safe work load
   - iv) center of gravity
   - v) load weight

2. Identify hazards and describe safe work practices pertaining to material handling.
   - i) load considerations
   - ii) supervision of material handling
   - iii) securing work area
   - iv) communication

3. Identify codes and regulations pertaining to material handling.
   - i) OSHA regulations

4. Identify types of material handling equipment and accessories and describe their applications and limitations.
   - i) wire rope
   - ii) fiber rope
   - iii) chains
   - iv) rigging hardware

- Drums
- Sheaves
- Hooks
- Rings, links and swivels
- Shackles
- Eye bolts
- Turnbuckles
- Spreader and equalizer beams
- Blocks

v) slings
vi) jacks
vii) ladders and scaffolds
viii) knots, bends and hitches

5. Describe the procedures used to inspect, maintain and store material handling equipment.

Practical Requirements:

1. Tie knots, bends, and hitches used for lifting and moving equipment.

2. Inspect, select and use the appropriate sling to lift a control valve with the proper center of gravity.

3. Select and use ladders appropriate for a given task.

ER1500 Communication and Trade Documentation

Learning Outcomes:

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of trade related documentation and its use.

Duration: 9 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe the importance of effective verbal and non-verbal communication.
   - i) other tradespersons
   - ii) colleagues
   - iii) supervisors
   - iv) suppliers/manufacturers
   - v) Central Control Room Operators (CCRO)

2. Identify types of trade related documentation and describe their purpose, applications and procedures for use.
   - i) manufacturers' specifications
   - ii) codes and standards
     - CSA
     - ISA
   - iii) work orders / work packs
   - iv) maintenance schedules
     - Preventative maintenance
     - Predictive maintenance
   - v) calibration/maintenance records

Practical Requirements:

1. Complete a calibration Data sheet.

2. Complete an instrument data sheet according to manufacturer's specifications.

ER1201 Drawings, Schematics and Specifications

Learning Outcomes:

- Demonstrate knowledge of drawings, schematics and specifications and their applications.
- Demonstrate knowledge of interpreting and extracting information from drawings, schematics and specifications.

Duration: 30 Hours

Pre-Requisite(s): ER1500

Objectives and Content:

1. Identify types of drawings and describe their applications.
    i. civil / site
    ii. architectural
    iii. mechanical
    iv. structural
    v. electrical
    vi. shop drawings
    vii. sketches
    viii. as-builts
    ix. piping and instrument drawings (P & IDs)
    x. installation drawings
    xi. loop drawings
    xii. location drawings
    xiii. logic drawings

2. Review and interpret information from drawings.
    i. alphabet of lines
    ii. elevations
    iii. scales
    iv. legends
    v. symbols and abbreviations
    vi. notes and specifications

3. Review and interpret information from basic drawings, schematics, wiring diagrams and documents.

4. Describe procedures used to obtain material lists.

Practical Requirements:

1. Gather and interpret information from various drawings.

2. Determine measurements from scaled drawings.

3. Use information to obtain a materials list for installation.

4. Sketch basic drawing views

ER1140 DC Theory

Learning Outcomes:

- 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.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to DC theory.

2. Describe the atomic structure of matter.
   i. electron theory
      - matter
      - atoms
      - electric charge
      - protons, electrons, neutron
   ii. static electricity and electrostatics
      - positive and negative charge
      - electrostatic field
      - transferring static electricity
        - conduction
        - induction
   iii. discharging static charges
      - electrons in motion
      - causes of current
      - conductors, semi-conductors, insulators

- electron current flow
- conventional current flow

3. Identify electrical units and symbols.
   i. absolute electrical units
      - current
      - voltage
      - resistance
   ii. prefixes for absolute units

4. Identify different forms of energy and describe the effects of dynamic electricity.
   i. different forms of energy to produce electricity
      - chemical action
      - piezoelectric effect
      - magnetism
      - heat
      - light and solar energy
      - friction
   ii. effects of dynamic electricity
      - heating effects
      - chemical effects
      - magnetic effects
      - psychological and physiological effects

5. Identify and analyze the components necessary for the assembly of an electric circuit.
   i. the electron path (conductors)
   ii. the load
   iii. the source
   iv. the control
   v. closed circuit
   vi. open circuit
   vii. short circuit

6. Identify and describe the three basic electrical properties.
   i. voltage
   ii. current
   iii. resistance

7. Explain Ohm's Law

8. Describe the following in relation to electricity.
    i. work
    ii. power
    iii. joules and coulombs
    iv. electrical power (watt)
    v. combination of the Power formulas and Ohm's Law
    vi. watts and horsepower
    vii. BTU
    viii. kilowatt hours
        - meter reading and cost

9. Identify measuring instruments and describe their applications and procedures for use.
    i. ammeter
    ii. voltmeter
    iii. ohmmeter
    iv. multimeter
    v. circuit tester
    vi. continuity tester
    vii. megger

10. Identify hazards and describe safe work practices pertaining to DC electricity.

Practical Requirements:

1. Compute values of electrical energy and power.

2. Use electrical measuring instruments.

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

4. Ensure calibration of measuring instruments in accordance with manufacturing specifications.

5. Conduct megger test.

ER1150 Series and Parallel DC Circuits

Learning Outcomes:

- Demonstrate knowledge of series, parallel and complex circuits, their characteristics and operation

Duration: 45 Hours

Pre-Requisite(s): ER1140

Objectives and Content:

1. Describe the characteristics of a series circuit and calculate values.
   i. resistance
   ii. current
   iii. voltage
   iv. power
   v. open resistor
   vi. shorted resistor

2. Describe the characteristics of a parallel circuit and calculate values.
   i. resistance
   ii. current
   iii. voltage
   iv. power
   v. open resistor
   vi. shorted resistor

3. Explain Kirchhoff's Laws.
   i. current law
   ii. voltage law

4. Describe the characteristics of a combination circuit and calculate values.

5. Describe the procedures used to troubleshoot series, parallel and complex DC circuits.

Practical Requirements:

1. Analyze and measure amperage and voltage in series DC circuits.
2. Analyze and measure amperage and voltage in parallel DC circuits.
3. Analyze and measure amperage and voltage in combination DC circuits.
4. Analyze and measure resistance and/or continuity in basic DC circuits.
5. Analyze and measure power consumption in basic DC circuits.

ER1170 Voltage Drop and Power Loss

Learning Outcomes:

- Demonstrate knowledge of voltage drop and power loss and its impact on a circuit.

Duration: 30 Hours

Pre-Requisite(s): ER1151

Objectives and Content:

1. Identify the types of conductor materials and describe their characteristics.
   i. aluminum
   ii. copper

2. Identify types of insulators and describe their characteristics and applications.

3. Explain conductor resistance and its effects on a circuit.
   i. resistivity
   ii. cross-sectional area
   iii. length
   iv. temperature coefficient of resistance

4. Describe the procedures used to determine conductor resistance

5. Explain line voltage drop and its effects on a circuit.
   i. factor affecting voltage drop
   ii. calculate voltage drop
   iii. CEC requirements
   iv. voltage drop percentage

6. Explain power loss and its effects on a circuit.
   i. calculate power loss

7. Describe the operation of a three-wire system.
   i. purpose of a three-wire system
   ii. neutral wire

Practical Requirements:

1. Use CEC tables to calculate voltage drop.

2. Calculate the absolute values in three-wire circuits.

ER1510 Conductors and Cables

Learning Outcomes:

- Demonstrate knowledge of conductors and cables and their associated components.
- Demonstrate knowledge of the procedures used to install conductors and cables.
- Demonstrate knowledge of the procedures used to terminate conductors.

Duration: 30 Hours

Pre-Requisite(s): ER1170

Objectives and Content:

1. Define terminology associated with conductors and cables.
   i. CSA designations
   ii. voltage ratings
   iii. number and size range of conductors
   iv. number of strands
   v. conditions of use
   vi. glanding
   vii. temperature ratings

2. Identify hazards and describe safe work practices pertaining to conductors and cables.

3. Identify tools and equipment relating to conductors and cables and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to conductors and cables.
   i) Canadian Electrical Code (CEC)
   ii) Canadian Standards Association (CSA)

5. Interpret information pertaining to conductors and cables found on drawings and specifications.

6. Identify types of conductors and cables and describe their characteristics and applications.

7. Identify conductor and cable components and accessories and describe their characteristics and applications.

8. Identify methods of circuit protection and describe their characteristics and applications.
   i) Zener diodes
   ii) opto-isolators
   iii) circuit breakers
   iv) fuses

9. Identify the considerations used when selecting conductors and cables and their associated components and accessories.

10. Describe the procedures used to install conductors and cables and their associated components and accessories.

11. Describe the procedures used to terminate conductors.

Practical Requirements:

1. Select and terminate armored cables.

2. Select and terminate TECK cables.

3. Dress a cable with proper glanding.

ER1460 Wireways, Conduit, Electrical Metallic Tubing (EMT) and Fittings

Learning Outcomes:

- Demonstrate knowledge of wireways, conduit, EMT and fittings, their characteristics and applications.
- Demonstrate knowledge of the procedures used to install wireways, conduit, EMT and fittings.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with wireways, conduit, EMT and fittings.

2. Identify hazards and describe safe work practices pertaining to wireways, conduit, EMT and fittings.

3. Identify tools and equipment relating to wireways, conduit, EMT and fittings and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to wireways, conduit, EMT and fittings.

5. Interpret information pertaining to wireways, conduit, EMT and fittings found on drawings and specifications.

6. Identify types of wireways, conduit and EMT and describe their characteristics and applications.

7. Identify wireway, conduit and EMT fittings and accessories and describe their characteristics and applications.

8. Describe the procedures used to bend conduit and EMT.

9. Describe the procedures used to install wireways, conduit and EMT and their fittings and accessories.

ER2470 Pneumatic Supply Systems I

Learning Outcomes:

- Demonstrate knowledge of pneumatic supply systems, their components and operation.
- Demonstrate knowledge of schematics, their use and interpretation.
- Demonstrate knowledge of pneumatic related calculations.

Duration: 25 Hours

Pre-Requisite(s): ER1460

Objectives and Content:

1. Define terminology associated with pneumatic supply systems.

2. Identify hazards and describe safe work practices pertaining to pneumatic supply systems.
   i) energy state awareness

3. Interpret information pertaining to pneumatic supply systems found on drawings and specifications.

4. Identify types of pneumatic supply systems and describe their applications and operation.
   i) instrument air
   ii) service air

5. Identify types of pneumatic supply system components and describe their purpose and operation.
   i) compressors
   ii) relays
   iii) valves
   iv) regulators
   v) gauges

vi) actuators

6. Describe the methods of air treatment in pneumatic supply systems.
   i) filters
   ii) dryers
   iii) after-coolers
   iv) de-icers
   v) receivers

7. Interpret schematics to determine the operation of pneumatic supply systems.

8. Perform pneumatic related calculations.

Practical Requirements:

1. Simulate or install an actual pneumatic supply systems.

2. Maintain pneumatic supply systems.

3. Troubleshoot pneumatic supply systems.

ER2480 Pneumatic Supply Systems II

Learning Outcomes:

- Demonstrate knowledge of the procedures used to install, maintain and troubleshoot pneumatic supply system equipment and components.
- Demonstrate knowledge of the procedures used to commission pneumatic supply systems.

Duration: 25 Hours

Pre-Requisite(s): ER2470

Objectives and Content:

1. Identify tools and equipment relating to pneumatic supply systems and describe their applications and procedures for use.

2. Describe the procedures used to select and install pneumatic supply systems and components.

3. Describe the procedures used to maintain and troubleshoot pneumatic supply systems and components.
   i) compressors
   ii) lubricating fluids (condition and level)
   iii) dryers
   iv) de-icers
   v) hoses, piping and tubing
   vi) filters

4. Describe the procedures used to commission pneumatic supply systems and components.

Practical Requirements:

1. Commission a pneumatic supply system.

ER1420 Introduction to Pressure Measurement and Calibration

Learning Outcomes:

- Demonstrate knowledge of pressure measurement and calibration.
- Demonstrate knowledge of the procedures used to install, calibrate, maintain and troubleshoot basic pressure measurement devices.

Duration: 70 Hours

Pre-Requisite(s): ER1201

Objectives and Content:

1. Define terminology associated with pressure measurement and calibration.

2. Identify hazards and describe safe work practices pertaining to pressure measurement and calibration.
   i. application of intrinsically safe pressure transmitters
   ii. safe installation methods for pressure sensors in hazardous environments
   iii. knowledge of appropriate tubing and hazards of high pressure tubing installations
3. Identify equipment relating to pressure measurement and describe their applications and procedures for use.
   i. Differential pressure (d/p) cells
   ii. Pressure switches
   iii. Pressure gauges
   iv. Pressure transmitters (wireless, analog, pneumatic, digital, Smart)
   v. Pressure transducers
   vi. Pressure recorders

4. Interpret information pertaining to pressure measuring devices found on drawings, specifications and nameplates.

5. Interpret and maintain calibration records.
6. Identify units of measure used to express pressure measurement values.

7. Perform conversions and calculations relating to pressure measurement.
   i. the formula used to calculate pressure: P=F/A

8. Explain the principles of pressure measurement and its relationship to temperature, level and flow.

9. Identify types of basic pressure measurement devices and describe their applications.
   i. pneumatic
   ii. hydraulic

10. Identify pressure related calibration standards and describe their applications.
    i. Manometers
    ii. Dead weight tester
    iii. Test gauges and calibrators

11. Describe the installation procedures for pressure measurement devices in various applications.

12. Describe the procedures used to maintain and troubleshoot basic pressure measurement devices.
    i. the procedure for placing a pressure instrument into / out of service
    ii. environmental conditions that can affect transmitter operation
    iii. the elements of periodic maintenance

13. Discuss the importance of pressure measurement in industry.

14. Describe the configuration of smart transmitters and their applications in relationship to pressure.
    i. Hart protocol
    ii. Foundation field bus
    iii. Configuring transmitters

15. Describe the configuration of Wireless pressure transmitters and their applications
    i. Gateway setup
    ii. Configuring transmitters

Practical Requirements:

1. Install various pressure measurement instruments as per installation details.

2. Calibrate pressure measurement instruments to include smart, wireless, analog, and record calibration data using latest test equipment.

3. Perform calculations that relate to pressure measurement.

ER1520 Tubing and Piping Systems

Learning Outcomes:

- Demonstrate knowledge of tubing and piping systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, maintain and troubleshoot tubing and piping systems and their components.

Duration: 30 Hours

Pre-Requisite(s): ER1420

Objectives and Content:

1. Define terminology associated with tubing and piping systems.

2. Identify hazards and describe safe work practices pertaining to tubing and piping systems.

3. Identify tools and equipment relating to tubing and piping systems and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to tubing and piping systems.

5. Interpret information pertaining to tubing and piping systems found on drawings and specifications.

6. Identify types of tubing and piping systems and describe their applications.
   - i) rigid
   - ii) flexible
     - Tubing
     - hoses
   - iii) ferrous
   - iv) non-ferrous

7. Identify types of tubing and piping and describe their compatibility, characteristics and applications.

8. Identify types of tube and pipe fittings and describe their characteristics and applications.

9. Identify tubing and piping system accessories and describe their characteristics and applications.

10. Identify types of valves used in tubing and piping systems and describe their applications and operation.

11. Describe the procedures used to select and install tubing and piping system components and accessories.

12. Perform tube bending and installation.

13. Describe the procedures used to maintain and troubleshoot tubing and piping systems and components.

Practical Requirements:

1. Bend tubing based on instructor's template.

2. Install compression tubing fittings to manufacturer's specifications.

ER1530 Introduction to Fluids

Learning Outcomes:

- Demonstrate knowledge of the principles and applications of fluids.

Duration: 25 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with fluids.

2. Identify hazards and describe safe work practices pertaining to fluids.

3. Explain the principles and theories of fluids.
   i) Pascal's law
   ii) Boyle's law
   iii) Charles' law
   iv) Combined Gas law
   v) Bernoulli's principle

4. Describe units of measure as they relate to fluids.

5. Identify fluid related formulae and describe their applications.

6. Identify fluid related symbols and abbreviations found on drawings and schematics.

ER1430 Flow Measurement

Learning Outcomes:

- Demonstrate knowledge of calibrating and configuring various types of flow instruments and devices
- Demonstrate knowledge of selecting and installing various flow instruments and devices
- Demonstrate knowledge of understanding the principles of operation for flow measurement
- Demonstrate knowledge of safety procedures in relation to flow measurement devices
- Demonstrate knowledge of understanding the guidelines for periodic maintenance and troubleshooting
- Demonstrate knowledge of maintaining flow calibration standards and records
- Demonstrate knowledge of interpreting information on documents and specifications

Duration: 110 Hours

Pre-Requisite(s): ER1420, ER1530, ER1201

Objectives and Content:

1. Define terminology associated with flow measurement.

2. Identify hazards and describe safe work practices pertaining to flow measurement and calibration.
   i. application of intrinsically safe flow transmitters
   ii. safe installation methods for flow sensors in hazardous environments
   iii. knowledge of appropriate tubing installations

3. Identify equipment relating to flow measurement and describe their applications and procedures for use.
   i. continuous flow devices
   ii. differential pressure (d/p) cells – direct and indirect measurement
   iii. ultrasonic meters
   iv. magnetic flow meters
   v. turbine meters
   vi. positive displacement meters
   vii. coriolis meters
   viii. vortex-shedding meters
   ix. thermal flow meters
   x. mass flow meters
   xi. volumetric flow meters
   xii. variable area flow meters
   xiii. metering the flow of solid products
   xiv. flow switches

4. Interpret information pertaining to flow measuring devices found on drawings, specifications and nameplates.

5. Interpret and maintain flow calibration records.

6. Identify units of measure used to express mass and volumetric flow measurement values.

7. Perform conversions and calculations relating to flow measurement.

8. Explain the principles of flow measurement and its relationship to temperature and pressure.

9. Describe the procedures used to calibrate and configure flow measuring devices.

10. Describe the selection and installation procedures for flow measurement devices in various applications.

11. Describe the procedures used to maintain and troubleshoot basic flow measurement devices.
    i. the procedure for placing a flow instrument in/out of service
    ii. the elements of periodic maintenance

12. Explain the importance of flow measurement in industry.
13. Describe the configuration of smart transmitters and their applications in relationship to flow.
    i. Hart protocol
    ii. Foundation field bus
    iii. Configuring transmitters

14. Describe the configuration of Wireless flow transmitters and their applications
    i. Gateway setup
    ii. Configuring transmitters

Practical Requirements:

1. Install various flow measurement instruments to include volumetric and mass flow.

2. Calibrate various flow measurement instruments using smart, analog, HART, field bus, AMS, wireless, and record calibration data using latest test equipment.

3. Perform calculations that relate to flow measurement and the properties of fluid.

ER1440 Level and Density Measurement

Learning Outcomes:

- Demonstrate knowledge of calibrating and configuring various level and density instruments and devices
- Demonstrate knowledge of selecting and installing level and density instruments and devices
- Demonstrate knowledge of understanding the principles of operation for level and density measurement
- Demonstrate knowledge of safety procedures in relation to level and density measurement
- Demonstrate knowledge of maintaining level and density calibration standards and records
- Demonstrate knowledge of understanding guidelines for periodic maintenance and troubleshooting
- Demonstrate knowledge of interpreting information on documents and specifications

Duration: 50 Hours

Pre-Requisite(s): ER1420, ER1201

Objectives and content:

1. Define terminology associated with level and density measurement and calibration.

2. Identify hazards and describe safe work practices pertaining to level and density measurement and calibration.

    i. application of intrinsically safe level and density transmitters
    ii. safe installation methods for level and density devices

3. Identify equipment relating to level and density measurement and describe their applications and procedures for use.
   i. continuous level devices
   ii. differential pressure (d/p) cells
   iii. ultrasonic
   iv. capacitance
   v. nuclear
   vi. radar /microwave
   vii. magnetic
   viii. weight systems using load cells
   ix. level switches
   x. level gauges
   xi. level and density transmitters (wireless, analog, pneumatic, digital, Smart)
   xii. level and density recorders

4. Identify calibration and test equipment relating to level and density measurement and describe their applications and procedures for use.

5. Interpret information pertaining to level and density measuring devices found on drawings, specifications and nameplates.

6. Interpret and maintain calibration records.

7. Identify units of measure used to express level and density measurement values.

8. Perform conversions and calculations relating to level and density measurement.

9. Explain the principles of level and density measurement and its relationship to temperature, pressure and flow.

10. Describe the installation procedures for level and density measurement devices in various applications.

11. Describe the procedures used to maintain and troubleshoot basic level and density measurement devices.
    i. the procedure for placing a level and density instrument into / out of service
    ii. the elements of periodic maintenance

12. Discuss the importance of level and density measurement in industry.
13. Describe the configuration of smart transmitters and their applications in relationship to level.
    i. Hart protocol
    ii. Foundation field bus
    iii. Configuring transmitters

14. Describe the configuration of Wireless level transmitters and their applications
    i. Gateway setup
    ii. Configuring transmitters

Practical Requirements:

1. Install various level and density measurement instruments as per installation details.

2. Calibrate level and density measurement instruments to include smart, wireless, analog, and record calibration data using latest test equipment.

3. Perform calculations that relate to level and density measurement.

ER1450 Temperature Measurement

Learning Outcomes:

- Demonstrate knowledge of calibrating and configuring various temperature instruments using different test equipment and standards.
- Demonstrate knowledge of selecting and installing temperature instruments and devices
- Demonstrate knowledge of understanding the principles of operation for temperature measurement
- Demonstrate knowledge of safety procedures in relation to temperature instruments
- Demonstrate knowledge of understanding guidelines for periodic maintenance
- Demonstrate knowledge of maintaining temperature calibration standards and records
- Demonstrate knowledge of interpreting information on documents and specifications

Duration: 60 Hours

Pre-Requisite(s): ER1201

Objectives and Content:

1. Define terminology associated with temperature measurement.

2. Identify hazards and describe safe work practices pertaining to temperature measurement and calibration.

    i. application of intrinsically safe temperature transmitters
    ii. safe installation methods for temperature sensors in hazardous environments

iii. knowledge of appropriate temperature sensor installations

3. Identify equipment relating to temperature measurement and describe their applications and procedures for use.
   i. Thermowell
   ii. Thermometer
   iii. Bimetallic strip
   iv. Resistance temperature detector (RTD)
   v. Thermocouple
   vi. Temperature gauge
   vii. Pyrometers
   viii. Thermistor
   ix. liquid, gas and vapor-filled systems
   x. temperature switches

4. Correlate changes in temperature with changes in a substance's physical state.

5. Interpret information pertaining to temperature measuring devices found on drawings, specifications and nameplates.

6. Interpret and maintain temperature calibration records.
   i. primary and secondary temperature calibration standards

7. Identify units of measure used to express temperature measurement values.

8. Perform conversions and calculations relating to temperature measurement.

9. Describe the procedures used to calibrate and configure temperature measuring devices.

10. Describe the selection and installation procedures for temperature measurement devices in various applications.

11. Describe the procedures used to maintain and troubleshoot basic temperature measurement devices.
    i. the procedure for placing a temperature instrument into / out of service
    ii. the elements of periodic maintenance

12. Explain the importance of temperature measurement in industry.

13. Describe the configuration of smart transmitters and their applications in relationship to temperature.
    i. Hart protocol
    ii. Foundation field bus
    iii. Configuring transmitters

14. Describe the configuration of Wireless temperature transmitters and their applications
    i. Gateway setup
    ii. Configuring transmitters

Practical Requirements:

1. Install various temperature measurement instruments.

2. Calibrate temperature measurement instruments, to include smart, HART, field bus, wireless, analog with approved test equipment and record calibration data.
    i. Type “K” Temperature Transmitter
    ii. Type “ J” Temperature Transmitter
    iii. RTD Temperature Transmitter

3. Perform calculations that relate to temperature measurement.

ER1711 Signal Transmission Systems

Learning Outcomes:

- Demonstrate knowledge of signal transmission systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, configure, upgrade, maintain, troubleshoot and replace signal transmission systems.

Duration: 30 Hours

Pre-Requisite(s): ER1420

Objectives and Content:

1. Define terminology associated with signal transmission.

2. Identify hazards and describe safe work practices pertaining to signal transmission.

3. Identify tools and equipment relating to signal transmission systems and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to signal transmission.

5. Interpret information pertaining to signal transmission found on drawings and specifications.

6. Identify types of communication protocols and describe their characteristics and applications.

7. Identify types of signal transmission systems and describe their characteristics and applications.
   i) pneumatic
   ii) wired
   iii) fibre optic

iv) wireless

8. Identify signal transmission system components and accessories and describe their purpose and operation.
   i) tubing
   ii) cables
   iii) antennas
   iv) converters
   v) transducers
   vi) multi-plexers
   vii) network switches/hubs

9. Describe the procedures used to select and install signal transmission systems and their components.

10. Describe the procedures used to configure, calibrate and upgrade signal transmission systems and their components.

11. Describe the procedures used to maintain, troubleshoot and replace signal transmission systems and their components.

Practical Requirements:

1. Calibrate various signal transducers and related equipment.

ER1733 Electronics (Circuits and Components)

Learning Outcomes:

- Demonstrate knowledge of AC/DC circuits and their characteristics.
- Demonstrate knowledge of electronics, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, troubleshoot and replace electronic circuits and their components.

Duration: 90 Hours

Pre-Requisite(s): ER1140

Objectives and Content:

1. Define terminology associated with electronics.

2. Identify hazards and describe safe work practices pertaining to electronics.
   i) energy state awareness
   ii) static electricity discharge

3. Identify tools and equipment relating to electronic circuitry and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to electronics.

5. Interpret information pertaining to electronics found on devices, drawings and specifications.

6. Describe the operation of a wheatstone bridge circuit.

7. Explain conventional current flow vs. electron flow theory in electronics.

8. Identify number systems used in electronics and describe their applications.
   i) binary

ii) decimal
iii) hexadecimal
iv) octal
v) binary coded decimal (BCD)

9. Perform conversions between number systems.

10. Identify types of logic gates and describe their applications.

11. Identify semiconductor materials used in electronics and describe their characteristics and applications.

12. Identify electronic components and describe their purpose and operation in a circuit.
    i) rectifiers
    ii) diodes
    iii) transistors
    iv) op amps
    v) thyristors

13. Describe the procedures used to select and install electronic circuits.

14. Describe the procedures used to maintain, troubleshoot and replace electronic circuitry.

15. Perform calculations pertaining to electronics.
    i) power
    ii) current
    iii) voltage
    iv) frequency (timing)
    v) logic

Practical Requirements:

1. Troubleshoot basic problems with electronic circuits.

CM2150 Workplace Communications

Learning Outcomes:

- Demonstrate knowledge of understanding and applying communication skills as outlined in the Employability Skills 2000, Conference Board of Canada
- Demonstrate knowledge of understanding the importance of well-developed writing skills in business and in career development
- Demonstrate knowledge of understanding the purpose of the various types of business correspondence
- Demonstrate knowledge of examining the principles of effective business writing
- Demonstrate knowledge of examining the standard formats for letters and memos
- Demonstrate knowledge of writing effective letters and memos
- Demonstrate knowledge of examining the fundamentals of informal reports and the report writing procedure
- Demonstrate knowledge of producing and orally presenting an informal report
- Demonstrate knowledge of examining effective listening skills and body language in communication

Duration: 45 Hours

Pre-Requisite(s): 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

ii. 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 and use of audio/visual aids
   iv. discuss and participate in confidence building exercises used to
   i. 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:

- Demonstrate knowledge of understanding what defines customer service
- Demonstrate knowledge of understanding why service is important
- Demonstrate knowledge of understanding the relationship between "service" and "sales.
- Demonstrate knowledge of understanding the importance of a positive attitude
- Demonstrate knowledge of understanding the methods of resolving customer complaints

Duration: 30 Hours

Pre-Requisite(s): 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:

- Demonstrate knowledge of applying quality assurance/quality control procedures as related to the trade.
- Demonstrate knowledge and awareness of quality principles and processes.
- Demonstrate knowledge of applying quality assurance/quality control procedures in a shop project.

Duration: 30 Hours

Pre-Requisite(s): 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:

- Demonstrate knowledge of computer systems and their operation.
- Demonstrate knowledge of popular software packages and their applications.
- Demonstrate knowledge of security issues of computers.

Duration: 30 Hours

Pre-Requisite(s): 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
    ii. document)
    iii. 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:

- Demonstrate knowledge of participating in meetings
- Demonstrate knowledge of basic concepts of the workplace such as unions, workers' compensation, workers' rights, human rights, workplace diversity, and gender sensitivity.

Duration: 30 Hours

Pre-Requisite(s): 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
    i. 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 and Safety Act as it refers to workers' rights

6. Human Rights.
    i. describe what information cannot be included on an employment
    i. application
    ii. describe what information cannot be included in an interview
    iii. examine the Human Rights Code and explain the role of the
    i. 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:

- Demonstrate knowledge of effective use of job search techniques

Duration: 15 Hours

Pre-Requisite(s): 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 Trades 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 Trades Certification website.

SD1720 Entrepreneurial Awareness

Learning Outcomes:

- Demonstrate knowledge of understanding the various types of business ownership
- Demonstrate knowledge of understanding the advantages and disadvantages of self-employment
- Demonstrate knowledge of identifying the characteristics of an entrepreneur
- Demonstrate knowledge of stating the purpose of a business plan
- Demonstrate knowledge of identifying the main elements of a business plan

Duration: 15 Hours

Pre-Requisite(s): 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

AP1100 Introduction to Apprenticeship

Learning Outcomes:

- Demonstrate knowledge of describing the apprenticeship registration process
- Demonstrate knowledge of explaining the steps to complete the Apprenticeship Program
- Demonstrate knowledge of understanding the roles of the Apprentice, Journeyperson, Training Institutions, Industry and Governing Bodies in the Apprentice Program
- Demonstrate knowledge of explaining the significance of the Interprovincial Standards Red Seal Program

Duration: 15 Hours

Pre-Requisite(s): 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 administrating apprenticeship
        - Department of Advanced Education and Skills
        - 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 Apprenticeship and Trades Certification Division of the Department of Advanced Education and Skills 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
    iii. identify who is responsible for tracking and signing-off on trade skills
    iv. identify the nearest Industrial Training Office to your community
    v. 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)
    ii. 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

MA1060 Basic Math

Learning Outcomes:

- Demonstrate knowledge of numeracy skills and knowledge required for institutional and on-the-job learning
- Demonstrate knowledge of applying mathematical concepts in the performance of trade practices
- Demonstrate knowledge of developing an appreciation for mathematics as a critical element of the learning environment
- Demonstrate knowledge of using 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.

Duration: 60 Hours

Pre-Requisite(s): 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:

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

BLOCK II

ER2430 Hydraulic Supply Systems I

Learning Outcomes:

- Demonstrate knowledge of hydraulic supply systems, their components and operation.
- Demonstrate knowledge of schematics, their use and interpretation.
- Demonstrate knowledge of hydraulic related calculations

Duration: 30 Hours

Pre-Requisite(s): Completion of all Entry Level Courses

Objectives and Content:

1. Define terminology associated with hydraulic supply systems.

2. Identify hazards and describe safe work practices pertaining to hydraulic supply systems.
   i) energy state awareness
      - Accumulators
      - suspended loads

3. Interpret information pertaining to hydraulic supply systems found on drawings and specifications.

4. Identify types of hydraulic supply systems and describe their applications and operation.

5. Identify hydraulic supply system components and describe their purpose and operation.
   i) pumps
   ii) motors
   iii) actuators

iv) valves
v) accumulators

6. Interpret schematics to determine the operation of hydraulic supply systems.

7. Perform hydraulic calculations.

Practical Requirements:

1. Troubleshoot a hydraulic system (actual or simulated) using a schematic diagram.

ER2450 Hydraulic Supply Systems II

Learning Outcomes:

- Demonstrate knowledge of the procedures used to maintain and troubleshoot hydraulic supply systems and components.
- Demonstrate knowledge of the procedures used to commission hydraulic supply systems.

Duration: 30 Hours

Pre-Requisite(s): ER2430

Objectives and Content:

1. Identify tools and equipment relating to hydraulic supply systems and describe their applications and procedures for use.

2. Identify types of fluids used in hydraulic supply systems and describe their characteristics and applications.

3. Describe the procedures used to maintain and troubleshoot hydraulic supply systems and components.
   - i) check hoses, piping and tubing
   - ii) check fluids (condition and level)
   - iii) check/change filters
   - iv) determine operating parameters
   - v) adjust system pressure, temperature and flow

4. Describe the procedures used to commission hydraulic supply systems and components.
   - i) initial
   - ii) return to service

Practical Requirements:

1. Construct a hydraulic system (actual or simulated) and troubleshoot accordingly.

ER2460 Compressors

Learning Outcomes:

- Demonstrate knowledge of compressors, their components and operation.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot compressors and components.
- Demonstrate knowledge of the procedures used to commission compressors.

Duration: 25 Hours

Pre-Requisite(s): Completion of all Entry Level Courses

Objectives and Content:

1. Define terminology associated with compressors.

2. Identify hazards and describe safe work practices associated with compressors.
   i) energy state awareness

3. Identify tools and equipment relating to compressors and describe their applications and procedures for use.

4. Identify classifications and types of compressors, their specifications and applications.
   i) dynamic/centrifugal
   ii) positive displacement

5. Identify compressor components and accessories and describe their purpose and operation.

6. Describe the procedures used to select and size compressors and their components.

7. Describe the procedures used to maintain and troubleshoot compressors and their components.

8. Describe the procedures used to commission compressors and their components.

ER1741 On-Off Control Devices

Learning Outcomes:

- Demonstrate knowledge of on-off control devices, their components and operation.
- Demonstrate knowledge of the procedure used to install, maintain, troubleshoot and replace on-off control devices.

Duration: 40 Hours

Pre-Requisite(s): Completion of all Entry Level Courses

Objectives and Content:

1. Define terminology associated with on-off control devices.

2. Identify hazards and describe safe work practices pertaining to on-off control devices.
   i) energy state awareness

3. Interpret codes and regulations pertaining to on-off control devices.

4. Interpret information pertaining to on-off control devices found on drawings specifications and nameplates.

5. Identify types of on-off control devices and describe their characteristics and applications.
   i) pushbuttons / selectors
   ii) switches
      - limit
      - proximity
      - centrifugal
      - temperature
      - level
      - flow
      - pressure

iii) photo sensors
iv) relays

6. Describe the procedures used to select and install on-off control devices.

7. Describe the procedures used to maintain, troubleshoot and replace on-off control devices.

Practical Requirements:

1. Install discrete control devices.

2. Activate a control valve using a switch.

ER2490 Final Control Elements

Learning Outcomes:

- Demonstrate knowledge of final control elements, their accessories, components and operation.
- Demonstrate knowledge of the procedures used to install, maintain, troubleshoot and replace final control elements, their accessories and components.

Duration: 50 Hours

Pre-Requisite(s): Completion of all Entry Level Courses

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 codes and regulations pertaining to final control elements.

5. Interpret information pertaining to final control elements found on drawings, specifications and nameplates.

6. 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

7. 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
8. 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

9. Describe the procedures used to select, size and install final control elements, their accessories and components.

10. Describe the procedures used to maintain, troubleshoot and replace final control elements, their accessories and components.

Practical Requirements:

1. Calibrate, maintain and troubleshoot final control elements.

ER2530 Single-Phase Theory

Learning Outcomes:

- Demonstrate knowledge of single-phase electricity, its characteristics and associated principles.
- Demonstrate knowledge of AC devices and their characteristics.

Duration: 45 Hours

Pre-Requisite(s): Completion of all Entry Level Courses

Objectives and Content:

1. Define terminology associated with single-phase electricity.

2. Identify hazards and describe safe work practices pertaining to single-phase electricity.

3. Identify units of measure and symbols pertaining to single-phase electricity.

4. Explain the principles of magnetism.

5. Explain the principles of electromagnetism.

6. Explain the principles of electromagnetic induction.

7. Identify the types of electromagnetic induction and describe their characteristics and applications.
   i) self induction
   ii) mutual induction

8. Explain alternating current (AC) generation.

9. Identify types of devices used in AC generation and describe their characteristics and applications.

10. Identify types of transformers used in control circuitry and describe their characteristics and applications.

11. Identify types of AC/DC circuits and describe their characteristics.
    i) resistance/capacitance (RC)
    ii) resistance/inductance (RL)
    iii) resistance/inductance/capacitance (RLC)

12. Perform calculations pertaining to single-phase electricity.

Practical Requirements:

1. Determine the properties of an AC circuit.

2. Determine absolute values in an AC series circuit containing RLC components.

3. Determine absolute values in an AC parallel circuit containing RLC components.

4. Calculate power and power factor in AC circuits.

5. Perform calculations pertaining to single-phase electricity.

ER2540 Power Supplies

Learning Outcomes:

- Demonstrate knowledge of power supplies, their components and operation.
- Demonstrate knowledge of the procedures used to install, maintain, troubleshoot, and replace power supplies.

Duration: 10 Hours

Pre-Requisite(s): Completion of all Entry Level Courses

Objectives and Content:

1. Define terminology associated with power supplies.

2. Identify hazards and describe safe work practices pertaining to power supplies.

3. Interpret codes and regulations pertaining to power supplies.

4. Interpret information pertaining to power supplies found on drawings, specifications and nameplates.

5. Identify types of power supplies and describe their characteristics and operating principles.
   i) AC/DC power supplies
   ii) uninterruptable power supplies (UPS)

6. Describe the procedures used to select and install power supplies.

7. Describe the procedures used to maintain, troubleshoot and replace power supplies.

BLOCK III

ER2550 Job Planning

Learning Outcomes:

- Demonstrate knowledge of the procedures used to plan and organize jobs.

Duration: 6 Hours

Pre-Requisite(s): Completion of all Block II Courses

Objectives and Content:

1. Identify sources of information relevant to job planning.
   - i) documentation
   - ii) drawings
   - iii) related professionals
   - iv) clients

2. Describe the considerations for determining job requirements.
   - i) personnel
   - ii) tools and equipment
   - iii) materials
   - iv) permits
   - v) safety planning

3. Describe the procedures used to plan job tasks.

4. Explain the importance of maintaining a parts inventory.

ER2560 Process Analyzers I (Solids and Liquids)

Learning Outcomes:

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

Duration: 40 Hours

Pre-Requisite(s): Completion of all Block II Courses

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 codes and regulations pertaining to process analyzers.

5. Interpret information pertaining to process analyzers found on drawings and specifications.

6. Explain the principles of operation for process analyzers.

7. Identify types of process analyzers and describe their characteristics and applications.
   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

xii) oxygen
xiii) moisture / dewpoint
xiv) chlorine
xv) brine

8. Identify process analyzer components and describe their purpose and operation.

9. Describe the procedures used to select and install process analyzers and their components.

10. Describe the procedures used to configure and calibrate process analyzers.

11. Describe the procedures used to maintain, troubleshoot and replace process analyzers and their components.

12. Describe process sample conditioning and its importance to process analysis.

13. Describe the procedures and equipment used to obtain and condition samples for process analysis.

Practical Requirements:

1. Calibrate conductivity and ph analyzers

ER2570 Process Analyzers II (Gases)

Learning Outcomes:

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

Duration: 20 Hours

Pre-Requisite(s): ER2560

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 codes and regulations pertaining to process analyzers.

5. Interpret information pertaining to process analyzers found on drawings and specifications.

6. Explain the principles of operation for process analyzers.

7. Identify types of process analyzers and describe their characteristics and applications.
   i) chromatography
   ii) spectrographic
   iii) flue gas analyzers
   iv) environmental

- Gas
- noise

8. Identify process analyzer components and describe their purpose and operation.

9. Describe the procedures used to select and install process analyzers and their components.
10. Describe the procedures used to configure and calibrate process analyzers.

11. Describe the procedures used to maintain, troubleshoot and replace process analyzers and their components.

12. Describe process sample conditioning and its importance to process analysis.

13. Describe the procedures and equipment used to obtain and condition samples for process analysis.

ER2580 Equipment Monitoring Devices

Learning Outcomes:

- Demonstrate knowledge of equipment monitoring and its associated principles.
- Demonstrate knowledge of equipment monitoring devices, their components and operation.
- Demonstrate knowledge of the procedures used to install, calibrate, configure, maintain, troubleshoot and replace equipment monitoring devices.

Duration: 40 Hours

Pre-Requisite(s): Completion of all Block II Courses

Objectives and Content:

1. Define terminology associated with equipment monitoring devices.

2. Identify hazards and describe safe work practices pertaining to equipment monitoring devices.

    i. application of intrinsically equipment monitoring device transmitters
    ii. safe installation methods for equipment monitoring device sensors in hazardous environments

3. Identify tools and equipment relating to equipment monitoring devices and describe their applications and procedures for use.
    i. continuous equipment monitoring devices and switches
        - LVDTs
        - Accelerometers and wobulators
        - Strain gauges
        - Load cells
        - Proximity switches

- Tachometers
- Optical

4. Interpret codes and regulations pertaining to equipment monitoring devices.

5. Interpret information pertaining to equipment monitoring devices found on drawings, specifications and nameplates.

6. Interpret and maintain equipment monitoring devices calibration records.

7. Identify units of measure used to express equipment monitoring device values.

8. Perform conversions and calculations relating to equipment monitoring.

9. Explain the principles of equipment monitoring devices.

10. Describe the procedures used to calibrate and configure equipment monitoring devices.

11. Describe the selection and installation procedures equipment monitoring devices in various applications.

12. Describe the procedures used to maintain and troubleshoot equipment monitoring devices.
    i. the procedure for placing an equipment monitoring devices in/out of service
    ii. the elements of periodic maintenance

13. Explain the importance of equipment monitoring devices in industry.

14. Describe the configuration of Wireless equipment monitoring devices and their applications
    i. Gateway setup
    ii. Configuring transmitters

Practical Requirements:

1. Select and install various equipment monitoring devices.

2. Calibrate and configure equipment monitoring devices to include smart, wireless, analog, and record calibration data using latest test equipment.

ER2670 Safety and Security Systems

Learning Outcomes:

- Demonstrate knowledge of safety and security systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, maintain, troubleshoot, configure, calibrate and replace safety and security systems and their components.

Duration: 24 Hours

Pre-Requisite(s): Completion of all Block II Courses

Objectives and Content:

1. Define terminology associated with safety and security systems.

2. Identify hazards and describe safe work practices pertaining to safety and security systems.

3. Identify tools and equipment relating to safety and security systems and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to safety and security systems.

5. Interpret information pertaining to safety and security systems found on drawings and specifications.

6. Identify types of safety and security systems and describe their components, characteristics and applications.
   i) gas detection
   ii) heat detection
   iii) fire detection
   iv) smoke detection

v) intruder detection
vi) security and safety cameras
vii) Safety Instrument Systems (SIS)
viii) machinery safety system
- emergency stop monitoring
- safety sensors and devices

ix) safety relief valves

7. Describe the procedures used to select and install safety and security systems and their components.

8. Describe the procedures used to configure and calibrate safety and security systems and their components.

9. Describe the procedures used to maintain, troubleshoot and replace safety and security systems and their components.

Practical Requirements:

1. Calibrate a gas detector.

2. Configure as SIS system.

3. Calibrate a safety relief valve.

ER2590 Drives and Motors

Learning Outcomes:

- Demonstrate knowledge of drives and motors, their components and operation.
- Demonstrate knowledge of the procedures used to calibrate, configure, maintain and troubleshoot drives.
- Demonstrate knowledge of the procedures used maintain and troubleshoot motors.

Duration: 40 Hours

Pre-Requisite(s): Completion of all Block II Courses

Objectives and Content:

1. Define terminology associated with drives and motors.

2. Identify hazards and describe safe work practices pertaining to drives and motors.

3. Interpret codes and regulations pertaining to drives and motors.

4. Interpret information pertaining to drives and motors found on drawings, specifications and nameplates.

5. Explain single and three-phase power and their applications in drives and motors.

6. Identify types of drives and describe their characteristics and operating principles.
   i) AC drives
   ii) DC drives

7. Identify types of motors and describe their characteristics and operating principles.
   i) control motors

- servos
- stepping

ii) single-phase

iii) three-phase

8. Describe the procedures used to calibrate and configure drives.

9. Describe the procedures used to maintain and troubleshoot drives and motors.

Practical Requirements:

1. Use test equipment to test motors.

2. Identify the motor types and components.

3. Install, service and maintain DC And AC motors.

ER2600 Trade Related Computer Use

Learning Outcomes:

- Demonstrate knowledge of trade related computer equipment and accessories and their use.

Duration: 10 Hours

Pre-Requisite(s): Completion of all Block II Courses

Objectives and Content:

1. Define terminology associated with trade related computer use.

2. Identify hazards and describe safe work practices pertaining to trade related computer use.
   i) online vs. offline applications
   ii) hazardous locations

3. Identify trade related computer equipment and accessories and describe their characteristics and applications.
   i) hardware
   ii) software/firmware
   iii) interfacing equipment

4. Identify the requirements and describe the procedures used to backup data and equipment configuration.

ER2610 Human Machine Interface Systems

Learning Outcomes:

- Demonstrate knowledge of operating Human Machine Interface (HMI) systems and their components.
- Demonstrate knowledge of the procedures used to install, configure, upgrade, maintain and troubleshoot Human Machine Interface (HMI) systems and their components.

Duration: 30 Hours

Pre-Requisite(s): ER2600

Objectives and Content:

1. Define terminology associated with HMI systems.

2. Identify hazards and describe safe work practices pertaining to HMI systems.

3. Identify tools and equipment relating to HMI systems and describe their applications and procedures for use.

4. Interpret information pertaining to HMI systems found on drawings and specifications.

5. Identify types of HMI systems and describe their characteristics and applications.

6. Identify HMI system components and describe their purpose and operation.
   i) hardware
   ii) software

7. Describe the procedures used to select and install HMI systems and their components.

8. Describe the procedures used to configure and upgrade HMI systems and their components.

9. Describe the procedures used to maintain and troubleshoot HMI systems and their components.

Practical Requirements:

1. Create and validate HMI configuration including the following information:
   i. depiction of process control strategy
   ii. equipment statuses

2. Back up and restore HMI configuration.

BLOCK IV

ER2620 Basic Process Control

Learning Outcomes:

- 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 install, 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.

Duration: 65 Hours

Pre-Requisite(s): Completion of all Block III Courses

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.
   i) dead time
   ii) transfer lag

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. Set up and calibrate controllers.

ER2630 Advanced Process Control

Learning Outcomes:

- Demonstrate knowledge of advanced process control and its purpose.
- Demonstrate knowledge of the procedures used to, configure, tune, maintain, and troubleshoot process control systems.
- Demonstrate knowledge of the procedures used to commission and optimize process control systems.

Duration: 65 Hours

Pre-Requisite(s): ER2620

Objectives and Content:

1. Define terminology associated with advanced process control.

2. Identify hazards and describe safe work practices pertaining to advanced process control.

3. Interpret codes and regulations pertaining to advanced process control.

4. Interpret information pertaining to advanced process control found on drawings and specifications.

5. Explain advanced process control and its purpose.

6. Identify methods of advanced process control and describe their applications.
   i) ratio
   ii) feed forward
   iii) adaptive

7. Explain process loop interactions and their impact on process control.

8. Describe the procedures used to configure and tune process control systems.

9. Describe the procedures used to maintain and troubleshoot process control systems.

10. Describe the procedures used to commission and optimize process control systems.

Practical Requirements:

1. Tune control systems.

ER2640 Programmable Logic Controller Systems

Learning Outcomes:

- Demonstrate knowledge of programming languages.
- Demonstrate knowledge of programmable logic controller (PLC) systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, configure, maintain, troubleshoot and replace PLC systems.

Duration: 50 Hours

Pre-Requisite(s): ER2630

Objectives and Content:

1. Define terminology associated with PLC systems.

2. Identify hazards and describe safe work practices pertaining to PLCs.
   i) online vs. offline applications
   ii) hazardous locations

3. Interpret codes and regulations pertaining to PLCs.

4. Interpret information pertaining to PLC systems found on drawings and specifications.

5. Identify sources of information pertaining to PLC system maintenance, configuration and programming.

6. Identify programming languages used to program PLC systems.
   i) ladder diagram (LD)
   ii) function block diagram (FBD)
   iii) structured text (ST)
   iv) instruction list (IL)
   v) sequential function chart (SFC)
   vi) boolean logic diagrams

7. Interpret programming languages and describe their applications and the procedures used to program PLC systems.
   i) ladder diagram (LD)
   ii) function block diagram (FBD)
   iii) sequential function chart (SFC)

8. Identify PLC system components and describe their purpose and operation.
   i) hardware
   ii) software
   iii) network communication protocols

9. Describe the procedures used to select and install PLC systems and their components.

10. Describe the procedures used to configure and program PLC systems and their components.
    i) I/O configuration
    ii) data table
    iii) user program
    iv) communication interface

11. Describe the procedures used to maintain, troubleshoot and replace PLC systems and their components.

Practical Requirements:

1. Program a PLC using ladder logic via an actual or simulation program.
   i. manipulate files to and from the PLC processor.

ER2650 Distributed Control Systems

Learning Outcomes:

- Demonstrate knowledge of distributed control systems (DCSs), their components and operation.
- Demonstrate knowledge of the procedures used to install, configure, upgrade, maintain, troubleshoot and replace DCSs and components.

Duration: 45 Hours

Pre-Requisite(s): ER2630

Objectives and Content:

1. Define terminology associated with DCSs.

2. Identify hazards and describe safe work practices pertaining to DCSs.

3. Identify tools and equipment relating to DCSs and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to DCSs.

5. Interpret information pertaining to DCSs found on drawings and specifications.

6. Identify sources of information pertaining to DCSs maintenance, configuration and programming.

7. Describe the procedures used to program a DCS.

8. Identify DCS components and describe their purpose and operation.
   i) hardware
   ii) software
   iii) network communication protocols

9. Describe the procedures used to select and install DCSs and their components.

10. Describe the procedures used to configure and upgrade DCSs and their components.

11. Describe the procedures used to maintain, troubleshoot and replace DCSs and their components.

Practical Requirements:

1. Configure a loop and DCS system.

2. Configure a control application on a DCS system.

3. Troubleshoot a DCS network.

ER2660 Supervisory Control and Data Acquisition Systems

Learning Outcomes:

- Demonstrate knowledge of supervisory control and data acquisition (SCADA) systems, their components and operation.
- Demonstrate knowledge of the procedures used to install, configure, upgrade maintain, troubleshoot and replace SCADA systems and components.

Duration: 15 Hours

Pre-Requisite(s): ER2640, ER2650

Objectives and Content:

1. Define terminology associated with SCADA systems.

2. Identify hazards and describe safe work practices pertaining to SCADA systems.

3. Identify tools and equipment relating to SCADA systems and describe their applications and procedures for use.

4. Interpret codes and regulations pertaining to SCADA systems.

5. Interpret information pertaining to SCADA systems found on drawings and specifications.

6. Identify sources of information pertaining to SCADA maintenance, configuration and programming.

7. Describe the procedures to program a SCADA system.

8. Identify SCADA system components and describe their purpose and operation.
   i) hardware
   ii) software

iii) network communication protocols

9. Describe the procedures used to select and install SCADA systems and their components.

10. Describe the procedures used to configure and upgrade SCADA systems and their components.

11. Describe the procedures used to maintain, troubleshoot and replace SCADA systems and their components.

Practical Requirements:

1. Configure and commission a SCADA logic program.

D. 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 Training 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 certain Plan of Training.

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 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.

3.0 Probationary Period

The probationary period for each Memorandum of Understanding will be six months. 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.

5.0 Apprenticeship Progression Schedule and Wage Rates

Progression Schedule

Instrumentation and Control Technician
7200 Hours

APPRENTICESHIP LEVEL AND WAGES

Year	Wage Rate At This Level	Requirements for progression to next level of apprenticeship	When requirements are met, the apprentice will progress to…
1st	60 %	▪ Completion of Block 1 (pre-employment) training ▪ Pass Block 1 exam ▪ Relevant work experience totaling 1800 hours or more	2nd Year
2nd	70%	▪ Completion of Block 2 training ▪ Pass Block 2 exam ▪ Relevant work experience totaling 3600 hours or more	3rd Year
3rd	80%	▪ Completion of Block 3 training ▪ Pass Block 3 exam ▪ Relevant work experience totaling 5400 hours or more	4th Year
4th	90%	▪ Completion of Block 4 training ▪ Pass Block exam for block 4 ▪ Relevant work experience totaling 7200 hours or more ▪ 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.

Block Exams

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

Instrumentation and Control Technician 7200 Hours		
CLASS CALLS		
Call Level	Requirements for Class Call	Hours awarded for In-School Training
Direct Entry Apprentice: PLA & / or Block 1	▪ Minimum of 1000 hours of relevant work experience ▪ Prior Learning Assessment (PLA) at designated college (if applicable)	To be determined by the number of courses completed after each class call
Block 2	▪ Minimum of 3000 hours of relevant work experience and training	230
Block 3	▪ Minimum of 5000 hours of relevant work	210
Block 4	▪ Minimum of 7000 hours of relevant work	240

Direct Entry Apprentice

- Must complete Block 1 courses through PLA and / or in school training.
- Block 1 training is to be completed via class calls; up to 16 weeks of training per calendar year.
- Must attend in-school training until Block 1 is complete before attending Blocks 2 or higher

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 hand tools as and when 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 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

The ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed, with the condition that one of these be a final year apprentice.

12.0 Relationship to a Collective Bargaining Agreement

Collective agreements take precedence over the conditions outlined in the Plan of Training.

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 regularly attend training programs 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 registering as a Trade Qualifier.

14.5 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.

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

14.7 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 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 Advanced Education and Skills within 30 days of the decision.

E. Requirements for Red Seal Certification for Apprentices

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 program.

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

   Or

   A total of 9000 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.

F. 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.

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 provincial/interprovincial 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.