Plan of Training

Automotive Service Technician

Newfoundland Labrador

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

March 2010

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Institutional and Industrial Education Division

Approved by:

Chairperson, Provincial Apprenticeship and Certification Board

Date: March 17, 2010

Preface

This Apprenticeship Standard is based on the 2009 edition of the National Occupational Analysis for the Automotive Service Technician trade.

This document describes the curriculum content for the Automotive Service 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.

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A. Profile Chart

OCCUPATIONAL SKILLS			
SV1100 Safety	SV1156 Service Information Systems	SV1165 Hand Tools	SV1176 Shop Tools and Equipment
WD1301 Oxy Fuel Welding/Cutting	WD2331 GMAW Welding (MIG)		
ENGINES AND ENGINE SUPPORT SYSTEMS			
SV1196 Lubrication and Fluids Servicing	SV1305 Engine Principles	SV1315 Cooling Systems	SV1395 Charging Systems
SV1495 Lighting Systems	SV1600 Ignition Systems	SV1651 Fuel Delivery	SV1661 Intake and Air Filtration Systems
SV1671 Exhaust Systems	SV2061 Manual Transmissions and Trans-axles	SV2070 Automatic Transmissions and Trans-axles	SV2171 Engine Diagnostics
SV2181 Engine Removal and Installation	SV2220 Emission Control	SV2255 Fuel Injection Systems	SV2820 Diesel Engine Principles
SV2830 Diesel Engine Diagnostics	SV2840 Diesel Engine Repair	SV2900 Engine Rebuilding (Gasoline)	SV2261 Preventative Maintenance Inspections (PMI)
SV2281 Pre Delivery Inspections (PDI)			
VEHICLE MANAGEMENT SYSTEMS			
SV1130 Electrical and Electronic Principles	SV2016 On Board Computer Diagnostics I	SV2017 On Board Computer Diagnostics II	

DRIVE LINE SYSTEMS			
SV1286 Drive Lines	SV2051 Engine Clutches	SV2061 Manual Transmissions and Trans-axles	SV2070 Automatic Transmissions and Trans-axles
SV2101 Transfer Cases and Hub Assemblies	SV2111 Differential and Axle Assemblies	SV2091 Electronic Transmission Controls	
ELECTRICAL AND COMFORT CONTROL SYSTEMS			
SV1130 Electrical and Electronic Principles	SV1376 Batteries	SV1385 Starting Systems	SV1395 Charging Systems
SV2144 Automotive Heating Systems	SV2145 Air Conditioning Systems	SV2155 Power Actuated Accessories	
STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, HUBS AND WHEEL BEARINGS			
SV1216 Wheels and Tires	SV1226 Manual Steering	SV1255 Suspension	SV1610 Steering Columns
SV1631 Hydraulic Brake Systems	SV1640 Power Brake Systems	SV2021 Power Steering	SV2030 Electronic Power Steering
SV2041 Wheel Alignment	SV2121 Anti-Lock Brake System and Traction Control		
BODY COMPONENTS, TRIM AND RESTRAINT SYSTEMS			
SV1550 Body Components and Trim	SV2161 Air Bag Systems		
HYBRID AND ALTERNATE FUEL SYSTEMS			
SV2250 Alternative and Variable Fuels			

B. NOA Comparison Table

NOA 2009 Tasks		2010 POT	
Task 1 – Uses and maintains tools and equipment			
1.01	Maintains tools and equipment	SV1165	Hand Tools
1.02	Uses hoisting and lifting equipment	SV1176	Shop Tools and Equipment
		WD1301	Oxy Fuel Welding/Cutting
		WD2331	GMAW Welding (MIG)
1.03	Uses PPE and safety equipment	SV1100	Safety
Task 2 – Performs common trade activities			
2.01	Uses technical information	SV1156	Service Information Systems
2.02	Estimates preliminary job cost		
2.03	Maintains safe work environment	SV1100	Safety
Task 3 – Diagnoses engine systems			
3.01	Diagnoses cooling systems	SV1196	Lubrication and Fluids Servicing
3.02	Diagnoses lubricating systems	SV1305	Engine Principles
		SV1315	Cooling Systems
		SV2171	Engine Diagnostics
3.03	Diagnoses base engine	SV2820	Diesel Engine Principles
		SV2830	Diesel Engine Diagnostics
		SV2261	Preventative Maintenance Inspections(PMI)
		SV2281	Pre-Delivery Inspections (PDI)
Task 4 – Repairs engine systems			
4.01	Repairs cooling systems	SV1196	Lubrication and Fluids Servicing
4.02	Repairs lubricating systems	SV1305	Engine Principles
		SV1315	Cooling Systems
		SV2181	Engine Removal and Installation
4.03	Repairs base engine	SV2840	Diesel Engine Repair
		SV2900	Engine Rebuilding (Gasoline)
Task 5 – Diagnoses engine support systems			
5.01	Diagnoses fuel delivery systems	SV1651	Fuel Delivery
		SV2255	Fuel Injection Systems
5.02	Diagnoses ignition systems	SV1600	Ignition Systems
5.03	Diagnoses intake/exhaust systems	SV1661	Intake and Air Filtration Systems
		SV1671	Exhaust Systems

NOA 2009 Tasks		2010 POT	
5.04	Diagnoses emission systems	SV2220	Emission Control
5.05	Diagnoses accessory drive systems and mounts	SV1395 SV1495 SV2061 SV2070	Charging Systems Lighting Systems Manual Transmissions and Trans-axles Automatic Transmissions and Trans-axles
5.06	Diagnoses diesel engine support systems	SV2830	Diesel Engine Diagnostics
Task 6 – Repairs engine support systems			
6.01	Repairs gasoline delivery systems	SV1651 SV2255	Fuel Delivery Fuel Injection Systems
6.02	Repairs ignition systems	SV1600	Ignition Systems
6.03	Repairs intake/exhaust systems	SV1661 SV1671	Intake and Air Filtration Systems Exhaust Systems
6.04	Repairs emission systems	SV2220	Emission Control
6.05	Repairs accessory drive systems and mounts	SV1395 SV1495 SV2061 SV2070	Charging Systems Lighting Systems Manual Transmissions and Trans-axles Automatic Transmissions and Trans-axles
6.06	Repairs diesel engine support systems	SV2840	Diesel Engine Repair
Task 7 – Diagnoses vehicle management systems			
7.01	Reads diagnostic trouble codes	SV2017 SV2016	On-Board Computer Diagnostics II On-Board Computer Diagnostics I
7.02	Monitors parameters		
7.03	Interprets test results		
7.04	Test system circuitry and components		
Task 8 – Repairs vehicle management systems			
8.01	Updates components software	SV2017 SV2016	On-Board Computer Diagnostics II On-Board Computer Diagnostics I
8.02	Replaces components		
8.03	Verifies vehicle management system repair		
		SV1130	Electrical and electronic principles

NOA 2009 Tasks		2010 POT	
Task 9 – Diagnose drive line systems			
9.01	Diagnoses drive shafts and axles	SV1286 SV2111	Drive Lines Differential and Axle Assemblies
9.02	Diagnoses manual transmissions / transaxles	SV2061	Manual transmissions and trans-axles
9.03	Diagnoses automatic transmissions / transaxles	SV2070 SV2091	Automatic transmissions and trans-axles Electronic Transmission Controls
9.04	Diagnoses clutches	SV2051	Engine Clutches
9.05	Diagnoses transfer cases	SV2101	Transfer Cases and Hub Assemblies
9.06	Diagnoses final drive assemblies	SV2111	Differential and Axle Assemblies
Task 10 – Repairs drive line systems			
10.01	Repairs drive shafts and axles	SV1286 SV2111	Drive Lines Differential and Axle Assemblies
10.02	Repairs manual transmissions / transaxles	SV2061	Manual transmissions and trans-axles
10.03	Repairs automatic transmissions / transaxles	SV2070 SV2091	Automatic transmissions and trans-axles Electronic Transmission Controls
10.04	Repairs clutches	SV2051	Engine Clutches
10.05	Repairs transfer cases	SV2101	Transfer Cases and Hub Assemblies
10.06	Repairs final drive assemblies	SV2111	Differential and Axle Assemblies
Task 11 – Diagnoses electrical systems and components			
11.01	Diagnoses starting/charging systems and batteries	SV1385 SV1395	Starting Systems Charging Systems
11.02	Diagnose basic wiring and electrical systems	SV1130	Electrical and Electronic Principles
11.03	Diagnoses lighting and wiper systems	SV2155	Power Actuated Accessories
11.04	Diagnoses entertainment systems		

NOA 2009 Tasks		2010 POT	
11.05	Diagnoses electrical options	SV1130 SV2155	Electrical and electronic principles Power Actuated Accessories
11.06	Diagnose instrumentation and information displays	SV1130	Electrical and electronic principles
11.07	Diagnoses electrical accessories	SV2155	Power Actuated Accessories
Task 12 – Diagnoses electrical systems and components			
12.01	Repairs starting/charging systems and batteries	SV1385 SV1395	Starting Systems Charging Systems
12.02	Repairs basic wiring and electrical systems	SV1130	Electrical and Electronic Principles
12.03	Repairs lighting and wiper systems	SV2155	Power Actuated Accessories
12.04	Repairs entertainment systems		
12.05	Repairs electrical options	SV1130	Electrical and electronic principles
12.06	Repairs electrical accessories	SV1130	Electrical and electronic principles
12.07	Installs electrical accessories		
12.08	Repairs instrumentation and information displays	SV2155	Power Actuated Accessories
Task 13 – Diagnoses HVAC and comfort control systems			
13.01	Diagnoses air flow control systems	SV2144 SV2145	Automotive Heating Systems Air Conditioning Systems
13.02	Diagnoses refrigerant systems		
13.03	Diagnoses heating systems		
Task 14 – Repairs HVAC and comfort control systems			
14.01	Repairs air flow control systems	SV2144 SV2145	Automotive Heating Systems Air Conditioning Systems
14.02	Repairs refrigerant systems		
14.03	Repairs heating systems		
Task 15 – Diagnoses steering and suspension, braking, control systems, tires, wheels, hugs and wheel bearings			
15.01	Diagnoses steering, suspension and control systems	SV1226 SV1255 SV1610 SV2021 SV2030	Manual Steering Suspension Steering Columns Power Steering Electronic Power Steering

NOA 2009 Tasks		2010 POT	
15.02	Diagnoses braking and control systems	SV1631 SV1640 SV2121	Hydraulic Brake Systems Power Brake Systems Anti-Lock Brake System and Traction Control
15.03	Diagnoses tires, wheels, hubs and wheel bearings	SV1216 SV2041	Wheels and Tires Wheel Alignment
Task 16 – Repairs steering and suspension, braking, control systems, tires, wheels, hugs and wheel bearings			
16.01	Repairs steering, suspension and control systems	SV1226 SV1255 SV1610 SV2021 SV2030	Manual Steering Suspension Steering Columns Power Steering Electronic Power Steering
16.02	Repairs braking and control systems	SV1631 SV1640 SV2121	Hydraulic Brake Systems Power Brake Systems Anti-Lock Brake System and Traction Control
16.03	Repairs tires, wheels, hubs and wheel bearings	SV1216 SV2041	Wheels and Tires Wheel Alignment
Task 17 – Diagnoses body components, trim and restraint systems			
17.01	Diagnoses restraint systems	SV2161	Air Bag Systems
17.02	Diagnoses wind noise, rattles and water leaks	SV1550	Body Components and Trim
17.03	Diagnoses interior and exterior components and trim		
17.04	Diagnoses latches, locks and movable glass		
Task 18 – Repairs body components, trim, restraint systems and installed accessories			
18.01	Repairs restraint systems	SV2161	Air Bag Systems
18.02	Repairs problems with wind noise, rattles and water leaks	SV1550	Body Components and Trim
18.03	Repairs interior and exterior components and trim		
18.04	Repairs latches, locks and movable glass		
Task 19 – Repairs hybrid and alternate fuel systems			
19.01	Implements hybrid safety protocols	SV2250	Alternative and Variable Fuels

NOA 2009 Tasks		2010 POT	
19.02	Diagnoses hybrid systems		
19.03	Diagnoses alternate fuel systems		
Task 20 – Repairs hybrid and alternate fuel systems			
20.01	Repairs hybrid systems	SV2250	Alternative and Variable Fuels
20.02	Repairs alternate fuel systems		

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.

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

Block I				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
TS1510	-	Occupational Health and Safety	6	None
TS1520	-	WHMIS	6	None
TS1530	-	Standard First Aid	14	None
SV1100	AST-100	Safety in the Shop	15	None
SV1125	-	Gaskets, Seals and Bearings	30	SV1186
SV1130	AST-155	Electrical and Electronic Principles	90	SV1305
SV1142	AST-420	Hydraulic Principles	25	SV1196
SV1156	AST-120	Service Information Systems	20	None
SV1165	AST-105	Hand Tools	30	SV1100
SV1176	AST-105	Shop Tools and Equipment	20	SV1156; SV1165; TS1520
SV1186	-	Fasteners, Tubing and Fittings	15	SV1176

Block I				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
SV1196	AST-210	Lubrication and Fluids Servicing	25	SV1125
SV1216	AST-125	Wheels and Tires	25	SV1196
SV1255	AST-160 AST-415	Suspension	45	SV1216
SV1286	AST-240	Drive Lines	25	None
WD1301	AST-130	Oxy-Fuel Welding/Cutting	30	SV1165
SV1305	AST-200	Engine Principles	60	SV1196
SV1315	AST-205	Cooling Systems	30	SV1305
SV1376	AST-155	Batteries	20	SV1130
SV1385	AST-215	Starting Systems	30	SV1376
SV1395	AST-220	Charging Systems	30	SV1376
SV1495	AST-225	Lighting Systems	30	SV1376
SV1550	AST-150	Body Components and Trim	15	None
SV1600	AST-235	Ignition Systems	30	SV1305; SV1376
SV1625	-	Front-Wheel Drive	25	None
SV1631	AST-140 AST-410	Hydraulic Brake Systems	75	SV1142; SV1216
SV1640	AST-140 AST-410	Power Brake Systems	15	SV1631
SV1661	AST-335	Intake and Air Filtration Systems	15	SV1305
SV1671	AST-335	Exhaust Systems	15	SV1305; TS1510

Block I				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
SV2261	AST-165	Preventative Maintenance Inspections (PMI)	10	None
SV2281	AST-120	Pre-Delivery Inspections (PDI)	10	None
AP1101	-	Introduction to Apprenticeship	15	None
*AM1100	-	Math Essentials	30	None
AM1220	-	Mechanical Math Fundamentals	30	AM1100
CM2160	-	Communication Essentials	45	None
SD1760	-	Workplace Essentials	45	None
MC1060	-	Computer Essentials	15	None

Total Hours	**1011**

***A student who can meet the mathematics requirement through an ACUPLACER® test may be exempted from AM1100 - Math Essentials. Please check with your training institution.**

Required Work Experience

Block II				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
SV2016	AST-310	On-Board Computer Diagnostics I (OBD-I)	60	Block I
SV2017	AST-310	On-Board Computer Diagnostics II (OBD-II)	30	SV2016
SV1651	AST-230	Fuel Delivery	15	SV1130 SV1305
SV2220	AST-330	Emission Control	45	SV2235
SV2235	AST-305 AST-400	Fuel Injection Systems	45	SV2017
SV2250	AST-405	Alternative and Variable Fuels	15	Block I
WD2331	AST-135	GMAW Welding (MIG)	30	Block I

Total Hours	**240**

Required Work Experience

Block III				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
SV1226	AST-245	Manual Steering	10	Block II
SV1610	AST-245	Steering Columns	15	SV2161
SV2021	AST-245	Power Steering	25	SV1226
SV2030	AST-245	Electronic Power Steering	15	SV2021
SV2041	AST-415	Wheel Alignment	40	SV2021
SV2121	AST-410	Anti-Locking Brake System and Traction Control	40	Block II
SV2155	AST-425	Power-Actuated Accessories	60	Block II
SV2161	AST-425	Air Bag Systems	25	Block II

Total Hours	**230**

Required Work Experience

Block IV				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
SV2051	AST-320	Engine Clutches	25	Block III
SV2061	AST-315	Manual Transmissions and Trans-Axles	40	Block III
SV2075	AST-420	Automatic Transmissions and Trans-axles	90	Block III
SV2091	-	Electronic Transmission Controls	25	SV2075
SV2101	AST-325	Transfer Cases and Hub Assemblies	25	Block III
SV2111	AST-340	Differential and Axle Assemblies	25	Block III
SV2271	AST-165	Provincial Government Inspections (MVI)	10	Block III

Total Hours	**240**

Required Work Experience

Block V				
Course No.	**IPG No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
SV1110	-	Ozone Depletion Substances	7	Block IV
SV2144	AST-435	Automotive Heating Systems	10	Block IV
SV2145	AST-435	Air Conditioning Systems	30	SV2144
SV2171	AST-300	Engine Diagnostics (Gasoline)	45	Block IV
SV2181	AST-300	Engine Removal and Installation	20	Block IV
SV2820	-	Diesel Engine Principles	30	Block IV
SV2830	-	Diesel Engine Diagnostics	30	SV2820
SV2840	-	Diesel Engine Repair	8	SV2820
SV2900	-	Engine Rebuilding (Gasoline)	60	Block IV

Total Hours	**240**

Total Course Credit Hours	**1961**

BLOCK I

TS1510 Occupational Health and Safety

Learning Outcomes:

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

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

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

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

3. Explain the purpose of joint health and safety committees.
    i. formation of committee
    ii. functions of committee
    iii. legislated rights
    iv. health and safety representation
    v. reporting endangerment to health

vi. appropriate remedial action
vii. investigation of endangerment
viii. committee recommendation
ix. employer's responsibility in taking remedial action

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

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

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

7. Explain duties of commission officers.
   i. powers and duties of officers
   ii. procedure for examinations and inspections
   iii. orders given by officers orally or in writing

iv. specifications of an order given by an officer to owner of the place of employment, employer, contractor, sub-contractor, employee, or supplier
v. service of an order
vi. prohibition of persons towards an officer in the exercise of his/her power or duties
vii. rescinding of an order
viii. posting a copy of the order
ix. illegal removal of an order

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

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

Practical Requirements:

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

2. Conduct a safety inspection of shop area.

TS1520 Workplace Hazardous Materials Information System (WHMIS)

Learning Outcomes:

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

Duration: 6 Hours

Pre-requisite(s): None

Objectives and Content:

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

2. Examine hazard identification and ingredient disclosure.
    i. prohibited, restricted and controlled products
    ii. classification and the application of whmis information requirements
    iii. responsibilities for classification
        - the supplier
        - the employer
        - the worker – Classification: rules and criteria
        - information on classification
        - classes, divisions and subdivision in WHMIS
        - general rules for classification
        - class A – compressed gases
        - class B – flammable and combustible materials
        - class C – oxidizing material
        - class D – poisonous and infectious material
        - class E – corrosive material
        - class F – dangerously reactive material

iv. products excluded from the application of WHMIS legislation
- consumer products
- explosives
- cosmetics, drugs, foods and devices
- pest control products
- radioactive prescribed substances
- wood or products made of wood
- manufactured articles
- tobacco or products of tobacco
- hazardous wastes
- products handled or transported pursuant to the Transportation of
- Dangerous Goods (TDG) Act

v. comparison of classification systems – WHMIS and TDG

vi. general comparison of classification categories

vii. detailed comparison of classified criteria

3. Explain labeling and other forms of warning.

i. definition of a WHMIS label
- supplier label
- workplace label
- other means of identification

ii. responsibility for labels
- supplier responsibility
- employer responsibility
- worker responsibility

iii. introduce label content, design and location
- supplier labels
- workplace labels
- other means of identification

4. Introduce material safety data sheets (MSDS).

i. definition of a material safety data sheet

ii. purpose of the data sheet

iii. responsibility for the production and availability of data sheets
- supplier responsibility
- employer responsibility
- workers responsibility

Practical Requirements:

1. Locate WHMIS label and interpret the information displayed.

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

TS1530 Standard First Aid

Learning Outcomes:

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

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

Duration: 14 Hours

Pre-requisite(s): None

SV1100 Safety in the Shop

Learning Outcomes:

- Demonstrate knowledge of various types of shop hazards.
- Demonstrate knowledge of safe work habits.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify various safety hazards.
    i. fire hazards
        - classification of fire types
        - purpose and use of fire extinguishers
    ii. explosion hazards
        - detection and prevention
        - spontaneous combustion
        - storage and handling of fuels
    iii. hazardous gases
        - carbon monoxide
        - ventilation
        - storage and handling of batteries

2. Describe safe working habits.
    i. avoiding personal hazards
    ii. following good housekeeping practices
    iii. reporting injuries

3. Identify workers' rights regarding safety.
    i. Workers Compensation Act

Practical Requirements:

1. Locate exits, fire alarms.

2. Locate shop ventilation systems.

3. Prepare a floor plan showing fire exit routes.

SV1125 Gaskets, Seals and Bearings

Learning Outcomes:

- Demonstrate knowledge of the procedures used to select, remove and install various types of bearings, gaskets, seals, and sealing compounds.
- Demonstrate knowledge of the procedures used identify causes of friction bearing failures.

Duration: 30 Hours

Pre-Requisite(s): SV1186

Objectives and Content:

1. Identify and describe friction bearings.
    i. definition
    ii. location
    iii. construction of precision insert bearings
        - backing materials
        - friction surface materials
        - thrust flange
        - spread
        - crush
        - locking devices
    iv. sizes
        - standard
        - under size
    v. construction of bushings
        - application
        - type of material
        - installation
        - sizing bushings to a shaft

2. Identify causes of friction bearing failure.

i. contamination
ii. insufficient lubrication
iii. improper installation
iv. misalignment
v. overloading
vi. corrosion

3. Describe procedures to remove and install friction bearings.
   i. removing and installing
   ii. measuring bearing oil clearance
   iii. storing and handling

4. Identify and describe anti-friction bearings.
   i. definition
   ii. location
   iii. types
      - ball
      - roller
      - needle
   iv. loading design
      - radial
      - thrust
      - combination
   v. identification methods

5. Identify causes of anti-friction bearing failure.
   i. spalling
   ii. brinelling
   iii. over-heating
   iv. cracked race
   v. broken or dented cage
   vi. dented shields
   vii. corrosion
   viii. dirt wear
   ix. electrical pitting
   x. improper installation

6. Describe procedures to remove and install anti-friction bearings.
    i. removing and installing
    ii. cleaning
    iii. inspecting
    iv. lubricating
    v. adjusting
    vi. storing and handling
    vii. following safety precautions

7. Identify and describe oil seals.
    i. function
    ii. classification
        - static
        - dynamic
    iii. types
    iv. materials
    v. construction

8. Identify causes of oil seal failure.

9. Describe procedures to remove and install oil seals.
    i. removing and installing
    ii. inspecting
    iii. cleaning (knowing the importance of cleanliness)
    iv. using proper tools (knowing the importance of using proper tools)
    v. storing and handling

10. Identify and describe gaskets.
    i. function
    ii. types
    iii. materials
    iv. making a gasket (methods)

11. Identify causes of gasket failure.

12. Describe procedures to remove and install gaskets.
    i. removing and installing
    ii. cleaning (knowing the importance of cleanliness)

iii. torquing bolts

13. Identify and describe sealing compounds.
    i. types
    ii. purpose

14. Identify causes of sealing compound failure.

15. Describe procedures to select and use sealing compounds and the precautions to follow when using them.

Practical Requirements:

1. Remove, service and install a tapered bearing.

2. Remove, measure and install a friction bearing.

3. Fabricate and install a gasket.

4. Remove and replace a non-serviceable bearing.

5. Remove and install an oil seal.

6. Apply sealer as a gasket.

SV1130 Electrical and Electronic Principles

Learning Outcomes:

- Demonstrate knowledge of using instruments to test components of series, parallel and series-parallel circuits to determine cause of malfunctions in an electrical circuit.

Duration: 90 Hours

Pre-Requisite(s): SV1305

Objectives and Content:

1. Identify and explain basic electrical principles.
    i. safety practices and procedures when working with electrical equipment
    ii. terminology – abbreviations and glossary of electrical terms
    iii. sources of electricity
        - generation of electricity
        - use of chemical, magnetic, heat, light, mechanical and DC power supply, crystals, AC circuits
    iv. theories and laws
        - electricity
        - magnetism and inductance
        - Ohm's law (volts, ohms and amperes, power)
    v. symbols and schematics
        - common automotive symbols
        - how to read schematics/wiring diagrams

2. Explain electrical principles using Ohm's law to calculate volts, ohms and amperes, and power.
    i. application of Ohm's law to electrical circuits
        - series circuit
        - parallel circuit
        - series and parallel circuit

3. Explain the use of instruments to test components of series, parallel and series-parallel circuits to determine cause of malfunctions in an electrical circuit.
    i. circuit testing devices
        - meters
        - volt
        - ohm
        - current
        - duty cycle
        - frequency
        - pulse width
        - meter ranges
        - correct hook-up of meters
        - test lights
        - circuit breakers
    ii. circuit problems and testing problems
        - short, open, ground, and high resistance
        - diagnostic troubleshooting procedures
        - testing procedures and equipment

4. Identify electronic components.
    i. wires and terminals
        - types and sizes
        - terminals and connectors
        - conductors, semi-conductors, and insulators
    ii. fibre optics (basics)
    iii. capacitors
        - construction
        - purpose
        - uses
    iv. resistors
        - identification
        - purpose
        - uses
    v. transistors
        - identification
        - purpose
        - uses
    vi. diodes
        - identification

- purpose
- uses

vii. piezoelectric crystal
viii. hall effect switches
ix. permanent magnet sensors/switches
x. circuit protectors
- fuses
- fuse links
- circuit breakers

xi. relays

5. Describe the procedures used to replace electrical components.

Practical Requirements:

1. Read schematics and wiring diagrams.

2. Use circuit testing devices.
   i. ampmeter
   ii. ohmmeter
   iii. voltmeter
   iv. test lights

3. Apply Ohms Law to electrical circuit.

4. Identify wires and terminals.
   i. demonstrate back probing

5. Test electronic circuits.

SV1142 Hydraulic Principles

Learning Outcomes:

- Demonstrate knowledge to identify hydraulic components and systems and their applications.
- Demonstrate knowledge to interpret and use hydraulic symbols and diagrams.
- Demonstrate knowledge to identify safety practices when working around hydraulic fluid.

Duration: 25 Hours

Pre-Requisite(s): SV1196

Objectives and Content:

1. Explain hydraulic principles in a shop environment.
    i. definition of Pascal's law
    ii. multiplication of force
    iii. using formulas to calculate area, pressure, and force
    iv. definition of Bernoulli's principle
    v. advantages of hydraulic systems
    vi. hydrodynamics
    vii. hydrostatics
    viii. properties of hydraulic fluid
        - viscosity
        - friction
        - flow
        - volume
        - laminar
        - turbulence
    ix. pressure (metric, imperial)
        - pressure gauge
        - absolute pressure
    x. force
    xi. energy

xii. work
xiii. power
xiv. torque

2. Identify basic hydraulic components and systems and their applications.
    i. pump
    ii. hydraulic actuator (linear, rotary)
    iii. pressure control valve
    iv. directional control valve
    v. flow control valve
    vi. reservoir
    vii. hoses

3. Identify symbols commonly used in hydraulic diagrams.

4. Explain how to interpret and use hydraulic symbols and diagrams.
    i. pictorial drawing
    ii. cut-away drawing
    iii. symbol drawing
    iv. exploded view

5. Identify safety practices when working around hydraulic fluids.
    i. support components which are statistically supported by hydraulic fluids before removal
    ii. releasing system pressure

Practical Requirements:

None**.**

SV1156 Service Information Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to select and use various types of service information systems.

Duration: 20 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Explain how to use an operator's manual and how to interpret its sections.

2. Explain how to decode motor vehicle serial numbers for identification purposes through use of appropriate service manual.
    i. make
    ii. model
    iii. year

3. Explain how to use paper and electronic copies of various other manuals.
    i. maintenance and lubrication manual
    ii. service manual
    iii. parts manual
    iv. special bulletins
        - purpose

4. Explain how to use computerized information systems.
    i. introduction to computers
        - computerized parts information
        - computerized service and repair information
    ii. work orders
    iii. warranty claims
    iv. time tickets
    v. tracking

vi. electronic service

Practical Requirements:

1. Using manuals and several different vehicles, identify the model and year for each vehicle.

2. Using manuals, locate disc brake caliper removal and installation procedures.

3. Using appropriate service manual, locate information on removing and installing a clutch.

4. Use diagnostic charts to troubleshoot a tail light problem.

5. Use electronic data retrieval systems to locate service information.

SV1165 Hand Tools

Learning Outcomes:

- Demonstrate knowledge of the procedures used to select, use and maintain various cutting and non-cutting hand tools.

Duration: 30 Hours

Pre-Requisite(s): SV1100

Objectives and Content:

1. Describe the procedures to select, use and maintain the following non-cutting hand tools.
    i. screwdrivers
        - standard
        - Phillips
        - Robertson
        - Torx
    ii. pliers
        - combination
        - gripping
        - cutting
        - vise-grips
        - snap ring
        - needle nose
    iii. special hose clamp tools
    iv. wrenches
        - open-end
        - box ends
        - ratcheting box ends
        - flex-head box ends
        - obstruction wrenches
        - special-purpose box wrenches
        - adjustable wrenches

- pipe wrenches
- spanner wrenches
- Allen and multi-spline wrenches (recognition of sizes – metric and imperial)

v. sockets and drives (recognition of sizes – metric and imperial)
- drive sizes
- socket points
- deep sockets
- flexible sockets
- drive handles
- speed handles
- ratchets
- universal joints
- adapters
- extensions

vi. hammers
- ball peen
- cross peen
- plastic tip
- brass-headed
- rubber mallets
- dead blow
- sledgehammers
- hammer handles

vii. punches
- starting
- pin
- centre
- aligning

viii. torque wrenches
- types
- sizes
- purpose

ix. torque multiplier

x. torque rods (stick)

2. Describe the procedures to select, use and maintain the following cutting hand tools.
   i. chisels

- flat
- cape
- round nose cape
- diamond point
- rivet buster

ii. chisel holder

iii. hacksaws
- types and designs
- blade classification and selection

iv. files
- types, designs and application
- file handles
- file cards

v. twist drills (recognition of sizes – metric and imperial)
- types and designs
- sharpening procedures

vi. taps (recognition of pipe tap sizes – metric and imperial)
- taper taps
- plug taps
- bottoming taps
- tap handles

vii. dies (recognition of sizes – metric and imperial)
- types
- dies stock

viii. thread restorers (recognition of sizes – metric and imperial)
- types and designs

3. Describe the procedures to recondition the following cutting and non-cutting hand tools.
   i. screwdrivers
   ii. chisels
   iii. screw starters
   iv. punches

4. Describe the procedures to select, use and maintain the following metric and imperial measuring tools.
   i. steel rules and squares
   ii. calipers
   iii. micrometers

iv. dial indicators
v. vernier calipers
vi. protractors
vii. dividers
viii. small hole gauges
ix. telescoping gauges
x. wire gauges
xi. drill gauges
xii. screw pitch gauges
xiii. feeler gauges

5. Describe the procedures to select, use and maintain the following miscellaneous tools.
   i. stud extractors
   ii. bushing and seal drivers
   iii. magnetic pickup tools
   iv. mechanical pickup tools
   v. inspection mirrors
   vi. stamping sets
   vii. stethoscopes
   viii. air blowgun

Practical Requirements:

1. Use hand tools for motorized equipment while working on different bench work projects.

2. Use precision measuring instruments.

SV1176 Shop Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of the procedures used to. select, inspect use and maintain shop tools and equipment.

Duration: 20 Hours

Pre-Requisite(s): SV1156, SV1165, TS1520

Objectives and Content:

1. Describe the procedures to select, inspect, use and maintain the following shop equipment.
   - i. hoists, floor, cable, and chain
   - ii. floor jacks
   - iii. safety stands
   - iv. hydraulic presses
   - v. drill presses
   - vi. bench grinders
   - vii. bench vises
   - viii. pullers
   - ix. pneumatic equipment
   - x. mobile cranes
   - xi. high pressure washers (heated)
   - xii. parts cleaners
   - xiii. portable air tanks
   - xiv. caustic cleaning tanks
   - xv. sand/glass bead blasters
   - xvi. air compressors
   - xvii. brake cleaning equipment
   - xviii. spring compressors
   - xix. transmission jacks
   - xx. creepers

2. Describe the procedures to select, inspect, use and maintain the following shop tools.
   i. air tools (pneumatic)
   ii. electric tools
   iii. torque multipliers

3. Describe procedures to select, inspect, use and maintain the following vehicle protective equipment.
   i. seat covers
   ii. fender covers
   iii. floor mats

Practical Requirements:

1. Use hoist safely.

2. Raise vehicles by means of a floor jack and place on safety stands.

3. Use high pressure washer and/or parts cleaner to clean parts or components.

4. Prepare a shop equipment maintenance plan.

SV1186 Fasteners, Tubing and Fittings

Learning Outcomes:

- Demonstrate knowledge of the procedures used to select and use common fasteners, different types of tubing, hoses, fittings, and flaring tools.

Duration: 15 Hours

Pre-Requisite(s): SV1176

Objectives and Content:

1. Describe the procedures to select and use fasteners.
    i. types of fasteners
        - bolts
        - nuts
        - studs
        - washers
            - flat
            - lock
            - external spring
            - internal spring
        - screws
            - cap screws
            - machine screws
            - sheet metal screws
            - self-tapping screws
        - keys and pins
            - woodruff keys
            - square keys
            - cotter pins
            - spring pins
            - tapered pins
            - clevis pins
        - locking devices (functions and types)

        - compounds
            - liquid compounds
            - lock-type compounds
            - anti-seizure compounds
    ii. thread classification (metric and imperial)
    iii. grade markings
    iv. theory of torquing
        - torque pattern
        - torque charts

2. Describe the procedures to select and use different types of tubing and hoses.
    i. types of tubing
        - steel
        - copper
        - non-metallic
        - rubber
    ii. recognition of sizes

3. Describe the procedures to select and use different types of fittings.
    i. types of low pressure fittings
    ii. types of flares (metric and imperial)
    iii. types of threads
    iv. torque limitation of fittings
    v. thread sealers

4. Identify various types of flaring tools.
    i. flaring tool kit
    ii. ISO flaring
    iii. tubing cutter
    iv. deburring tool
    v. tubing bender
    vi. tubing wrenches

5. Describe the procedures to use flaring tools.
    i. cutting
    ii. bending
    iii. flaring

Practical Requirements:

1. Install compression fittings.

2. Cut, flare, bend and connect tubing.

SV1196 Lubrication and Fluids Servicing

Learning Outcomes:

- Demonstrate knowledge of the procedures used to change engine oil and filter, and lubricate a vehicle's chassis.

Duration: 25 Hours

Pre-Requisite(s): SV1125

Objectives and Content:

1. Identify different types of oil and describe procedures to select and use them based on the following criteria.
    i. oil classification
        - API
        - SAE
        - synthetic
    ii. oil viscosity
    iii. oil additives
    iv. function of the oil
    v. contamination (recognition of contaminated fluid)
    vi. oil selection
        - hydraulic oil (transmission and steering)
            - function
            - classification
        - gear oil
            - function
            - classification

2. Describe procedures to change engine oil.
    i. draining the oil
    ii. handling hot oil
    iii. cleaning and inspecting drain plug and gasket for serviceability

iv. filling
v. checking oil level
vi. properly torquing drain plug
vii. storing used oil
viii. following precautions after performing an oil change
ix. install/record service date and reminder
x. service intervals

3. Describe procedures to change engine oil filters.
   i. selecting filter
      - construction of filter
      - types of filters
   ii) removing oil filter
   iii) installing/replacing oil filter seals
   iv) ensuring cleanliness
   v) analyzing filter failure
      - physical filter failure
        - filter case expanded
        - filter leaking at seams

4. Describe procedures to start and run engines.
   ii. inspecting for oil leaks
   ii. checking engine oil pressure
   iii. checking oil level
   iv. operating and resetting engine monitoring system according to manufacturer's specifications

5. Identify different types of grease and the criteria for selecting and using them.
   i. types of grease
      - wheel bearing grease
      - chassis grease
      - high temperature grease
      - multipurpose grease
      - extreme pressure grease
   ii. properties
   iii. function
   iv. classification

6. Identify equipment used to lubricate a vehicle's chassis.
    i. grease gun (hand and pneumatic
    ii. grease fitting
    iii. grease gun adapters

7. Describe procedures to lubricate vehicle's chassis.
    i. refilling the grease gun
    ii. storing and handling grease
    iii. interpreting lubricating charts

8. Identify issues surrounding the disposal of used lubricants.
    i. environmental issues
    ii. health issues
    iii. filter crushers
    iv. proper disposal procedures

9. Describe the procedures used to perform oil analysis.
    i. collecting specimen
    ii. determining contamination of sample
    iii. identifying contaminants in sample
    iv. interpreting analysis

Practical Requirements:

1. Lubricate a chassis following the manufacturer's recommendations.

2. Change engine oil and filter(s).

SV1216 Wheels and Tires

Learning Outcomes:

- Demonstrate knowledge of tire, wheel and rim construction.
- Demonstrate knowledge of the procedures used to inspect and service tires, wheels and rims.
- Demonstrate knowledge of the procedures used to perform wheel balancing.

Duration: 25 Hours

Pre-Requisite(s): SV1196

Objectives and Content:

1. Describe tire construction.
    i. radial
    ii. bias-ply
    iii. tube
    iv. tubeless
    v. tire size (low profile/aspect ratio)
    vi. DOT coding
    vii. load range (ply rating)
    viii. tread design
    ix. run-flat
    x. temperature range
    xi. speed rating
    xii. unidirectional tires
    xiii. tread wear

2. Identify causes of tire wear.
    i. under inflation
    ii. over inflation
    iii. misalignment
    iv. improper balance

v. improper load distribution
vi. ply steer / radial drag
vii. worn suspension

3. Describe procedures to inspect and service tires.
   i. rotating
   ii. deflating
   iii. inspecting
   iv. inflating
   v. repairing a flat
      - tubeless type tire
      - tube type tire
   vi. disposing of tire

4. Describe wheel/rim construction.
   i. wheel/rim selection
      - p-metric
      - European
      - metric
   ii. contours
   iii. aluminum wheels/rims
   iv. directional wheels/rims
   v. temporary spares

5. Describe procedures to inspect and service wheels/rims.
   i. following all occupational safety and health administration regulations and procedures pertaining to wheels
   ii. removing wheel nuts/bolts from a vehicle
      - right hand threads
      - left hand threads
   iii. deflating tire
   iv. disassembling tire from wheel
   v. inspecting
   vi. cleaning and painting rim parts
   vii. applying tire lubricant
   viii. installing tire on wheel
   ix. inflating tire
   x. installing wheel
   xi. lateral run-out

xii. radial run-out
xiii. dual tire matching

6. Explain the principles of wheel balancing.
   i. static balance
   ii. dynamic balance
   iii. run-out
      - radial
      - lateral
   iv. wheel weights
      - for steel wheels
      - for aluminum wheels
      - for magnesium wheels
   v. effects of an out-of-balance wheel

7. Describe procedures to perform wheel balancing.
   i. performing preliminary checks before balancing
   ii. performing wheel balancing using the following methods:
      - spin balancing on vehicle (strobe light)
      - off the vehicle dynamic balancing
      - off the vehicle static balancing

Practical Requirements:

1. Perform radial and lateral run-out check.

2. Perform a tire puncture repair using recommended procedures.

3. Dismount and mount a tire on a wheel.

4. Balance a wheel and tire assembly.

SV1255 Suspension

Learning Outcomes:

- Demonstrate knowledge of suspension components and their purpose.
- Demonstrate knowledge of the procedures used to remove, replace and/or adjust suspension components.
- Demonstrate knowledge of the procedures used to diagnose and repair computer-controlled active suspension systems.

Duration: 45 Hours

Pre-Requisite(s): SV1216

Objectives and Content:

1. Identify and describe suspension systems and components and their purpose(s).
    i. design of suspension
    ii. associated terminology
        - sprung
        - unsprung
        - spring rate
    iii. types of suspension systems (front and rear)
        - independent
        - solid axle
        - twin beam
        - McPherson strut
        - flex axle
        - air
    iv. frames
        - types
        - purpose
    v. bumpers
        - energy absorbing bumpers
        - energy absorbing bumper shocks
    vi. front and rear suspension components and systems

vii. operation of SLA, strut and wish-bone suspensions

2. Describe the procedures to inspect suspension systems.

3. Identify types of shock absorbers and their purpose.

4. Describe procedures to remove and replace shock absorbers.
   i. checking for serviceability
   ii. removing and replacing

5. Identify types of stabilizer bars and their purpose.

6. Describe procedures to inspect, remove and replace stabilizer bars.

7. Identify types of ball joints and tie rod ends and their purpose.

8. Describe procedures to inspect, remove, replace and service ball joints and tie rod ends.

9. Identify types of struts and their purpose.

10. Describe procedures to inspect, remove, replace and service struts.

11. Identify types of coil springs and control arms and their purpose.

12. Describe procedures to inspect, remove, replace and service coil springs and control arms.

13. Identify types of leaf springs and their purpose.

14. Describe procedures to inspect, remove, replace and service leaf springs.

15. Identify types of torsion bars and their purpose.

16. Describe procedures to inspect, remove, replace and adjust torsion bars.

17. Identify types of air ride systems and their purpose.
   i. active suspension
   ii. computer-controlled active suspension system

18. Identify air ride system components.
    i. height sensor
    ii. control module
    iii. air control solenoids

19. Describe procedures to inspect, remove, replace and adjust air ride systems.

20. Describe procedures to diagnose and repair computer-controlled active suspension systems.
    i. obtaining diagnosis
    ii. repairing system

Practical Requirements:

1. Remove and replace shock absorbers.

2. Remove and replace stabilizer bars.

3. Remove and replace ball joint.

4. Remove and replace struts.

5. Remove and replace coil springs and control arms.

6. Remove and replace leaf spring.

7. Remove, replace and adjust torsion bars.

SV1286 Drive Lines

Learning Outcomes:

- Demonstrate knowledge of the operation of major drive line components.

Duration: 25 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify drive line components and explain their function.
    i. types of drive lines
        - hotchkiss
        - torque tube
        - insulated
        - two-piece
    ii. types of universal joints
        - cross and roller
        - constant velocity

2. Describe procedures to remove, service and install drive shafts on rear drive vehicles.
    i. removing
    ii. rear-end torquing
    iii. balancing (causes of unbalance and effects)
    iv. phasing
    v. installing

3. Describe procedures to service universal joints on rear drive vehicles.
    i. inspecting
    ii. lubricating

4. Describe procedures to check drive line angles on rear drive vehicles and explain the purpose of doing so.

5. Describe procedures to adjust drive line angles on rear drive vehicles.
   i. transmission
   ii. rear axle
   iii. drive shaft

Practical Requirements:

1. Perform service on drive shafts on rear drive vehicles.

2. Remove, dismantle, inspect, lubricate and reassemble universal joints.

3. Check and adjust drive line angles on rear drive vehicles.

4. Balance drive shaft and check installation phase and angles of rear wheel drive shaft.

WD1301 Oxy-Fuel Welding/Cutting

Learning Outcomes:

- Demonstrate knowledge of the procedures used to operate oxy-fuel heating and cutting equipment to industrial safety standards for the removal and/or installation of parts.
- Demonstrate knowledge of the procedures used to perform braze welding and flame cutting using oxy-fuel equipment.

Duration: 30 Hours

Pre-Requisite(s): SV1165

Objectives and Content:

1. Describe procedures to operate oxy-fuel heating and cutting equipment to industrial safety standards for the removal and/or installation of parts.
    i. following safety precautions
        - safety apparel
        - storage and handling of welding gases
        - pre-operational inspection
    ii. setting up equipment
        - cylinders
        - gauges
        - regulators
        - valves-flame arrestor
        - torches and tips
        - hoses
        - testing for leaks
    iii. operating the torch
        - lighting procedures
        - types of flames and effect on materials
        - shutting down procedures

2. Describe procedures to perform braze welding using oxy-acetylene equipment.

3. Describe procedures to perform flame cutting with oxy-acetylene equipment.
   i. selecting cutting torch and tips
   ii. using cutting torch

Practical Requirements:

1. Assemble, test, light and adjust oxy-fuel welding and cutting equipment.

2. Perform braze welding on sheet metal using oxy-fuel equipment.

3. Perform flame cutting with oxy-fuel equipment.

4. Perform proper shut down procedures.

SV1305 Engine Principles

Learning Outcomes:

- Demonstrate knowledge of the operation and purpose of all major parts of engines.

Duration: 60 Hours

Pre-Requisite(s): SV1196

Objectives and Content:

1. Explain engine operating theory.
    i. matter
    ii. mass
    iii. energy
    iv. inertia
    v. force
    vi. momentum
    vii. torque
    viii. work
    ix. mechanical power
    x. friction
    xi. combustion
    xii. atmospheric pressure
    xiii. vacuum
    xiv. laws of gases: Boyle's law, Charles' law

2. Explain engine principles and the operation of all major parts and their purpose within the engine.
    i. principles of engine operation
        - stroke
        - bore
        - throw
        - top-dead centre
        - bottom-dead centre

- valve timing (diagram)
- firing order
- compression ratio
- volumetric efficiency
- mechanical efficiency
- reciprocating and rotating movement
- piston displacement
- clearance volume
- total volume
- scavenging
- engine clutches
- 2 strokes
- 4 strokes

ii. horsepower
- indicated HP
- friction HP
- flywheel or brake HP
- rated HP

iii. engine support system
- lubrication

iv. cylinder head
v. valves
vi. valve train
vii. camshaft
viii. cylinder block
ix. pistons
x. rings
xi. connecting rod
xii. crankshaft
xiii. bearings
xiv. lubrication pump
xv. oil cooler
xvi. water pump
xvii. flywheel
xviii. intake manifold
xix. exhaust manifold
xx. valve arrangements
xxi. in-line engine

xxii. V-engine
xxiii. overhead camshaft
xxiv. gasoline engine
xxv. diesel engine
xxvi. combustion chambers design
- open combustion
- pre-combustion
- turbulence combustion

3. Describe procedure to disassemble and assemble an engine, and to measure its dimensions.
   i. disassembling engine
   ii. assembling engine
   iii. measuring engine dimensions
   iv. following manufacturers' recommendations and specifications

Practical Requirements:

1. Perform an engine compression test.

2. Perform an engine vacuum test.

3. Remove and replace a timing belt.

SV1315 Cooling Systems

Learning Outcomes:

- Demonstrate knowledge of the purpose and operation of all major parts of cooling systems.

Duration: 30 Hours

Pre-Requisite(s): SV1305

Objectives and Content:

1. Identify and describe cooling systems.
    i. function
    ii. types
        - air cooled
        - liquid cooled
    iii. recovery system
        - pressurized
        - non-pressurized

2. Identify and describe components of an engine cooling system and their purpose/function.
    i. radiator
        - types
            - cross flow
            - down flow
        - construction
            - metal
            - plastic
            - aluminum
    ii. radiator cap
    iii. radiator and heater hoses
        - types
        - hose clamp

- thermostat

iv. water pump
- drives

v. fan assembly
- types of drive
  - clutch
  - electric
  - hydraulic
- shroud
- controls

vi. coolant
- types
  - gasoline
  - diesel
- mixing
- additives

vii. block heater
- types
  - in block
  - in line
  - metal heating element

3. Describe procedures to inspect, test and replace the following engine cooling system components.
   i. radiator
   ii. heater core assembly
   iii. radiator cap
   iv. radiator hoses
   v. heater hoses
   vi. water pump
   vii. mechanical/electric driven fan
   viii. coolant

4. Describe procedures to diagnose the following problems with cooling systems.
   i. overheating
   ii. overcooling
   iii. leaks

5. Describe procedures to bleed air from cooling systems.

6. Identify types of antifreeze.

7. Describe procedures to mix, install and recycle antifreeze.
    i. mixing
    ii. testing
    iii. adding additives

8. Describe procedures to drain, clean and refill cooling systems.

Practical Requirements:

1. Diagnose problems with a cooling system.

2. Drain and flush a coolant system.

3. Mix, install and recycle antifreeze.

SV1376 Batteries

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose battery problems.
- Demonstrate knowledge of the procedures used to service batteries.

Duration: 20 Hours

Pre-Requisite(s): SV1130

Objectives and Content:

1. Explain the principles of batteries.
    - i. safety rules when working with batteries
    - ii. storage of batteries
    - iii. battery construction
        - positive plates
        - negative plates
        - separators
        - electrolytes
        - chemical action
        - terminals
    - iv. chemical action when discharging
    - v. chemical action when charging
    - vi. sulfated batteries
    - vii. maintenance-free batteries
    - viii. temperature effects on batteries
    - ix. battery polarity
    - x. battery ratings
        - cold cranking amps
        - reserve capacity rating
    - xi. battery selection
    - xii. terminal pullers
    - xiii. hold-down clamp

xiv. battery maintenance
- procedures to clean batteries
- battery inspection
- electrolyte level

2. Describe the procedures to remove and install batteries and battery cables.

3. Identify battery connections.
   i. parallel circuits
   ii. series circuits
   iii. series-parallel circuits

4. Identify and explain the function of equipment used to perform battery tests.
   i. hydrometer
   ii. refractometer
   iii. built-in hydrometer

5. Describe procedures to test batteries.
   i. testing electrolyte levels
   ii. testing batteries
   - specific gravity variation (correcting specific gravity readings to allow for temperature)
   - parasitic draw
   - light-load test
   - high-discharge test
   - cold-cranking test
   - reserve capacity test

6. Identify and describe methods used to recharge batteries and explain the precautions to take when recharging a battery.
   i. methods
   - slow charge method
   - fast charge method
   - trickle charging

   ii. precautions
   - battery temperature precautions
   - importance of good ventilation

- safety precautions with highly explosive gases

7. Identify types of cable terminals and explain how to select the proper cable size.
   i. types of cable terminals
   ii. cable size selection

8. Describe procedures to replace battery cables and/or terminals.
   i. fastening terminals to cable (soldered and crimped)
   ii. installing corrosion inhibitor over terminals (importance)

9. Identify precautions to consider when starting engines with a booster battery.
   i. importance of proper booster cables
   ii. proper polarity and connections
   iii. series connections
   iv. protective glasses
   v. safety precautions

10. Describe procedures to start engines with a booster battery.

11. Identify causes of battery problems.
   i. effects on battery life
      - electrolyte level
      - overcharging
      - undercharging
      - cycling
   ii. battery hold-down loose or too tight
   iii. corroded terminals
   iv. frayed or broken cables
   v. cracked case
   vi. damaged battery trays and covers
   vii. causes of battery discharge

12. Describe the procedure to diagnose battery problems (voltage drop test).

Practical Requirements:

1. Perform a parasitic draw test.

2. Remove and replace a battery.

3. Perform a voltage drop test.

4. Test batteries.
    i. load test
    ii. specific gravity

5. Charge battery.
    i. slow
    ii. fast

SV1385 Starting Systems

Learning Outcomes:

- Demonstrate knowledge of the purpose and operation of all major parts of the starting system.

Duration: 30 Hours

Pre-Requisite(s): SV1376

Objectives and Content:

1. Identify types of starter systems.
    i. direct drive
    ii. gear reduction
    iii. permanent magnet

2. Identify the components of a starting system and their operation.
    i. starter switches
    ii. starter relays
    iii. starter solenoids

3. Describe procedures to diagnose starting problems.
    i. following safety procedures
    ii. using test meters
        - ammeter
        - voltmeter
        - ohmmeter
    iii. performing starting system diagnosis
        - battery
        - cables and grounds
        - ring gear and flywheel
        - starter damage
        - neutral and clutch safety switches
        - theft deterrents

iv. testing starter
- current test
- circuit voltage drop
- load test / no load test
- torque test

v. testing starter (internal)
- armature
- commutator
- field windings
- solenoids
- relays
- brushes
- bushings

4. Describe the procedures to test, and repair or replace starting systems and components.
   i. testing system
   ii. servicing starter
   iii. replacing bushing
   iv. replacing brush

Practical Requirements:

1. Diagnose starting problems.

2. Repair/replace starting systems on vehicle.

3. Remove and replace starter.

4. Perform a starter test (internal).

SV1395 Charging Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to test and service charging systems and components.
- Demonstrate knowledge of the procedures used to diagnose charging system problems.

Duration: 30 Hours

Pre-Requisite(s): SV1376

Objectives and Content:

1. Identify and describe AC generators and components and explain their principles of operation.
    i. basic charging systems
    ii. operating principles of AC generators
    iii. identification of parts
        - stator
        - rotor
        - diodes
        - rectifier bridge
        - brushes
    iv. types and functions of regulators
        - transistorized regulator
        - remote mounted regulator
        - integral type regulator
        - computer controlled regulator
    v. types of AC generators
        - brushless AC generator
        - 12 volt AC generator
        - 24 volt AC generator
        - 12/24 volt AC generator

2. Describe procedures to disassemble, test, repair and reassemble AC generators.
    i. disassembling AC generators
        - internal circuitry
    ii. testing AC generator components
        - stator
        - rotor
        - diodes
        - regulator
    iii. testing AC generator performance
        - AC generator output test
            - voltage
            - amperage
            - appropriate testing equipment
    iv. checking bearing condition
    v. checking slip ring condition
    vi. cleaning
    vii. reassembling

3. Describe procedures to diagnose the following charging system problems.
    i. no AC generator output
    ii. low AC generator output
    iii. high AC generator output
    iv. noisy AC generator
    v. battery uses excessive electrolyte

Practical Requirements:

1. Perform charging system tests using equipment recommended by manufacturer.

2. Make adjustments and repairs to charging system components.

3. Diagnose charging system components.

4. Remove and replace alternator.

5. Alternator and regulator test (internal).

SV1495 Lighting Systems

Learning Outcomes:

- Demonstrate knowledge of the purpose and operation of the major parts of lighting systems.

Duration: 30 Hours

Pre-Requisite(s): SV1376

Objectives and Content:

1. Describe types of lighting systems associated with a vehicle.
    i. exterior lighting and circuits
        - bulb identification
        - headlights and circuits
        - park lights and circuits
        - brake lights and circuits
        - signal lights and circuits
        - emergency flashers and circuits
        - fuses and circuit breakers
        - fusible links and protected circuits
        - LED lighting
        - Fibre optic lighting
        - Gas discharge lighting
    ii. interior lighting and circuits
        - dome lights
        - dash lights
        - glove compartment lights
        - courtesy lights
        - illuminated entry
    iii. accessory lighting and circuits
        - trailer lights
        - roof lights
        - fog lights

iv. daytime running lights and circuits

2. Describe procedures to use test equipment to locate opens, shorts and grounds in lighting systems.

3. Describe procedures to replace various lighting components.

4. Describe various procedures that apply to lighting systems.
   i. wiring harness
   ii. replacing bulbs, fuses or circuit breakers using wiring diagrams to locate circuits and components of circuits
   iii. using meters and test lights
   iv. removing trim components using special tools
   v. using aiming equipment

5. Describe procedures to diagnose motor vehicle lighting system problems.
   i. using wiring diagrams
   ii. using wire and terminal connection

Practical Requirements:

1. Use test equipment to locate, opens, shorts and grounds in lighting systems.

2. Make repairs to lighting system; wiring harness, bulb replacement, fuses or circuit breakers using wiring diagrams to locate circuits and components of circuits.

3. Diagnose motor vehicle lighting systems.

4. Read wiring diagrams.

5. Aim vehicle headlights.

SV1600 Ignition Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to test and service ignition systems.
- Demonstrate knowledge of the procedures used to diagnose ignition system problems.

Duration: 30 Hours

Pre-Requisite(s): SV1305, SV1376

Objectives and Content:

1. Identify and describe electronic ignition systems and components and their operation.
    i. principles of operation of ignition systems
        - distributor type
        - distributor-less type
    ii. components
        - triggering devices
            - optical
            - hall effect switches
            - magnetic generators
            - ignition points
        - reluctor
        - control unit
        - distributor assembly
        - rotor
        - coil

2. Describe procedures to check and test the condition of components of electronic ignition systems.
    i. pick-up coil
    ii. control unit
    iii. ignition coil
    iv. distributor cap

v. rotor
vi. spark plug/wires

3. Identify and describe spark plugs.
   i. construction of spark plugs
   ii. types
   iii. heat range

4. Describe procedures to remove, service and install spark plugs.
   i. removing
   ii. inspecting
   iii. gapping
   iv. testing
   v. installing/torquing

5. Describe procedures to diagnose the following ignition system problems on conventional and distributor less systems.
   i. no spark at plugs
   ii. weak or intermittent spark at plugs
   iii. missing at idle or low speed
   iv. missing during acceleration
   v. missing at all speeds
   vi. coil failure
   vii. short spark plug life
   viii. pre-ignition problems
   ix. detonation problems
   x. backfiring in intake manifold
   xi. backfiring in exhaust manifold
   xii. incorrect timing

Practical Requirements:

1. Check and adjust ignition timing.

2. Perform a coil output test.

3. Check and adjust spark plug gap.

4. Perform a secondary wire resistance test.

5. Use specialized diagnostic equipment.

SV1625 Front-Wheel Drive

Learning Outcomes:

- Demonstrate knowledge of the operation of the major parts of a front-wheel drive system.

Duration: 25 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Explain operation of the following front-wheel drive components.
    i. axle retainers and shafts
    ii. support bearing
    iii. steering knuckles
    iv. constant velocity joints
    v. bearings and seals
    vi. lubricants

2. Describe procedures to properly remove and install front-wheel drive components.
    i. overhauling
    ii. replacing

3. Describe the procedures to inspect, diagnose and service the following front-wheel drive components.
    i. front drive axles
    ii. support bearings
    iii. steering knuckles
    iv. constant velocity joints (drive axle joints) and boots
    v. wheel bearings and seals (front drive axle)
    vi. drive axle joint boots and clamps

Practical Requirements:

1. Disassemble, inspect, repair and assemble front wheel drive components.

2. Replace CV boot.

SV1631 Hydraulic Brake Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to remove, repair and replace hydraulic brake systems and components.

Duration: 75 Hours

Pre-Requisite(s): SV1142, SV1216

Objectives and Content:

1. Explain the fundamentals of brake systems.
    i. kinetic energy
    ii. heat
    iii. friction
    iv. coefficient of friction
    v. heat dissipation
    vi. hydraulic principles (refresh)
    vii. action of primary and secondary shoe
    viii. servo brakes

2. Identify master cylinders and their components.
    i. types
    ii. parts
    iii. types and function of hydraulic valves
        - proportional valve
        - metering valve
        - brake warning switch
        - combination valve
        - load proportioning valve

3. Describe procedures to remove, repair and replace master cylinders.
    i. removing and installing
    ii. cleaning

iii. repairing
iv. bleeding the master cylinder
v. adjusting brake pedal free play
vi. performing failure analysis

4. Identify drum type brakes and their components.
   i. self-adjusting brakes
   ii. hold-down springs
   iii. return springs
   iv. backing plates

5. Describe procedures to remove, repair and replace drum type brakes.
   i. removing and installing brake drum
   ii. removing brake shoes
      - lining condition and wear
      - brake shoe arc
      - identification of primary and secondary shoe
   iii. attaching lining to shoe
   iv. lubricating
   v. adjusting (minor and major adjustments)
   vi. measuring drum for wear
   vii. machining drum
   viii. performing failure analysis

6. Identify wheel cylinders and their components.
   i. types of wheel cylinders
   ii. identification of parts

7. Describe procedures to remove, repair and replace wheel cylinders.
   i. removing and installing
   ii. inspecting
   iii. cleaning
   iv. repairing
   v. bleeding the system
   vi. performing failure analysis

8. Identify disc type brakes, their components and operating principles.
   i. types

ii. component identification
iii. operating principles

9. Describe procedures to remove, repair and replace disc type brakes.
    i. removing and installing brake disc
    ii. inspecting
    iii. removing and installing caliper
    iv. reconditioning caliper
    v. checking brake pads for wear and contamination
    vi. measuring disc wear
    vii. machining brake disc
    viii. performing failure analysis

10. Identify parking brakes and their application.
    i. lever and fulcrum theory
    ii. mechanical advantage
    iii. application
    iv. types and designs
        - internal shoe
        - caliper type
        - drum lever type
        - drive shaft type (at transmission)
    v. parking brake lock mechanism

11. Describe procedures to remove, repair and replace parking brakes.
    i. removing and installing
    ii. adjusting
    iii. performing failure analysis

12. Describe procedures to remove, repair and replace brake lines.
    i. repairing and replacing
        - brake lines
        - fittings: joining and repairing lines
        - brake line supports
    ii. following safety rules

13. Identify and describe fluids used when bleeding brake systems.
    i. types of fluids

ii. properties of fluids
iii. replacement of fluids

14. Describe the methods used to bleed brake systems.
    i. pressure
    ii. gravity
    iii. scan tool usage

15. Describe procedures to diagnose hydraulic brake problems based on the following symptoms.
    i. correct brake pedal operation
    ii. one or more brakes drag
    iii. all brakes drag
    iv. vehicle pulls to one side
    v. soft or spongy pedal
    vi. poor braking action
    vii. brakes too sensitive
    viii. noisy brakes
    ix. air in system
    x. loss of brake fluid
    xi. brakes do not self-adjust
    xii. warning light comes on

16. Describe the procedures to verify brake job completion.

17. Identify safety issues related to components and operation of anti-locking brake systems (ABS).

18. Identify safety issues related to electric/hydraulic trailer brakes.

Practical Requirements:

1. Inspect, test and repair drum brakes.

2. Inspect, test and repair disc brakes.

3. Inspect, test and repair master cylinder.

4. Machine drums and disc rotors.

SV1640 Power Brake Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to inspect power brake systems.
- Demonstrate knowledge of the procedures used to diagnose problems with power brake systems.
- Demonstrate knowledge of the procedures used to service and repair power brake systems.

Duration: 15 Hours

Pre-Requisite(s): SV1631

Objectives and Content:

1. Describe the components and functions of power brake systems.
    i. general purpose of power brake systems
    ii. power boosters and theory of operation
        - vacuum operated
        - power steering pressure operated (hydro-boost)
        - electric pump operated
    iii. power brake systems
        - troubleshoot problems
        - make adjustments
    iv. vacuum pump
    v. remote reservoir

2. Describe the procedures to diagnose problems in a power brake system.
    i. performing failure analysis

3. Describe the procedures to service a power brake system.

Practical Requirements:

1. Inspect, remove and diagnose power brake system components.

SV1661 Intake and Air Filtration Systems

Learning Outcomes:

- Demonstrate knowledge of the operation and purpose of all major parts of the intake and air filtration systems.

Duration: 15 Hours

Pre-Requisite(s): SV1305

Objectives and Content:

1. Identify and describe air filters.
    i. principles
    ii. types: oil bath, paper or dry type, polyurethane

2. Describe the operating principles of intake manifolds.
    i. cold air
    ii. hot air
    iii. control
    iv. distribution
    v. tuning
    vi. variable induction

3. Identify and describe turbochargers and superchargers, their operation and use.

4. Describe induction systems and their relationship to turbochargers and superchargers.

5. Describe the operating principles and characteristics of intake and air charge systems and their components.
    i. design
    ii. intercoolers
    iii. volumetric efficiency

6. Describe the procedure to test and service components of intake and air filtration systems.

Practical Requirements:

1. Inspect, test and repair intake system components

SV1671 Exhaust Systems

Learning Outcomes:

- Demonstrate knowledge of the operation of all major parts of the exhaust system and their purpose.

Duration: 15 Hours

Pre-Requisite(s): SV1305, TS1510

Objectives and Content:

1. Describe the components of exhaust systems.
    i. manifolds
        - types
        - designs (combined, separate)
    ii. mufflers and resonators
        - types
        - purpose
    iii. catalytic converters
    iv. pipes, supports, clamps
    v. oxygen sensors
    vi. induction systems (turbochargers)

2. Describe the procedures to service components of exhaust systems.
    i. selecting and using proper tools
    ii. aligning
    iii. using sealers
    iv. removing and replacing
    v. checking system for leaks and/or restrictions
    vi. following safety precautions (carbon monoxide)

Practical Requirements:

1. Inspect, test and replace exhaust system and related components.

SV1550 Body Components and Trim

Learning Outcomes:

- Demonstrate knowledge of body components and trim and their applications.
- Demonstrate knowledge of the procedures used to diagnose and repair body components and trim.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify body components and accessories and describe their purpose and operation.
    i. interior
        - doors
        - seats
        - dashes
    ii. exterior
        - bumpers
        - mirrors
        - add-on accessories
        - mounts

2. Explain the principles of basic aerodynamics related to body design.

3. Identify types and sources of noise, vibration and harshness (NVH).
    i. chuckles / loose lumber
    ii. rattles
    iii. knocks and whines
    iv. offensive noises

4. Identify materials used to dampen or interrupt vibration.
    i. tapes

ii. adhesives
iii. insulators

5. Identify types and sources of wind and water leaks.

6. Identify types of seals, adhesives, cleaners and sealing materials and describe their applications and procedures for use.

7. Identify specialized tools and equipment and describe their applications and procedures for use.

8. Describe the procedures used to diagnose body components and trim.
   i. verify complaint
   ii. visually inspect
   iii. special considerations for paint on sensors and tint on windows.
   iv. retrieve diagnostic codes
   v. access service information
   vi. conduct tests and measurements
   vii. isolate problem and root cause
   viii. special considerations for paint on sensors and tint on windows.

9. Describe the procedures used to adjust, repair and/or replace body components and trim.
   i. perform repair
   ii. verify repair

Practical Requirements.

None.

SV2261 Preventative Maintenance Inspections (PMI)

Learning Outcomes:

- Demonstrate knowledge of the procedures to perform a preventative maintenance - inspection.

Duration: 10 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Explain the background and rationale for designing a preventative maintenance schedule.
    i. background on preventative maintenance inspections
    ii. reasons for performing a PM inspection
        - prevent expensive breakdowns
        - prevent small problems from becoming large ones
        - establish regular service patterns and help scheduling
        - provide better feedback on operating costs
    iii. example of PM inspection form
    iv. levels of PM inspection (e.g., minor inspection vs. major inspection)

2. Describe the procedures to design a preventative maintenance schedule.
    i. methods used to arrive at PM schedules and forms

3. Describe the procedures to perform a preventative maintenance inspection.
    i. procedures to be followed when performing a PM inspection
        - inspection only
        - inspection plus scheduled replacement of some items
        - same as above plus repairs up to a certain dollar figure
    ii. inspection during maintenance
        - air filter
        - battery electrolyte level

- battery connections
- cooling liquid level
- cooling liquid concentration
- automatic transmission fluid level
- manual transmission fluid level
- transfer case fluid level
- rear axle fluid level
- front axle fluid level (4x4)
- oil leaks
- windshield washer fluid level
- power steering fluid level
- brake fluid level
- belts (condition)
- constant velocity boots (visual inspection)
- exhaust system (visual inspection)
- shock absorbers and struts (visual inspection)
- tires (visual inspection)
- gas tanks (visual inspection)
- transmission filters
- brake fluid flush
- timing belt
- spark plugs
- fuel injection cleaning

Practical Requirements:

1. Locate pm inspection lists, vehicle owner's manuals and vehicle manufacturer's manuals.

2. Perform a pm inspection.

SV2281 Pre-Delivery Inspections (PDI)

Learning Outcomes:

- Demonstrate knowledge of the procedures to perform a pre-delivery inspection on a light duty motor vehicle.

Duration: 10 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Explain the background and rationale of the pre-delivery inspection.
    i. reasons why inspection is necessary
    ii. manufacturer's inspection forms

2. Describe the pre-delivery inspection procedures.
    i. use of a system or routine for doing any inspection
    ii. procedure to follow if problems are identified
    iii. procedure to follow if doors, trunk and bumpers are misaligned
    iv. inspection guidelines as outlined by manufacturer

Practical Requirements:

1. Perform a pre-delivery inspection on a light duty motor vehicle.

AP1101 Introduction to Apprenticeship

Learning Outcomes:

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

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define the following terms:
    i. apprenticeship
    ii. apprentice vs. registered apprentice
    iii. Journeyperson vs. Certified Journeyperson
    iv. Certificate of Apprenticeship
    v. Certificate of Qualification
    vi. Recognition of Prior Learning
    vii. dual certification

2. Explain the apprenticeship system in Newfoundland and Labrador and the roles and responsibilities of those involved.
    i. registered apprentice
    ii. training institution
    iii. employer
    iv. Journeyperson
    v. Department of Advanced Education and Skills
        - Industrial Training Section
        - Standards and Curriculum Section
    vi. Provincial Trade Advisory Committees
    vii. Provincial Apprenticeship and Certification Board

3. Identify the Conditions Governing Apprenticeship.

4. Describe the training and educational requirements.
   i. pre-employment (entry level) training
   ii. block release
   iii. on-the-job

5. Explain the steps in the registered apprenticeship process.
   i. criteria for eligibility
      - entrance requirements as per Conditions of Apprenticeship
      - employment
   ii. registration process
      - application requirements
   iii. Memorandum of Understanding
      - probation period
      - cancellation
   iv. Record of Occupational Progress (Logbook)
      - signing off skills
      - recording hours
      - updating PDO on progress
   v. class calls
      - schedule
      - EI Eligibility
      - Direct Entry
      - advanced level
   vi. Block Exams
   vii. progression
      - schedule
      - wage rates
   viii. cancellation of apprenticeship
   ix. Practical Examinations
   x. Provincial and Interprovincial examinations
   xi. certification
      - Certification of Apprenticeship
      - Certification of Qualification
      - Provincial certification
      - Interprovincial Red Seal endorsement

6. Explain the Interprovincial Standards Red Seal Program.
    i. designated Red Seal trade
    ii. the National Occupational Analysis (NOA)
    iii. Interprovincial (IP) Red Seal Endorsement Examination
    iv. relationship of NOA to IP Examination
    v. qualification recognition and mobility

7. Identify the current financial incentives available to apprentices.

8. Explain the NL apprenticeship and trades certification division's out-of- province apprenticeship policy.

Practical Requirements:

1. Use the Provincial Apprenticeship and Trades Certification web site at www.gov.nl.ca/app to:
    i. locate, download, and complete the Application for Apprenticeship and Memorandum of Understanding (MOU)
    ii. locate, download, and complete the Out of Province registration forms
        - Application for Apprenticeship (out of province)
        - Letter of Understanding (LOU)
        - Acceptance of Conditions Letter
    iii. locate, download, and complete the Work Experience Credits form
    iv. identify the locations of all Industrial Training offices
    v. locate and review the following learning resources relevant to the trade:
        - Study Guide
        - Exam Preparation Guide
        - Plan of Training

2. Use a logbook for this trade to:
    i. identify the hours for the trade (in-school and on-the-job)
    ii. identify the number of blocks
    iii. identify the courses in each block
    iv. identify the workplace skills to be completed and verified

3. Use the Red Seal Web site, http://www.red-seal.ca to retrieve the National Occupational Analyses (NOA) for this trade.
   i. identify the following components of the NOA:
      - Trends
      - Scope
      - Key Competencies
      - Blocks
      - Tasks
      - Subtasks
      - Pie Charts
      - Table of Specifications

AM1100 Math Essentials

Note: It is recommended that AM1100 be delivered in the first semester of the Entry Level training program.

Learning Outcomes:

- Demonstrate knowledge of the numeracy skills required to begin the 2nd level math course.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of mathematical principles in trade problem solving situations.
- Demonstrate the ability to solve simple mathematical word problems.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor should use trade specific examples to reinforce the course objectives

1. Use multiplication tables from memory.

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

3. Apply the order of operations in math problems.

4. Perform fraction and mixed number operations.
   i. read, write, add, subtract, multiply and divide fractions

5. Perform decimal operations.
   i. read, write, round off, add, subtract, multiply and divide decimals

6. Perform percent/decimal/fraction conversion and comparison.
   i. convert between fractions, decimals and percents

7. Perform percentage operations.
   i. read and write percentages
   ii. calculate base, rates and percentages

8. Perform ratio and proportion operations.
   i. use a ratio comparing two quantities with the same units
   ii. use a proportion comparing two ratios

9. Use the imperial measurement system in math problems.
   i. identify units of measurement for:
      - length
      - mass
      - area
      - volume
      - capacity

10. Use the metric measurement system in math problems.
    i. identify units of measurement for:
       - length
       - mass
       - area
       - volume
       - capacity

Practical Requirements:

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

AM1220 Mechanical Math Fundamentals

Learning Outcomes:

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

Duration: 30 Hours

Pre-Requisite(s): AM1100

Objectives and Content:

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

1. Employ percent/decimal/fraction conversion and comparison in trade specific situations.

2. Apply ratios and proportions to trade specific problems.

3. Use the Imperial Measurement system in trade specific applications.

4. Use the Metric Measurement system in trade specific applications.

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

6. Manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems, such as:
   i. right angle triangles
   ii. area
   iii. volume
   iv. perimeter

7. Perform calculations involving geometry that are relevant to the trade, such as:
   i. angle calculations
   ii. circle calculations

8. Use practical math skills to complete administrative trade tasks.
   i. material estimation
   ii. material costing
   iii. time & labour estimates
   iv. taxes & surcharges
   v. markup & projecting revenue

Practical Requirements:

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

Note:

This course has been designated as NON-TRANSFERABLE to other trades programs, and NOT ELIGIBLE FOR PRIOR LEARNING ASSESSMENT. Students completing training in this trade program are required to complete this math course.

CM2160 Communication Essentials

Learning Outcomes:

- Demonstrate knowledge of the importance of well-developed writing skills in the workplace and in career development.
- Demonstrate knowledge of the purpose of various types of workplace correspondence.
- Demonstrate knowledge of the principles of effective workplace writing.
- Demonstrate knowledge of standard formats for letters and memos.
- Demonstrate knowledge of principles related to writing effective letters and memos.
- Demonstrate the ability to prepare and deliver an oral presentation.
- Demonstrate knowledge of the importance of effective interpersonal skills in the workplace.

Duration: 45 Hours

Pre-Requisite(s): None

Objectives and Content:

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

1. Identify the principles for writing clear, concise, complete sentences and paragraphs which adhere to the conventions of grammar, punctuation, and mechanics.

2. Identify the principles of effective workplace writing.
    i. describe the value of well-developed writing skills to career success
    ii. discuss the importance of tone, and language or word choice in workplace communication, regardless of the circumstances
    iii. demonstrate an awareness of cultural differences when preparing workplace correspondence
    iv. describe the writing process as it applies to workplace communication
        - planning
        - writing

- editing/revising

v. identify the parts of a business letter and memo, and when each should be used in the workplace

vi. identify the standard formats for business letters and memos

vii. identify guidelines for writing sample letters and memos which convey:

- acknowledgment
- routine request
- routine response
- complaint
- refusal
- persuasive request
- letters of appeal

3. Identify types of informal workplace documents.

i. identify types & purposes of reports

- incident
- process
- progress

ii. identify common trade specific forms

iii. describe primary and secondary methods used to gather information

iv. discuss the importance of accuracy and completeness in reports and forms

4. Identify the elements of presentations used in the workplace.

i. identify presentation types

- impromptu
- informative
- demonstration
- persuasive

ii. identify the components of an effective presentation

- eye contact
- body language
- vocal qualities
- audience analysis
- multimedia tools
- keeping on topic

5. Demonstrate an understanding of interpersonal communications in the workplace.

i. identify listening techniques

ii. demonstrate an understanding of group dynamics

iii. describe the importance of contributing information and expertise in the workplace
iv. describe the importance of respectful and open communication in the workplace
v. identify methods to accept and provide feedback in a constructive and considerate manner
vi. explain the role of conflict in a group to reach solutions

6. Identify acceptable workplace uses of communication technologies.
   i. cell / Smart Phone etiquette
   ii. voice mail
   iii. e-mail
   iv. teleconferencing / videoconferencing for meetings and interviews
   v. social networking
   vi. other emerging technologies

Practical Requirements:

1. Write well-developed, coherent, unified paragraphs.

2. Write sample letters and memos.

3. Write one short informal report.

4. Complete a selection of at least 3 trade-related forms.

5. Deliver an effective oral presentation.

SD1760 Workplace Essentials

Note: It is recommended that SD1760 be delivered in the second half of the Entry Level training program.

Learning Outcomes:

- Demonstrate knowledge of workplace essentials in the areas of meetings, unions, workers compensation, workers' rights, and human rights.
- Demonstrate knowledge of good customer service practices.
- Demonstrate knowledge of effective job search techniques.

Duration: 45 Hours

Pre-Requisite(s): None

Objectives and Content:

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

1. Identify common practices related to workplace meetings.
    i. identify and discuss meeting format and preparation required for a meeting
    ii. explain the purpose of an agenda
    iii. explain the expected roles, responsibilities, and etiquette of meeting participants

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

3. Demonstrate an understanding of the Worker's Compensation process.
    i. describe the aims, objectives, regulations and benefits of the Workplace Health, Safety and Compensation Commission
    ii. explain the role of the Workers Advisor

iii. explain the internal review process

4. Demonstrate an understanding of workers' rights.
   i. define labour standards
   ii. identify regulations, including:
      - hours of work & overtime
      - termination of employment
      - minimum wages & allowable deductions
      - statutory holidays, vacation time, and vacation pay

5. Demonstrate an understanding of Human Rights issues.
   i. examine the Human Rights Code and explain the role of the Human Rights Commission
   ii. define harassment in various forms and identify strategies for prevention
      - direct
      - systemic
      - adverse effect
   iii. identify gender and stereotyping issues in the workplace
   iv. define basic concepts and terms related to workplace diversity including age, race, culture, religion, socio-economic status, and sexual orientation

6. Demonstrate an understanding of quality customer service.
   i. explain why quality service is important
   ii. identify barriers to quality customer service
   iii. identify customer needs & common methods for meeting them
   iv. identify and discuss the characteristics & importance of a positive attitude
   v. identify the importance of demonstrating good communication skills including body language, listening, questioning, and when using electronic communication devices
   vi. identify techniques for interacting with challenging customers to address complaints and resolve conflict

7. Demonstrate an understanding of effective job search techniques.
   i. identify and explain employment trends, opportunities, and sources of employment
   ii. identify and discuss essential skills for the trades as outlined by Human Resources and Skills Development Canada
   iii. review job ads and identify the importance of fitting qualifications to job requirements

iv. identify the characteristics of effective resumes, the types of resumes, and principles of resume formatting
v. identify the characteristics of an effective cover letter
vi. identify the components of a portfolio, and discuss the value of establishing and maintaining a personal portfolio
vii. identify the common characteristics of the job interview process:
- pre-interview preparation
- interview conduct
- post-interview follow up

Practical Requirements:

1. Create a resume.

2. Create a cover letter.

3. Participate in a mock job interview.

MC1060 Computer Essentials

Learning Outcomes:

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

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

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

1. Identify the major external components of a microcomputer system.
   i. input devices
   ii. output devices
   iii. central control unit

2. Use operating system software.
   i. start and quit a program
   ii. use the help function
   iii. use the find function
   iv. maximize and minimize a window
   v. use the task bar
   vi. adjust desktop settings such as screen savers, screen resolution, and backgrounds
   vii. shut down a computer

3. Perform file management commands.
   i. create folders
   ii. copy files and folders
   iii. move files and folders
   iv. rename files and folders

v. delete files and folders

4. Use word processing software to create documents.
   i. enter text
   ii. indent and tab text
   iii. change text attributes (bold, underline, font, etc.)
   iv. change layout format (margins, alignment, line spacing)
   v. spell check and proofread
   vi. edit text
   vii. save document
   viii. print document
   ix. close document
   x. retrieve documents

5. Use spreadsheet software to create spreadsheets.
   i. enter data in cells
   ii. create formulas to add, subtract, multiply and divide
   iii. save spreadsheet
   iv. print spreadsheet
   v. close spreadsheet
   vi. retrieve spreadsheet

6. Access the Internet.
   i. access websites using the world wide web(www)
   ii. identify examples of web browsers
   iii. use search engines with common searching techniques
   iv. describe security issues

7. Use electronic mail.
   i. describe e-mail etiquette
      - grammar and punctuation
      - privacy and legal issues when sharing and forwarding e-mail
      - work appropriate content
      - awareness of employer policies
   ii. manage e-mail using the inbox, sent, and deleted folders
   iii. send an e-mail message with attachment(s)
   iv. print e-mail

Practical Requirements:

None.

BLOCK II

SV2016 On-Board Computer Diagnostics I (OBD-I)

Learning Outcomes:

- Demonstrate knowledge of the operation of all major components related to OBD-I.

Duration: 60 Hours

Pre-Requisite(s): Block I

Objectives and Content:

1. Explain the basics of computers.
    - i. rational reasons for using electronic controls
        - accuracy
        - better control of emissions
    - ii. computer systems
        - inputs - information to the computer
        - outputs - commands from the computer
    - iii. computer operation
        - CPU basics
        - memory types - RAM, ROM, PROM, EEPROM, KAM
        - computer wiring, feeds and grounds
    - iv. input circuits
        - discreet
    - v. analogue
        - one, two and three wire sensors
    - vi. output circuits
        - positive and negative voltage control
        - pulse width modulation (PWM)
        - current limiting circuits (protection)
    - vii. sensing devices
        - switches

- thermistors
- potentiometers
- pressure sensors
- permanent magnet (PM) generators
- hall effect switches
- light emitting diode operated
- knock sensors

viii. feedback operation
- open loop
- closed loop
- oxygen sensors (O_2)

ix. adaptive learning
- purpose
- short term / long term

x. output systems
- solenoids – on/off and PWM
- relays
- lights
- stepper motors
- by-directional communications

2. Identify components of on-board diagnostic systems that serve to identify and diagnose problems in vehicle systems.

i. warning lights
- oil pressure
- charge indicator
- engine overheat
- service engine soon
- check engine (MIL according to SAE J-1930)
- air bag (SIR – Supplemental Inflatable Restraint)
- ABS and TCS
- service engine other than MIL (e.g., throttle system problems with electronic fuel injection pumps)

ii. trouble codes (accessing codes)
iii. grounding connectors
iv. key cycles
v. control button combinations
vi. read-out devices

vii. voltmeters, MIL, digital dashes
viii. scan tools
ix. sensors

3. Explain how on-board diagnostic systems serve to identify and diagnose problems in vehicle systems.
   i. means of checking light systems
      - bulb check position when turning ignition or run key to start
      - normal operation of light key-on with engine not running and with engine running
   ii. means of checking circuit operation
      - pressure switches
      - temperature switches
      - voltage differences (charge indicator)
      - solid state switches (modules or computers)
      - driver circuits
   iii. means of diagnosing light system problems (circuit checks)
      - load power source
      - ground (what completes circuit?)
      - computer circuits or voltage drop
   iv. other means of diagnosing system problems
      - scan tool data, sensor data, system status, history codes
      - operating modes commanded by scan tool or diagnostic key
      - operation of individual components
      - system tests
      - tests performed by vehicle computer

4. Describe service procedures.
   i. using shop manuals, step charts or diagnostic routines, specifications, and circuit operating modes
   ii. verifying repairs

Practical Requirements:

1. Demonstrate ability to use diagnostic tools.

2. Access trouble codes and analyze information received.

3. Interpret service manuals for wiring diagrams, flow charts and troubleshooting guides.

SV2017 On-Board Computer Diagnostics II (OBD-II)

Learning Outcomes:

- Demonstrate knowledge of the various components of OBD-II systems.
- Demonstrate knowledge of the procedures used to explain the logical approach to proper diagnostics.

Duration: 30 Hours

Pre-Requisite(s): SV2016

Objectives and Content:

1. Describe diagnostic procedures for OBD-II systems.
    i. comparison between OBD-I and OBD-II
    ii. diagnostic self-testing
        - types
            - passive
            - active
            - intrusive
            - monitors
            - drive cycles
            - recording test results
    iii. test fail actions (what happens if a test fails)
    iv. Diagnostic Trouble Code (DTC)
        - identification
        - types
        - pass/fail reporting
        - conditions to set and conditions to clear DTC's
    v. HO_2S (Heating Oxygen Sensor) and catalyst diagnostics
    vi. misfire detection
        - misfiring causing more than 1½ times acceptable emissions
        - catalyst-damaging misfire
        - rough road detection (software approach, ABS approach)
    vii. input monitoring

viii. output monitoring
- idle speed
- fuel trim
- EGR (Exhaust Gas Recirculation)

ix. EVAP system diagnostics
- non-enhanced systems
- enhanced systems

2. Describe repair procedures for OBD-II systems including PCM re-programming.

Practical Requirements:

1. Diagnose and repair OBD II systems.

SV1651 Fuel Delivery

Learning Outcomes:

- Demonstrate knowledge of the operation of all major parts of the fuel system.

Duration: 15 Hours

Pre-Requisite(s): SV1130, SV1305

Objectives and Content:

1. Describe components used in fuel tank construction.
    - i. tanks
        - steel
        - plastic
        - aluminum
        - design
    - ii. filler tubes
        - vent pipes
        - flow back
    - iii. filler caps (pressure/vacuum type)
    - iv. pickup tubes
        - screen
        - return
    - v. sending units (types)
    - vi. fuel gauges
        - types
        - low fuel level sensor
    - vii. filtering
        - single stage
        - dual stage
    - viii. fuel lines and fittings
        - metallic
        - non-metallic

ix. fuel supply designs
- return type
- return less

2. Describe the major characteristics and properties of fuels.
   i. gasoline
      - volatility
      - additives (ethanol, methanol)
      - ratings
      - combustion
      - contamination
      - A/F ratios
      - volumetric efficiency
   ii. safety precautions

3. Describe the operation and location of fuel delivery components.
   i. electrical fuel pumps
      - rotary
      - positive displacement
   ii. electrical (control circuits)

4. Describe procedures to replace pumps.

5. Describe procedures to pressure test and repair fuel systems.

6. Describe procedures to clean fuel delivery system.
   i. intake system;
   ii. fuel injector(s)

Practical Requirements:

1. Check fuel system delivery and operation while observing safety precautions.

2. Pressure test and repair fuel systems.

3. Perform fuel injection cleaning.

SV2220 Emission Control

Learning Outcomes:

- Demonstrate knowledge of the procedures used to identify, test, remove, service and replace emission control systems or components.

Duration: 45 Hours

Pre-Requisite(s): SV2235

Objectives and Content:

1. Identify and describe the components and their operating principles in an emission control system.
    i. crankcase (ventilation)
        - positive
        - opened and closed
    ii. air injectors
        - secondary
        - pulsed secondary
    iii. catalytic converters (types and functions)
        - pellet type
        - monolithic type
        - 2-way
        - 3-way
        - gases produced
    iv. EGR (exhaust gas recirculation)
        - positive back pressure valve
        - negative back pressure valve
        - delta back pressure valve
        - port gas recirculation valve
        - digital
        - linear
        - EVAP system components

2. Describe procedures to test emission control systems recommended under provincial guidelines and vehicle manufacturers' specifications.
    i. EGR systems
    ii. PCV
    iii. converter

3. Describe the gases produced as a result of combustion.

4. Identify testing equipment used to inspect, test and repair emission control systems and describe the procedures to use them.
    i. scope
    ii. gas analysis
    iii. scan tool
    iv. EVAP tester

Practical Requirements:

1. Diagnose and repair emission systems while maintaining industry standards.

SV2235 Fuel Injection Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose problems in gasoline fuel systems.
  Demonstrate knowledge of the procedures used to service gasoline fuel systems.

Duration: 45 Hours

Pre-Requisite(s): SV2017

Objectives and Content:

1. Describe fuel injection system components and their functions.
   i. single
   ii. multiple

2. Describe the design and function of major EFI (Electronic Fuel Injection) components.
   i. port fuel injection systems
      - multiport
      - sequential
      - continuous
   ii. injectors
      - construction
      - cold start
   iii. pressure regulators
      - TBI (Throttle Body Injection)
      - Port
   iv. throttle bodies
   v. air flow sensors
   vi. speed density system

3. Describe procedures to inspect and test fuel injection systems.
   i. customer complaint interpretation

ii. preliminary checks
iii. cylinder balance test
iv. fuel pressure test
v. injector test
vi. road test
vii. procedure to clean a flooded engine

4. Describe procedures to repair or replace fuel injection systems.

Practical Requirements:

1. Perform fuel pressure test.

2. Perform a cylinder balance test.

3. Perform an injector test.

SV2250 Alternative and Variable Fuels

Learning Outcomes:

- Demonstrate knowledge of other types of fuels used in combustion engines.
- Demonstrate knowledge of components used in combustion engines.
- Demonstrate knowledge of the safety factors that must be followed when working on alternative fuelled vehicles.

Duration: 15 Hours

Pre-Requisite(s): Block I

Objectives and Content:

1. Describe alternative fuels and explain their advantages and disadvantages.
    i. alternative fuels
        - LPG (Liquefied Petroleum Gas)
        - hydrogen
        - methane
        - compressed natural gas
        - licensing
        - legal aspects
        - inspect, test and repair
        - emission reduction
    ii. variable fuels
        - principles
        - components
    iii. hybrids

2. Describe the components used in alternative-fueled vehicles.
    i. LPG vehicles
    ii. compressed natural gas vehicles
    iii. electric vehicles
    iv. hybrid electric vehicles

- regenerative braking systems

v. fuel cell-powered vehicles

3. Describe the safety related factors that must be followed when working on alternative-fueled vehicles.

Practical Requirements.

None.

WD2331 GMAW Welding (MIG)

Learning Outcomes:

- Demonstrate knowledge of the procedures used to operate MIG welding equipment to industrial safety standards as needed for various motorized equipment.

Duration: 30 Hours

Pre-Requisite(s): Block I

Objectives and Content:

1. Identify equipment/material used in MIG welding.
    i. equipment
    ii. shielding gases
    iii. filler wire

2. Describe procedures to operate MIG welding equipment to industrial standards as needed for various motorized equipment.
    i. performing basic MIG welding
        - advantages of MIG welding
        - types of MIG welding
        - proper penetration
    ii. ensuring safety
        - electrical system cautions when MIG welding
        - location of ground cables
        - possible bearing damage from welding
        - possible computer and electrical accessory damage from welding
        - procedures to prevent electrical and bearing damage
    iii. setting-up and shutting-down equipment

Practical Requirements:

1. Weld using MIG equipment.

2. Perform set up and shut down procedures.

BLOCK III

SV1226 Manual Steering

Learning Outcomes:

- Demonstrate knowledge of the types and components of steering gear.
- Demonstrate knowledge of the procedures used for the maintenance and repair of steering linkage.

Duration: 10 Hours

Pre-Requisite(s): Block II

Objectives and Content:

1. Identify and describe steering gears.
    i. types
        - cam and lever (identification only)
        - worm and roller (identification only)
        - recirculating ball
        - rack and pinion
    ii. operation
    iii. ratio

2. Describe procedures to disassemble, assemble, test and adjust steering gears.
    i. performing overhaul and adjustment procedures
    ii. identifying problems
    iii. testing
    iv. performing failure analysis

3. Identify steering linkage components.

4. Explain steering geometry.

5. Describe procedures to disassemble, assemble, test and adjust steering linkages.
    i. toe setting (without alignment machine)
    ii. testing
    iii. centering steering wheel
    iv. performing linkage adjustments

Practical Requirements.

None.

SV1610 Steering Columns

Learning Outcomes:

- Demonstrate knowledge of all the major parts of the steering column.

Duration: 15 Hours

Pre-Requisite(s): SV2161

Objectives and Content:

1. Describe the construction and functions of steering columns and their components.
    i. steering columns and shafts
    ii. air bags
    iii. standard column
    iv. tilt column
    v. telescopic
    vi. turn signal
    vii. cruise
    viii. ignition switch
    ix. horn
    x. dimmer
    xi. lights
    xii. radio
    xiii. clock springs
    xiv. steering locks

2. Describe procedures to remove, disassemble and reassemble steering columns and components.
    i. disarming, removing, storing and installing air bags
    ii. removing and replacing steering wheels
    iii. removing and replacing clock springs
    iv. servicing shaft and coupling
    v. servicing energy absorbing steering columns
    vi. removing and replacing steering locks

3. Describe procedures to identify problems with steering columns.

Practical Requirements:

1. Remove, disassemble and reassemble a steering column.

SV2021 Power Steering

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose, maintain, repair and replace power steering components.

Duration: 25 Hours

Pre-Requisite(s): SV1226

Objectives and Content:

1. Identify and describe power steering components and their functions.
    i. valves
    ii. pumps
    iii. steering boxes
    iv. hoses
    v. switches

2. Identify and describe power steering gear assemblies.
    i. gear type integral
    ii. linkage
    iii. rack and pinion
    iv. fluids and adjustments
    v. hydraulic principles
    vi. control valves

3. Describe procedures to remove, disassemble, assemble and adjust power steering gear assembly.
    i. removing and installing
    ii. inspecting, testing and repairing
    iii. performing failure analysis

4. Identify and describe power steering pumps.

i. types
ii. drives

5. Describe procedures to remove, disassemble, and assemble power steering pumps.
   i. removing and installing
   ii. inspecting, testing and repairing
   iii. performing failure analysis

6. Describe procedures to diagnose power steering system problems.
   i. checking for leaks
   ii. testing pressure flow
   iii. performing noise diagnosis
   iv. performing failure analysis

Practical Requirements:

1. Remove and install a steering gear assemble.

2. Disassemble, assemble and adjust a power steering gear box assembly.

3. Disassemble and assemble a power steering pump.

4. Diagnose power steering systems.

SV2030 Electronic Power Steering

Learning Outcomes:

- Demonstrate knowledge of the function of various electronic power steering components.
- Demonstrate knowledge of the procedures to diagnose service and/or replace electronic power steering systems.

Duration: 15 Hours

Pre-Requisite(s): SV2021

Objectives and Content:

1. Identify electronic power steering components and their functions, and explain their principles of operation.
    i. components
    ii. principles of operation
        - four wheel steering
        - computer
        - sensor inputs
        - outputs – control of hydraulics
        - operating modes

2. Describe procedures to test, service and/or replace electronic power steering systems.
    i. diagnostic strategy
    ii. quick tests and visual inspections
    iii. trouble codes
    iv. test equipment

Practical Requirements.

None.

SV2041 Wheel Alignment

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose wheel alignment problems.
- Demonstrate knowledge of the procedures used to properly perform a wheel alignment.

Duration: 40 Hours

Pre-Requisite(s): SV2021

Objectives and Content:

1. Define wheel alignment terminology.
    i. caster
    ii. camber
    iii. steering axis inclination
    iv. included angle
    v. toe-in
    vi. tracking
    vii. positive and negative scrub radius
    viii. setback

2. Describe service manual procedures to pre-inspect vehicles for wheel alignment.

3. Identify and explain various alignment procedures.
    i. shim pack
    ii. eccentric
    iii. slotted adjustment
    iv. thread adjustment

4. Explain how to identify alignment problems.
    i. tire wear
    ii. handling problems

5. Describe procedures to perform two-wheel and four-wheel alignment.

Practical Requirements:

1. Pre-inspect vehicle for wheel alignment.

2. Perform a four wheel alignment.

SV2121 Anti-Locking Brake System and Traction Control

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose ABS or traction control systems.
- Demonstrate knowledge of the procedures used to service and repair ABS or traction control systems.

Duration: 40 Hours

Pre-Requisite(s): Block II

Objectives and Content:

1. Describe components and functions of ABS and traction control systems.
    i. computer
    ii. hydraulic modulator
    iii. wheel speed input
    iv. sensor circuit
    v. hydraulic channels
    vi. automatic stability control

2. Describe operating principles and safety concerns of ABS and traction control systems.
    i. safety concerns
    ii. benefits and limitations of ABS
        - coefficient of friction: tire to road
        - maximum braking versus maximum steering
        - ABS stopping ability with different surfaces
        - operating modes of a brake system: apply, hold, release
        - cycling speeds of ABS
        - driver perception of ABS
        - construction of basic system: integral or add-on

3. Describe system variations.
    i. types of wheel speed calculation (wheel speed averaging)

ii. hydraulic outputs
- front/rear split
- diagonal split
- individual control
- system control
- computers
- sensors

iii. computer EBCM (electronic brake control module) feeds and grounds

iv. computer inputs (wheel speeds, or vehicle speed)
- brake switch
- 4-wheel drive position
- modulator inputs to EBCM
- diagnostic request

v. computer outputs
- hydraulic modulator
- ABS warning lights
- diagnostic output

vi. wheel speed sensor construction
- operating frequency
- mounting methods and air gaps

4. Describe hydraulic modulator construction.
- integral system
- add-on

5. Describe system self-diagnostics.
   i. self-checks on start-up
   ii. continuous monitoring
   iii. failure modes and actions
   iv. trouble codes
   v. wheel speed sensor diagnostics
   - vehicle moving
   - vehicle not moving

6. Describe diagnostic procedures: logical approach to problem solving.

7. Describe procedures to distinguish between what is normal and what is not.

i. mechanical condition of brake system
ii. system cut-out speeds (no ABS below a pre-determined speed)
iii. causes of brake grabbing or lock-up at low speed (a non-ABS problem)

8. Describe service procedures for a hydraulic system.
   i. checking brake fluid levels
   ii. bleeding brakes
   iii. selecting acceptable brake fluid type
   iv. brake fluid flushes
   v. checking for leaks

9. Describe precautions when performing non-ABS service.
   i. replacing wheel studs
   ii. using top quality parts
   iii. following electric welding precautions
   iv. replacing tires (air pressure)

10. Describe procedures to service or repair speed sensor circuits.
    i. replacing or adjusting sensors
    ii. repairing speed sensor wiring (repairs and locations)
    iii. reprogramming and changing speed sensor buffer (DRAC) (changes to accommodate different tire sizes on trucks)
    iv. replacing speed sensor components on non-serviceable type wheel bearings

11. Identify components used with traction controls.
    i. manual controls
    ii. indicator lights
    iii. separate hydraulic actuators

12. Describe methods of achieving traction control (reduction of positive wheel slip).
    i. selective application of brakes on spinning drive wheels
    ii. throttle control
    iii. torque reduction; timing retard; fuel cutback or cut-off
    iv. operating speeds

13. Describe procedures to diagnose and repair ABS/traction control systems on light duty motor vehicles.

Practical Requirements:

1. Check wheel speed sensor output.

2. Connect a scan tool and check system for codes and read data.

3. Perform resistance checks on system components.

4. Perform bleeding procedures for a 4-wheel ABS system.

5. Replace ABS components.

SV2155 Power-Actuated Accessories

Learning Outcomes:

- Demonstrate knowledge of the procedures used to identify power-actuated accessories.
- Demonstrate knowledge of the procedures used to diagnose problems with power-actuated accessories.
- Demonstrate knowledge of the procedures used to service and repair power-actuated accessories.

Duration: 60 Hours

Pre-Requisite(s): Block II

Objectives and Content:

1. Describe operation of power-actuated accessories.
    - i. power antenna
    - ii. convertible top
    - iii. cruise control (speed)
        - vacuum-operated
        - electronically operated
    - iv. power windows
    - v. power seats
    - vi. sun roof (moon)
    - vii. trailer brake hook-up
    - viii. power door locks
    - ix. power trunk opener and closer
    - x. power mirrors
    - xi. heated mirrors and windows
    - xii. RAP (retained accessory power) systems (memory)
    - xiii. remote control for locks, etc.
    - xiv. battery protection systems: timer disconnects
    - xv. comfort and convenience items
        - radio and antennas

- cigarette lighter
- 12-volt power outlets (acc)
- GPS
- DVD players
- backup cameras and sensors
- trailing cruise
- self-parking

xvi. theft deterrent systems
- types
- operation

xvii. seat belt systems
xviii. windshield wipers
xix. remote starter
xx. parking aid
xxi. cruise control

2. Describe the procedures to service power-actuated accessories.
   i. reviewing diagnostic strategy
   ii. verifying customer concerns
   iii. performing preliminary checks
   iv. using published diagnostic system checks
   v. checking for service bulletins
   vi. using trouble code diagnostics if codes are present
   vii. using system diagnosis
   viii. using diagnostics suitable for intermittent problems
   ix. verifying repair

3. Describe procedures used to service power actuated accessories controlled by the following.
   i. solenoids
   ii. series-wound motors
   iii. permanent magnet (PM) motors
   iv. pneumatic controlled

4. Describe procedures to diagnose and repair problems associated with wind, water, and dust leaks, as well as rattles.

Practical Requirements:

1. Locate feeds and grounds, and all components used in a power window or power door lock system.

2. Perform diagnostic tests on a power door lock or power window system.

3. Diagnosis power actuated accessories system failure.

SV2161 Air Bag Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to identify, test, diagnose and repair air bag systems and their components.

Duration: 25 Hours

Pre-Requisite(s): Block II

Objectives and Content:

1. Describe SIR (Supplementary Inflatable Restraint) system design, operation and components.
    i. system design and operation
        - system design
        - SDM (sensing and diagnostic module) systems
        - DERM (diagnostic energy reserve module) systems
        - difference between DERM and SDM systems
        - active and passive
        - occupant protection in a crash
        - system operation
    ii. system components
        - inflator module
        - SIR clock spring (coil in steering wheel)
        - warning lamp
        - arming sensors
        - discriminating sensors
        - wiring harness
        - shorting devside impact (SIR)
        - seatbelt retractors
2. Describe procedures to service SIR systems.
    i. disabling the SIR
    ii. enabling (connecting) the SIR as per OEM manual
    iii. following precautions when windshields are replaced

iv. handling components (precautions)
v. electrostatic discharge (ESD) – static electricity (precautions)
vi. using special tools for SIR service
vii. performing wiring repairs
viii. disposing of inflator module (air bag) and scrapping vehicle
ix. inspecting components after a crash
- steering column dimension check

x. replacing sensors

3. Describe procedures to diagnose SIR system problems.
   i. performing SIR diagnostic check
      - trouble codes
      - scan tool use
   ii. interpreting service information

Practical Requirements:

1. Deactivate and reactivate an SIR system.

2. Remove and replace an airbag.

3. Perform a SIR diagnostic check.

4. Diagnose an SIR system failure.

BLOCK IV

SV2051 Engine Clutches

Learning Outcomes:

- Demonstrate knowledge of the operation of the major components of clutches.

Duration: 25 Hours

Pre-Requisite(s): Block III

Objectives and Content:

1. Identify engine clutch components and their functions.
    i. clutch disc
        - single and multi-disc
        - facings
        - cushioning device
        - torsional device
    ii. pressure plate assembly
        - types
        - coil spacing
        - semi-centrifugal
        - diaphragm spacing
    iii. clutch release bearing and fork (types)
    iv. clutch housing and clutch shaft
    v. clutch linkage and pedal
        - types
        - mechanical
        - hydraulic
        - master and slave cylinders
        - adjustments (bleeding)

2. Explain the principles of operation of engine clutch components and safety concerns associated with them.
    i. pressure plate assembly
    ii. pilot bearings and bushings
    iii. face (condition – re-facing)
    iv. flywheel and ring gear

3. Describe the procedures to diagnose the following clutch faults and how to make adjustments for proper operation.
    i. chatter
    ii. slippage
    iii. noises
    iv. transmission alignment
    v. transmission mount condition

4. Describe the procedures to remove and replace engine clutch components.
    i. clutch release bearing and fork
    ii. transmission

NOTE: To service and repair clutches, some vehicles require that the engine be removed. Use service manual for vehicle being repaired.

Practical Requirements:

1. Diagnose and adjust a clutch for proper operation.

2. Remove, check, reinstall and adjust a clutch assembly in a rear wheel drive or front wheel drive vehicle (transaxle or transmission removal only).

3. Perform a flywheel run-out check.

SV2061 Manual Transmissions and Trans-Axles

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose problems relating to manual transmissions.
- Demonstrate knowledge of the procedures used to service and overhaul manual transmissions.

Duration: 40 Hours

Pre-Requisite(s): Block III

Objectives and Content:

1. Identify and describe components of manual transmissions and trans-axles.
    i. gears
        - gear terminology
        - gear mounting
        - gear ratios
        - gear selection
    ii. transmissions and trans-axles
        - types
        - synchromesh
    iii. synchronizers
    iv. detent and interlock
    v. trans-axle final drive
    vi. shifting mechanisms
    vii. lubricants
    viii. seals and sealants

2. Explain the basic operation of manual transmissions and trans-axles.

3. Describe procedures to service manual transmissions and trans-axles.
    i. using special tools
    ii. diagnosing transmission/trans-axle problems and causes

iii. servicing transmissions and trans-axles
iv. overhauling procedures
v. disassembling and reassembling transmissions and trans-axles

Practical Requirements:

1. Service manual transmissions and transaxles.

2. Disassemble, inspect, repair, assemble and make adjustments to a manual transmission and or a manual transaxle.

SV2075 Automatic Transmissions and Trans-Axles

Learning Outcomes:

- Demonstrate knowledge of the operation of the major parts of automatic transmissions and trans-axles.
- Demonstrate knowledge of the procedures used to diagnose problems related to automatic transmissions.

Duration: 90 Hours

Pre-Requisite(s): Block III

Objectives and Content:

1. Identify and describe components (types, design and materials) of automatic transmissions and trans-axles.
    i. planetary gear sets
    ii. oil pumps
    iii. pressure regulator valves
    iv. servos
    v. bands
    vi. clutches
    vii. spool valves
    viii. balance valves
    ix. manual control valves
    x. shifter valves
    xi. governors
    xii. throttle valves
    xiii. accumulators
    xiv. valve body
    xv. up shift valves/downshift valves
    xvi. torque converters (construction)

2. Explain the principles of operation of automatic transmissions and trans-axles.
    i. torque converters

ii. transmission cooling and lubrication
iii. power flow
iv. multiple speed
v. manual control mechanisms
vi. final drive

3. Describe the procedures to diagnose problems in automatic transmissions and trans-axles.
   i. pressure test
   ii. problem diagnosis
   iii. road test

4. Describe procedures to repair automatic transmissions and trans-axles using the manufacturer's manual.

5. Describe procedures to maintain automatic transmissions and trans-axles.
   i. selecting fluids
   ii. checking fluids
      - level
      - cleanliness
      - factors affecting life of fluids
   iii. changing fluids and filters
   iv. replacing external gaskets and seals
   v. adjusting band
   vi. adjusting throttle and shift linkage

6. Describe the procedures to remove and install automatic transmissions and trans-axles and components.
   i. changing electrical components
   ii. removing, checking and replacing torque converters
   iii. removing and installing automatic transmissions and trans-axles

7. Identify towing and pushing precautions to follow when removing and installing automatic transmissions and trans-axles.

Practical Requirements:

1. Perform maintenance service on automatic transmissions and transaxles as it is recommended by the vehicle manufacturer.
    i. change fluid and filters
    ii. adjust bands
    iii. inspect for leaks

2. Diagnose problems in automatic transmissions and/or transaxles.

3. Remove and install automatic transmission/transaxles.

4. Dismantle, inspect, repair and assemble automatic transmissions and/or transaxles.

5. Perform a transmission pressure test.

6. Flush a torque converter and transmission cooling system.

SV2091 Electronic Transmission Controls

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose problems relating to electronic transmission control systems.
- Demonstrate knowledge of the procedures used to service and repair electronic transmission control systems.

Duration: 25 Hours

Pre-Requisite(s): SV2075

Objectives and Content:

1. Describe the components and functions of electronic transmission controls.
    i. electronic transmission controls
        - computer systems used with automatic transmissions
        - components controlled by computer
        - computers used: dedicated computer, PCM (Powertrain Control Module), etc.
        - computer inputs
        - computer outputs
        - solenoids (state change)
        - P.W.M. (Pulse Width Modulated) solenoids and force motors
    ii. hydraulic components used with computer controls
        - hydraulic versus electronic gear selection
        - shift valves
        - converter control circuits
        - pressure control circuits

2. Describe procedures to diagnose, and repair or replace transmissions electronic control systems.
    i. diagnosing problems
        - diagnostic strategy
        - use of self-diagnostics

- use of scan tool
- road testing and use of check charts
- failure modes
- pressure tests

ii. repairing and adjusting

- wiring repairs
- clearing of trouble codes
- clearing or resetting of adaptive memory after repairs
- reprogramming

iii. replacing transmission components

Practical Requirements:

1. Diagnose and repair transmissions with electronic control systems.

SV2101 Transfer Cases and Hub Assemblies

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose problems relating to transfer cases and hub assemblies.
- Demonstrate knowledge of the procedures used to service and repair transfer cases and hub assemblies.

Duration: 25 Hours

Pre-Requisite(s): Block III

Objectives and Content:

1. Identify and describe components of transfer cases, hub assemblies, and locking axles, and explain their function.
    i. types of transfer cases
        - part-time four-wheel drive
        - full-time four-wheel drive
        - electronic controlled shift
        - all-wheel drive systems
    ii. types of hub accessories
        - manual
        - automatic
    iii. types of locking axels
        - manual operated
        - vacuum operated
        - electrically operated

2. Describe procedures to diagnose problems in a transfer case.
    i. check lubricants
        - levels
        - quality

3. Describe procedures to service various types of front hub assemblies and locking axle systems on four-wheel drive vehicles.
    i. automatic locking type
    ii. manual locking type
    iii. axle locking type

Practical Requirements:

1. Diagnose problems in a transfer case.

2. Remove, inspect, repair, assemble and reinstall a transfer case assembly.

3. Service front hub assembly on four wheel drive vehicles.

SV2111 Differential and Axle Assemblies

Learning Outcomes:

- Demonstrate knowledge of the procedures used to diagnose problems relating to differential and axle assemblies.
- Demonstrate knowledge of the procedures used to service and repair differential and axle assemblies.
- Demonstrate knowledge of the procedures used to overhaul differential and axle assemblies.

Duration: 25 Hours

Pre-Requisite(s): Block III

Objectives and Content:

1. Identify and describe differential assemblies and explain their operating principles.
    i. differential (standard)
        - types (removable and integral carrier)
        - components
        - adjustments
        - lubrication
        - gear ratio
        - theory of operation: operating principles
    ii. differential (limited slip/locking)
        - types
        - adjustments
        - lubrication
        - theory of operation: operating principles

2. Describe procedures to evaluate the condition of a differential to determine its serviceability.
    i. diagnose noise origins

3. Describe procedures to service a differential assembly.

i. removing and replacing assembly
ii. replacing pinion seal

4. Describe procedures for overhauling a differential assembly.

5. Identify types of axles and rear axle bearings and retainers.
   i. types of axles
      - semi-floating
      - three-quarter floating
      - full-floating
   ii. types of rear axle bearings and retainers
      - straight roller type
      - tapered roller type
      - ball bearing type

6. Describe procedures for servicing axles, bearings and seals.
   i. attaching axle in the housing
      - C-locks
      - axle retainer plate
   ii. measuring and adjusting axle end play

Practical Requirements:

Practical skills enhance the apprentices' ability to meet the objectives of this course.

1. Remove, inspect, repair and assemble a differential assembly.

SV2271 Provincial Government Inspections (MVI)

Learning Outcomes:

- Demonstrate knowledge of the procedures to perform provincial safety inspections.

Duration: 10 Hours

Pre-Requisites: Block III

Objectives and Content:

1. Explain the purpose of a provincial government safety inspection and its history.
    i. purpose of inspection
    ii. people or authorities involved in inspections
    iii. responsibilities of those involved

2. Describe provincial government safety inspection procedures.
    i. inspection instructions
    ii. specifications and tolerances
    iii. documentation of inspections
        - inspection forms
        - reject stickers
        - stickers used when vehicle passes inspection
        - liability – unsafe vehicles

Practical Requirements:

1. Perform government motor vehicle safety inspection.

BLOCK V

SV1110 Ozone-Depletion Substances

Learning Outcomes:

Demonstrate knowledge of regulations on ozone-depleting substances.

Duration: 7 Hours

Pre-Requisite(s): Block IV

Objectives and Content:

1. Describe procedures for handling ozone-depletion substances (refrigerants) used in motor vehicles as per Regulations.

2. Identify the Act relating to ozone-depletion substances regulations.

NOTE: **Curriculum and certification supplied by HRAI are to be delivered by instructors who are certified to teach ODS courses for motive power occupations.**

Practical Requirements:

None.

SV2144 Automotive Heating Systems

Learning Outcomes:

- Demonstrate knowledge of procedures to inspect, diagnose, service, and repair components of the auto heating system.

Duration: 10 Hours

Pre-Requisite(s): Block IV

Objectives and Content:

1. Identify automotive heating system components and explain their purpose and operating principles.
    i. components
    ii. operating principles
    iii. methods of temperature control
        - solenoid controlled valves
        - manual controlled valves
        - vacuum controlled valves
        - blend door control

2. Describe procedures to diagnose and correct problems with the following heating system components.
    i. controls – vacuum, manual, and electronic
    ii. hoses (carrying heated coolant)
    iii. heater core (blockage)
    iv. blend doors
    v. inlet air filters (ventilation)

3. Describe procedures to diagnose the following heating system problems.
    i. lack of heat
    ii. excessive heat
    iii. coolant (hot) leaks

Practical Requirements:

1. Check operation of heater and vent controls

2. Flush a heater core and check water flow

SV2145 Air Conditioning Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures to inspect, diagnose, service, and repair air conditioning systems.

Duration: 30 Hours

Pre-Requisite(s): SV2144

Objectives and Content:

1. Identify and describe the principles of refrigeration.
    - i. process of heat transfer
        - convection
        - radiation
        - evaporation
    - ii. states of matter (structure)
        - solid
        - liquid
        - gas
    - iii. measurement of heat
        - latent heat
        - specific heat
    - iv. pressure
        - atmospheric pressure
        - pressure measurement
        - temperature and pressure
    - v. process of refrigeration
        - heat flow
        - heat absorption
        - pressure and boiling points
    - vi. ton of refrigeration/BTU per hour

2. Identify automotive air conditioning system components, and explain their purpose and operating principles.
    i. refrigerants
        - handling safety
        - R-12, R-134 and blends
        - temperature/pressure relationship
        - environmental concerns
    ii. air conditioning system types
        - cycling clutch/orifice tube
        - variable displacement/orifice tube
        - cycling clutch/thermostatic expansion valve
        - variable displacement/thermostatic expansion valve
    iii. air conditioning controls
        - manual control systems
        - components of manual control systems
        - automatic temperature control systems
        - components of auto temperature air conditioning systems
    iv. basic refrigeration circuit
        - basic circuit
        - evaporator
        - compressor
        - condenser
        - metering devices
        - orifice tubes
        - expansion valves
        - receiver/dryer
        - accumulator/dryer
    v. compressors
        - fixed displacement compressors
        - variable displacement compressors

3. Describe procedures to diagnose problems with automotive air conditioning systems.
    i. diagnosing air conditioning system problems
        - function test
        - performance test
        - gauge and manifold sets

ii. identifying objectionable odors in air conditioning systems
- cause of odor
- removal of biological cause
- after blow systems for automotive air conditioning fan

4. Describe procedures to service automotive air conditioning systems.
   i. servicing air conditioning systems
      - controls
      - hoses
      - wiring
   ii. servicing refrigerant systems
      - refrigerant recovery and recycling
      - system evacuation and leak testing
      - recharging
      - component replacement
      - installing filters in contaminated refrigerant systems
      - refrigerant oils
   iii. servicing compressors – without discharge
      - clutch repairs
      - pulley bearing replacement
   iv. servicing compressors – system discharge
      - shaft seal replacement
      - switch replacements
      - control valve and pressure relief valve replacement

5. Describe procedures to convert air conditioning systems from R-12 refrigerant to R-134 or other accepted refrigerants.
   i. identifying factors affecting type of conversion needed
   ii. proceeding with basic conversion

Practical Requirements:

1. Diagnose and correct problems with automotive air conditioning systems

2. Recover, recycle, vacuum and recharge an A/C system.

3. Service the clutch on an A/C compressor.

SV2171 Engine Diagnostics (Gasoline)

Learning Outcomes:

- Demonstrate knowledge of procedures to diagnose problems when engines fail to perform properly.
- Demonstrate knowledge of problematic symptoms and procedures to follow to isolate problems.

Duration: 45 Hours

Pre-Requisite(s): Block IV

Objectives and Content:

1. Describe procedures to diagnose the following problems and replace components when gasoline engines fail to perform properly.
    i. oil consumption
    ii. coolant consumption
    iii. oil contamination
    iv. coolant contamination
    v. oil pressure
        - low
        - high
    vi. cooling/heating problems
    vii. engine noise
    viii. valve timing
    ix. vacuum leaks

2. Identify testing equipment used to diagnose problems when gasoline engines fail to perform properly
    i. positive and negative pressure testing gauge
    ii. compression gauge
    iii. leak down tests
    iv. stethoscope
    v. engine analyzer

vi. exhaust gas analyzer
vii. scan tool
viii. multi-meters
ix. noid light
x. temperature sensing tools
xi. using dyes to find leaks

3. Describe procedures to diagnose gasoline engine problems based on the following symptoms.
   i. engine will not crank
   ii. engine cranks slowly, but will not start
   iii. engine cranks normally, but will not start
   iv. engine starts, but will not continue to run at idle
   v. engine starts, idles rough without abnormal smoke or noise
   vi. engine starts, idles rough with abnormal smoke and noise
   vii. engine misfires above idle, but idles correctly
   viii. engine will not return to idle
   ix. fuel leaks on ground, engine runs normally
   x. noticeable loss of power
   xi. noise or rap from one or more cylinders
   xii. above normal combustion noise with excessive black smoke
   xiii. engine noise
   xiv. engine overheats/underheats
   xv. instrument panel oil warning light on at idle
   xvi. engine will not shut off with key
   xvii. combustion gas leakage

Practical Requirements:

1. Check cylinder compression.

2. Check engine oil pressure.

3. Perform engine diagnostics using specialized equipment.

4. Perform a cylinder leak down test.

5. Perform an engine vacuum test.

SV2181 Engine Removal and Installation

Learning Outcomes:

- Demonstrate knowledge of procedures used to remove and reinstall engines to manufacturer's specifications.
- Demonstrate knowledge of procedures used to and inspect parts for wear.

Duration: 20 Hours

Pre-Requisite(s): Block IV

Objectives and Content:

1. Describe procedures to remove an engine.
    i. draining systems
        - oil
        - coolant
    ii. disconnecting and identifying electrical wires, hydraulic lines, and accessories hood
    iii. disconnecting engine from transmission
    iv. supporting the transmission
    v. selecting suitable engine hoist
    vi. removing engine from chassis
    vii. following precautions
    viii. following service manual recommendations
    ix. removing and installing accessory drive belts

2. Describe procedures to inspect parts for wear.
    i. inspecting engine mounts
    ii. checking for loose or worn parts
    iii. checking linkages operation

3. Describe procedures to install engines.
    i. installing procedures
    ii. aligning parts properly (knowing the importance)
    iii. using torque attaching fasteners

iv. reconnecting all attaching components and accessories
v. refilling system fluids

4. Describe procedures to test engine operation.
   i. starting engine
   ii. checking oil pressure
   iii. checking for leaks
   iv. checking for abnormal noise
   v. following manufacturer's recommendations

Practical Requirements:

1. Remove engines from a vehicle, following manufacturers recommended procedures.

2. Install engines in vehicles using manufacturers recommended procedures.

3. Start and run engine.

SV2820 Diesel Engine Principles

Learning Outcomes:

- Demonstrate knowledge of the working principles of a diesel engine.
- Demonstrate knowledge of the operation of the components of a diesel engine.
- Demonstrate knowledge of the various systems on a diesel engine.
- Demonstrate knowledge of procedures to inspect and test delivery pumps and injectors.

Duration: 30 Hours

Pre-Requisites: Block IV

Objectives and Content:

1. Describe the design, construction and operation of diesel engine components.
    i. fuel delivery pump
    ii. tanks, lines and filters
    iii. water separators
    iv. hydraulic injectors
    v. in-line injector pumps
    vi. distributor injector pumps
    vii. fuel injectors
        - mechanical
        - electronically controlled
    viii. governors

2. Describe the basic operating principles of a diesel engine assembly.
    i. compression ignition (compression ratio)
    ii. fuel efficiency of diesel engine
        - high compression
        - more heat energy per unit of fuel
    iii. comparison of strength of engine parts and weight
        - gasoline versus diesel

iv. two-stroke and four-stroke engines
v. combustion chambers
    - direct injection
    - pre-combustion chamber
vi. head gasket considerations
    - compression or combustion space adjusted by head gasket
    - thickness
vii. crankcase vent systems
    - vacuum regulator valves

3. Describe diesel fuel characteristics.
    i. cetane rating
    ii. grades
    iii. specific gravity – quality, heat content
    iv. sulfur content
    v. clean fuel requirements (importance)

4. Describe fuel systems.
    i. fuel supply systems
        - tank
        - lines
        - filter
        - water separator
        - supply pumps
        - electric
        - mechanical - diaphragm
    ii. injection systems
        - types
        - in-line pumps
        - distributor type pumps
        - governors
        - injector nozzles
        - hole types
        - pintle types

5. Describe the diesel EGR system.

i. purpose of having an EGR system on diesel engine
ii. methods used to control EGR
    - vacuum switches or valves
    - ECM controlled
    - EPR (exhaust pressure regulator) valves

6. Describe the diesel lubrication system.
    i. engine oil
        - energy-conserving
        - API classifications
        - viscosity classifications

7. Describe cold starting procedures and running aids.
    i. glow plug systems
        - 6-12 systems
        - systems controls
    ii. cold start timing advance
    iii. fuel heaters
    iv. heated intake air systems

8. Describe procedures to inspect and test delivery pumps and injectors using proper tools and equipment.
    i. testing and adjusting injectors
    ii. identifying diesel fuel system faults

Practical Requirements:

None.

SV2830 Diesel Engine Diagnostics

Learning Outcomes:

- Demonstrate knowledge of procedures to identify symptoms and possible problems related to engine components.
- Demonstrate knowledge of procedures to test engine components.
- Demonstrate knowledge to diagnose problems related to electrical components.

Duration: 30 Hours

Pre-Requisite(s): SV2820

Objectives and Content:

1. Describe procedures to identify the following symptoms and possible problems.
    i. engine will not crank over
    ii. engine cranks slowly, but will not start
    iii. engine cranks normally, but will not start
    iv. engine starts, but will not continue to run
    v. engine starts, but idles rough
    vi. engine misfires above idle, but idles correctly
    vii. fuel leaks, but engine runs normally
    viii. loss of power
    ix. noise or rap from cylinders
    x. abnormal combustion noise with black smoke
    xi. engine overheats
    xii. instrument panel oil warning light turns on at idle
    xiii. engine will not shut off with key
    xiv. presence of black/white/blue smoke

2. Describe the procedures to test the following fuel supply system components.
    i. tank
    ii. lines
    iii. pumps
    iv. filters and water separators

v. valves
vi. accelerator controls
vii. fuel solenoids

3. Describe the procedures to test diesel engine fuel injectors.
   i. pump and injector system operation
   ii. nozzle test
   iii. inspection procedures

4. Describe the procedures to perform the following tests on diesel engine components.
   i. compression test
   ii. leak down test
   iii. cranking speed test
   iv. coolant leak test
   v. combustion gas leakage test

5. Describe the procedures to diagnose problems with electrical/electronic components.
   i. fuel heaters – test operation
   ii. glow plugs
      - test operation
      - controls
      - test glow plug electrical systems
   iii. injection pumps
      - electrical control
   iv. electronic-controlled injectors and related systems
   v. heated air intake systems

Practical Requirements:

1. Perform diagnostics on a diesel engine using specialty tools.

2. Perform a compression test on a diesel engine.

3. Test the operation of a diesel engine cold start system.

4. Perform a fuel pressure test on a diesel engine.

SV2840 Diesel Engine Repair

Learning Outcomes:

- Demonstrate knowledge of procedures to service and repair diesel engine components.

Duration: 8 Hours

Pre-Requisite(s): SV2820

Objectives and Content:

1. Describe procedures to install head gaskets.

2. Describe procedures to service injection nozzles.

3. Describe procedures to adjust governors.
   i. manual control
   ii. electronic

4. Describe procedures to service electrical/electronic components.
   i. replacing glow plugs
   ii. servicing electrical/electronic controls

5. Describe procedures to service and replace pumps and filters.

Practical Requirements:

None.

SV2900 Engine Rebuilding (Gasoline)

Learning Outcomes:

- Demonstrate knowledge of procedures to disassemble, service, and reassemble cylinder head and cylinder block assemblies.

Duration: 60 Hours

Pre-Requisite(s): Block IV

Objectives and Content:

1. Describe procedures to disassemble a cylinder head

2. Describe procedures to inspect and service cylinder heads for defects and wear
    i. visual inspection
    ii. crack detection
    iii. measuring dimensions
    iv. valve and seat re-grinding
    v. following manufactures' recommendations and specifications

3. Describe procedures to reassemble a cylinder head
    i. cleaning
    ii. guide clearance
    iii. valve seating
    iv. valve height
    v. seals

4. Describe procedures to disassemble a cylinder block
    i. marking
    ii. ridge removal

5. Describe procedures to inspect and service the cylinder block and its components for defects and wear
    i. visual inspection
    ii. measuring dimensions

iii. de-glazing
iv. following manufactures' recommendations and specifications

6. Describe procedures to reassemble a cylinder block
   i. cleaning
   ii. piston clearances
   iii. ring gaps
   iv. bearing clearances
   v. end play
   vi. following manufactures' recommendations and specifications

Practical Requirements:

1. Disassemble cylinder head and its components.

2. Inspect and service cylinder head and its components according to manufactures specifications.

3. Reassemble cylinder head according to manufactures specifications.

4. Disassemble cylinder block and its components.

5. Inspect and service cylinder block and its components according to manufacturer's specifications.

6. Assemble cylinder block according to manufacturer's specifications.

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 a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

2.0 Entrance Requirements

2.1 Entry into the occupation as an apprentice requires:

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

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

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

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

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

3.0 Probationary Period

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

4.0 Termination of a Memorandum of Understanding

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated inSection14.

5.0 Apprenticeship Progression Schedule, Wage Rates and Advanced Training Criteria

Progression Schedule, Wage Rate and Advanced Training Criteria are stated in the specific occupational Plan of Training for each designated apprenticeship occupation.

Progression Schedule

Automotive Service 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 training ▪ Pass block 1 exam ▪ Minimum 1800 hours of combined relevant work experience and training	2nd Year
2nd	70%	▪ Completion of Block 2training ▪ Pass block 2 exam ▪ Minimum 3600 hours of combined relevant work experience and training	3rd Year
3rd	80%	▪ Completion of Block 3 training ▪ Pass block 3 exam ▪ Minimum 5400 hours of combined relevant work experience and training	4th Year
4th	90%	▪ Completion of Block 4 training ▪ Pass block 4 exam ▪ Completion of Block 5 Training ▪ Minimum 7200 hours of combined relevant work experience and training ▪ Sign-off of all workplace skills in apprentice logbook ▪ Pass certification exam	Journeyperson Certification

Wage Rates

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

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.

Automotive Service 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 2400 hours of relevant work experience and training	240
Block 3	▪ Minimum of 4000 hours of relevant work experience and training	230
Block 4	▪ Minimum of 5400 hours of relevant work experience and training	240
Block 5	▪ Minimum of 6960 hours of relevant work experience and training	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 their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

7.0 Periodic Examinations and Evaluation

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

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

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

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

8.0 Granting of Certificates of Apprenticeship

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

9.0 Hours of Work

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

10.0 Copies of the Registration for Apprenticeship

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

11.0 Ratio of Apprentices to Journeypersons

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

12.0 Relationship to a Collective Bargaining Agreement

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

13.0 Amendments to a Plan of Apprenticeship Training

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

14.0 Employment, Re-Employment and Training Requirements

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

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

14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.

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

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

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

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

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

15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training

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

E. Requirements for Red Seal Endorsement

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

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

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

   Or

   A total of 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.
- ensures a certified journeyperson is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Advanced Education and Skills.

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 block, provincial and 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.