Apprenticeship and Industry Training

Motorcycle Mechanic

Curriculum Guide

049 (2022)

Alberta

Apprenticeship and Industry Training

ALBERTA ADVANCED EDUCATION

Motorcycle mechanic : apprenticeship education program curriculum guide

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Motorcycle Mechanic
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COURSE OUTLINE

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding a sponsor. Sponsors guide apprentices, and support on-the-job learning through provision of mentorship. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution (PSI) – usually a college or technical institute.

To receive their post-secondary credential, apprentices must learn theory and skills, and they must pass examinations. Criteria for the program—including the content and delivery of technical training—are developed and updated by the Registrar.

The graduate of the Motorcycle Mechanic apprenticeship program is an individual who will be able to:

- repair and maintain motorcycles and ATVs which are powered with internal combustion engines
- comprehend work orders, technical bulletins and estimates, and relate the information to the job at hand
- interpret warranty policy in terms of service reports, component failures and analysis records
- when his/her journeyperson certificate has been earned, the Motorcycle Mechanic may opt to specialize in the repairing, rebuilding and servicing of any one or more of the many assemblies of the modern motorcycle
- have executive and supervisory opportunities in the motorcycle industry which are frequently available to trained and certified mechanics with above capabilities and motivation
- be able to familiarise him/her with the work experience of closely allied equipment: e.g. snowmobiles, outdoor power equipment
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Alberta's apprenticeship programs are supported by industry stakeholders that ensures a highly skilled, internationally competitive workforce in the province. The Registrar establishes the educational standards and provides direction to the system supported by industry and the PSI's. The Ministry of Advanced Education provides the legislative framework and administrative support for the apprenticeship and industry training system.

Special thanks are offered to the following industry members who contributed to the development of the standard:

Mr. C. Zilkie	Edmonton
Mr. D. Fletcher	Raymond
Mr. G. Knodel	Medicine Hat
Mr. P. Gibson	Red Deer
Mr. M. Dunford	Grande Prairie
Mr. B. Mayne	Camrose
Mr. J. Taylor	Tofield

Alberta Government

Alberta Advanced Education works with industry, sponsor and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and sponsors
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, sponsors, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment

Occupational Health and Safety

Persons engaged in, or supporting an individual in an experiential learning environment are often exposed to more worksite hazards than in other forms of traditional post-secondary education and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Occupational Health and Safety-OHS (a division of Alberta Labour and Immigration) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.alberta.ca/occupational-health-safety.aspx

Technical Training

Apprenticeship technical training is delivered by the PSI's throughout Alberta. The PSI's are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All PSI's place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all professions.

The PSI's work with industry and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs across the province. They develop curriculum from the curriculum guides established by the Registrar in consultation with the PSI's and industry and provide the technical training to apprentices.

The following PSI's deliver Motorcycle Mechanic trade apprenticeship technical training:

Grande Prairie Regional College

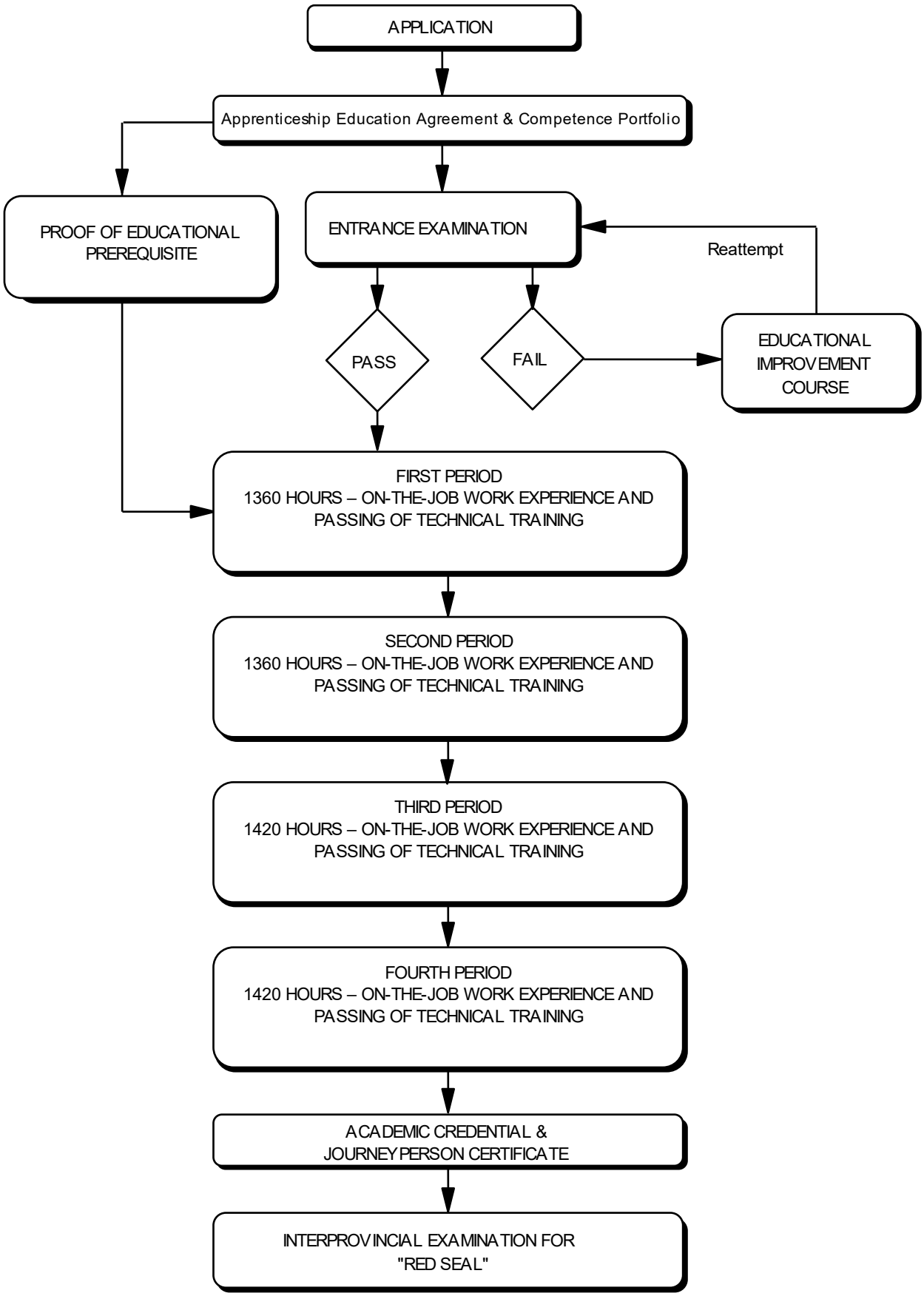
Procedures for Recommending Revisions to the Curriculum Guide

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

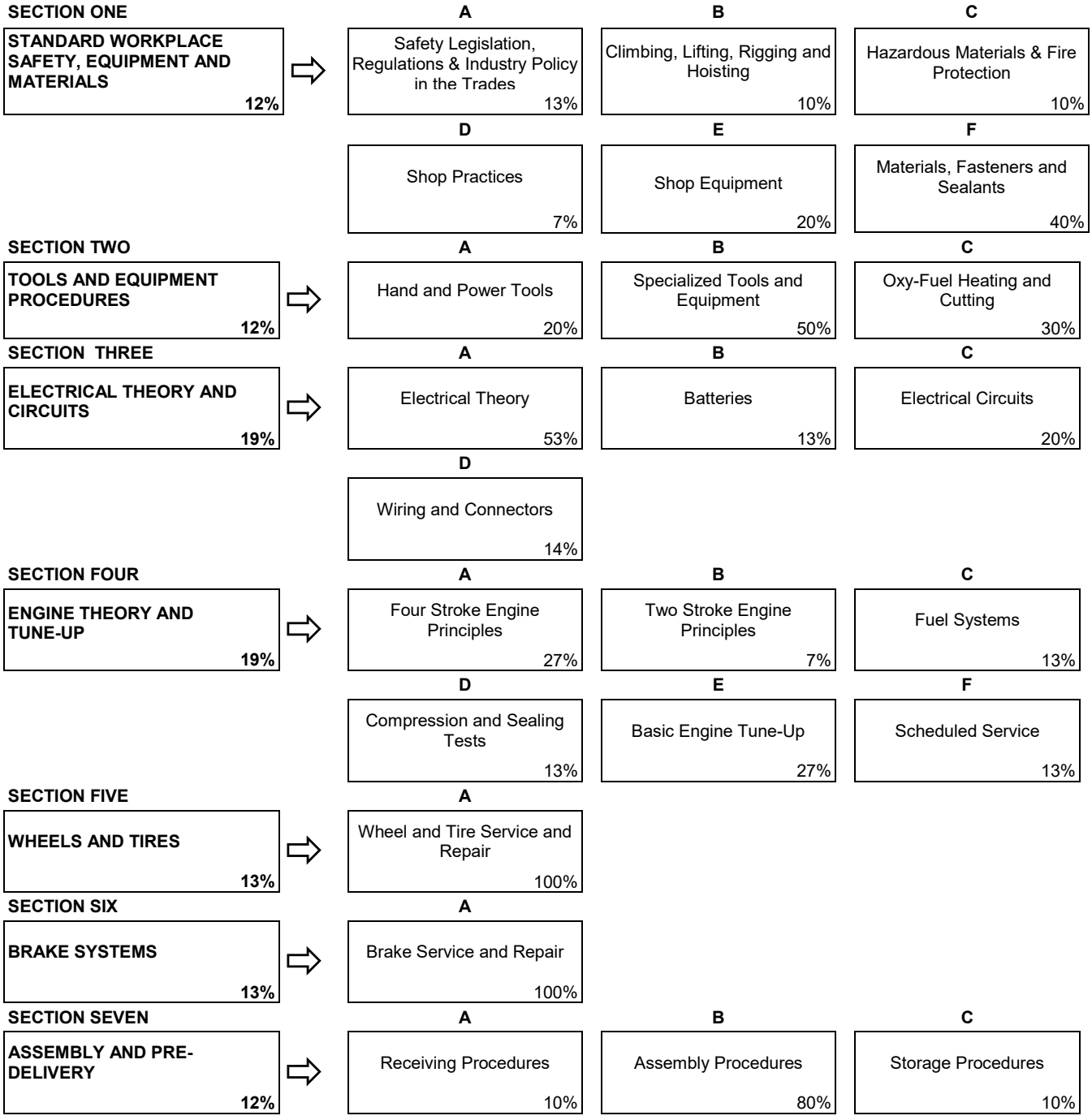
Registrar of Apprenticeship Programs
c/o Apprenticeship Delivery and Industry Support Services
Apprenticeship Delivery and Industry Support
Advanced Education
19th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used.

Apprenticeship Route toward Academic Credential



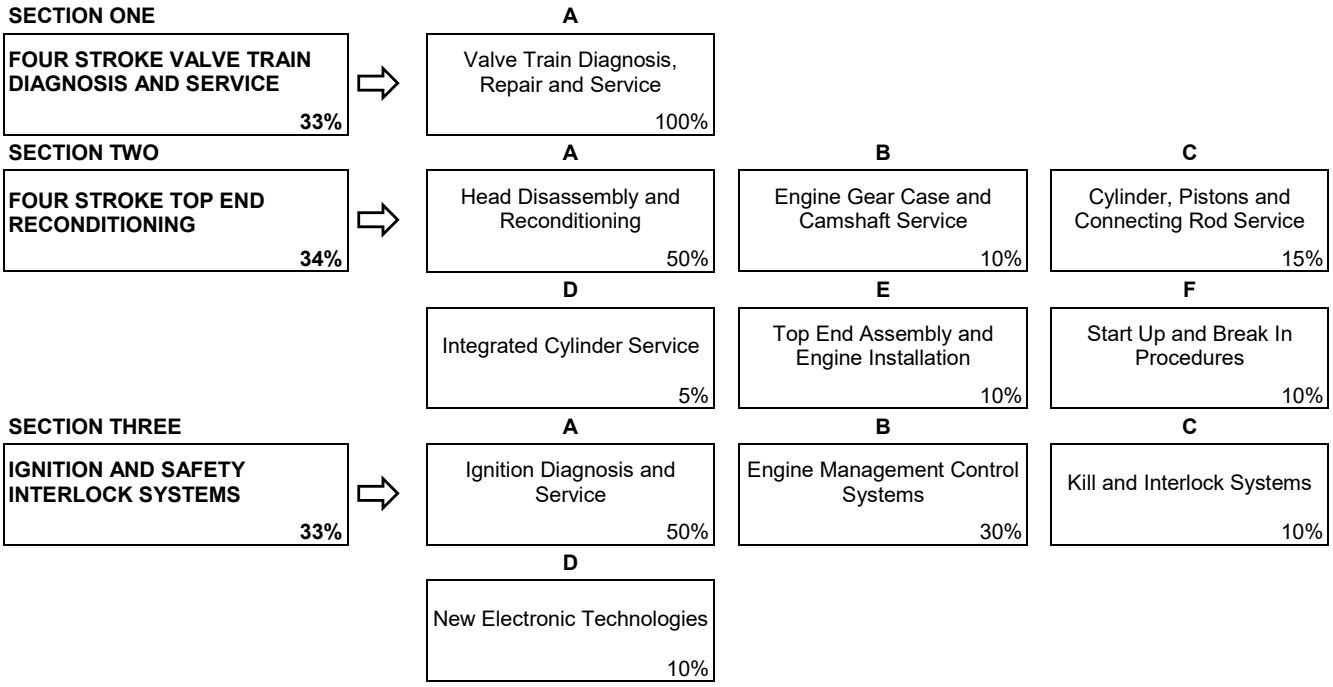
Motorcycle Mechanic Training Profile
FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)



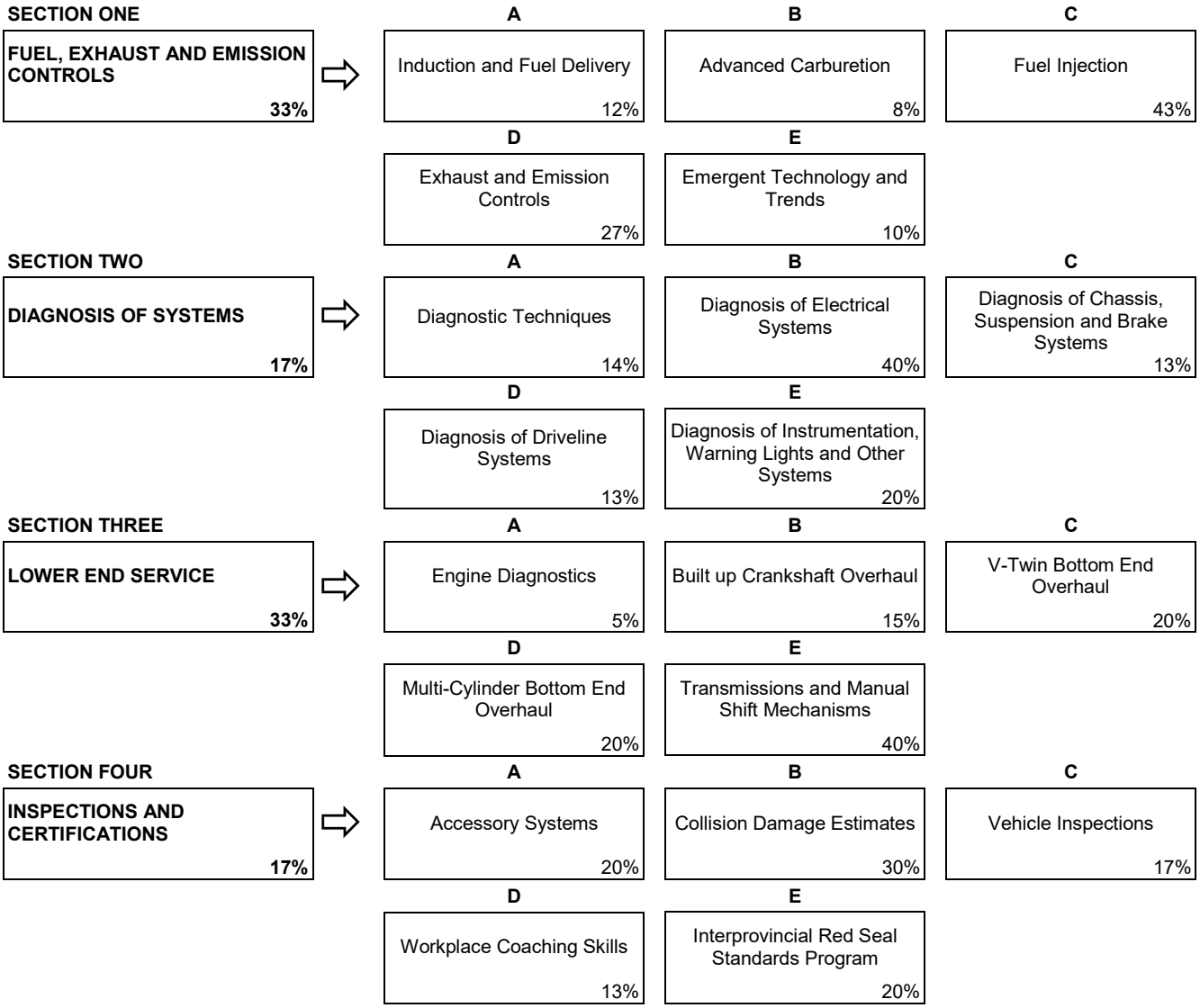
SECOND PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

		A	B	C
SECTION ONE				
CHARGING AND STARTING SYSTEMS **19%**	⇨	Charging Systems 60%	Electric Starting Systems 40%	
SECTION TWO				
TWO STROKE TOP END RECONDITIONING **12%**	⇨	Teardown and Inspection 33%	Reconditioning and Reassembly 67%	
SECTION THREE				
FRAMES AND SUSPENSIONS **25%**	⇨	Frame Design and Wheel Alignment 15%	Front Suspension Procedures 55%	Rear Suspension Procedures 30%
SECTION FOUR				
LUBRICATION, COOLING AND FUELS **12%**	⇨	Lubrication Systems 57%	Cooling Systems 33%	Fuels 10%
SECTION FIVE				
CLUTCHES AND PRIMARY DRIVES **13%**	⇨	Clutch Systems 50%	Primary Kick-Start Systems 10%	Primary Drive Systems 40%
SECTION SIX				
FINAL DRIVES **19%**	⇨	Final Drive Service and Repair 49%	ATV Four Wheel Drive Lines 51%	

THIRD PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)



FOURTH PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)



FIRST PERIOD TECHNICAL TRAINING
MOTORCYCLE MECHANIC TRADE
CURRICULUM GUIDE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... STANDARD WORKPLACE SAFETY, EQUIPMENT AND MATERIALS 12%

A. Safety Legislation, Regulations & Industry Policy in the Trades 13%

Outcome: Apply legislation, regulations and practices ensuring safe work in this trade.

1. Demonstrate the application of the Occupational Health and Safety Act, Regulation and Code.
2. Describe the sponsor's and employee's role with Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations and related advisory bodies and agencies.
3. Describe industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of worker and sponsors to apply emergency procedures.
5. Describe tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of sponsors and employees with the selection and use of personal protective equipment (PPE).
7. Maintain required PPE for tasks.
8. Use required PPE for tasks.

B. Climbing, Lifting, Rigging and Hoisting 10%

Outcome: Use industry standard practices for climbing, lifting, rigging and hoisting in this trade.

1. Describe manual lifting procedures.
2. Describe rigging hardware and associated safety factors.
3. Select equipment for rigging loads.
4. Describe hoisting and load moving procedures.
5. Maintain personal protective equipment (PPE) for climbing, lifting and load moving equipment.
6. Use PPE for climbing, lifting and load moving equipment.

C. Hazardous Materials & Fire Protection..... 10%

Outcome: Apply industry standard practices for hazardous materials and fire protection in this trade.

1. Describe roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program.
2. Describe three key elements of WHMIS.
3. Describe handling, storing and transporting procedures for hazardous material.
4. Describe venting procedures when working with hazardous materials.
5. Describe hazards, classes, procedures and equipment related to fire protection.

D. Shop Practices 7%

Outcome: Work effectively in motorcycle service.

1. Use shop information systems to interpret a work order and create parts requisition.
2. Describe the legal responsibilities involved in motorcycle service.

E. Shop Equipment 20%

Outcome: Use common motorcycle shop equipment effectively.

1. Identify common shop equipment.
2. Use common shop equipment.
3. Maintain common shop equipment.

F. Materials, Fasteners and Sealants 40%

Outcome: Perform a thread repair procedures on a variety of materials.

1. Identify metallic and non-metallic materials and applications.
2. Describe threaded fastener types, measurements, applications and torque procedures.
3. Perform a thread cleaning, repairing, cutting, and broken fastener removal procedures.
4. Describe drill bits and operation of a drill press.
5. Describe the use of thread locking compounds, sealants, adhesives, surface prep-sprays and liquid gaskets.

SECTION TWO: ..... TOOLS AND EQUIPMENT PROCEDURES 12%

A. Hand and Power Tools 20%

Outcome: Demonstrate the use of common hand tools.

1. Describe the types, uses and care of hand tools.
2. Demonstrate the use and maintenance of power hand tools.

B. Specialized Tools and Equipment 50%

Outcome: Use specialized equipment for cleaning, measuring, testing and service work.

1. Describe the uses and care of electrical testing and service tools.
2. Measure components to calculate wear and clearances.
3. Perform torque measurements and procedures.
4. Describe the use of specialized cleaning tools.
5. Describe the use of special service tools.
6. Describe the use of tune-up tools.
7. Describe wheel, suspension and frame tools and equipment.
8. Describe the purpose and use of engine service and overhaul equipment.

C. Oxyfuel Heating and Cutting 30%

Outcome: Perform the metal cutting and heating operations.

1. Describe the components, characteristics and safety requirements for oxyfuel torch use.

2. Describe oxyfuel torch use, set up, shut down and storage procedures.
3. Perform oxyfuel heating and cutting operations.

SECTION THREE: ..... ELECTRICAL THEORY AND CIRCUITS..... 19%

A. Electrical Theory 53%

Outcome: Perform meter tests to diagnose and repair electrical problems.

1. Describe electrical nomenclature.
2. Perform ohm's and watts law calculations.
3. Identify simple series and parallel circuits.
4. Identify shorts, opens and grounds.
5. Calculate voltage, current and resistance in series and parallel circuits.
6. Describe the power formula (watts) as applied to a lighting circuit.
7. Use a digital voltmeter, ammeter, ohmmeter and diode checker.
8. Perform a voltage drop tests in multiple circuits.
9. Perform a total amperage draw test in a lighting circuit.

B. Batteries..... 13%

Outcome: Perform battery maintenance and testing.

1. Describe battery construction, operation, activation, disposal and safety procedures.
2. Perform battery testing, servicing and storage procedures.
3. Describe new battery technology and electric propulsion systems for motorcycles.

C. Electrical Circuits..... 20%

Outcome: Use wiring diagrams to identify electrical problems.

1. Read a wiring schematic diagram.
2. Describe the use of test meters to identify circuit defects.
3. Test continuity in a simple lighting circuit.
4. Trace current flow on multiple circuit diagrams.

D. Wiring and Connectors 14%

Outcome: Repair electrical wires and connectors.

1. Describe multiple plug and crimp connector types, use and replacement.
2. Select wires, fuses or circuit breakers for an application.
3. Perform soldering and repair of connectors and wiring.

SECTION FOUR: ..... ENGINE THEORY AND TUNE-UP 19%

A. Four Stroke Principles 27%

Outcome: Apply operating and design principles of four stroke engine operation.

1. Describe four stroke engine design, materials, components and operating principles,
2. Describe camshaft timing methods.

B. Two Stroke Principles 7%

Outcome: Apply operating and design principles to two stroke engine operation.

1. Describe two stroke engine design, materials and components.
2. Describe two stroke engine operating principles.

C. Fuel Systems 13%

Outcome: Service motorcycle fuel systems, air filters and air box.

1. Describe the individual fuel systems and types of air filters and carburetors.
2. Describe the fuel related principles of air pressure, air speed and atomization.
3. Describe the design differences and operation of carburetors.
4. Describe the effects of improper fuel storage on carburetor operation.
5. Perform inspection and service of air filters air box, ducting, hoses and clamps.
6. Overhaul a single venturi carburetor.

D. Compression and Sealing Tests 13%

Outcome: Perform compression, leak-down, and crankcase sealing tests.

1. Perform dry and wet compression tests.
2. Perform cylinder leak-down testing.
3. Perform two stroke crankcase pressure and vacuum tests.

E. Basic Engine Tune-Up 27%

Outcome: Perform an engine tune-up.

1. Perform basic ignition tune-up.
2. Perform valve clearance adjustment on a variety of adjustment designs:
3. Inspect the camshaft timing and adjust cam chain tension.
4. Perform adjustments and synchronization to multi-bank carburetors.
5. Perform engine start up and check procedures.

F. Scheduled Service 13%

Outcome: Perform manufacturer's scheduled maintenance.

1. Identify intervals and procedures for scheduled maintenance.
2. Perform procedures for scheduled maintenance.
3. Perform basic electrical tests and recognize if a fault code is set.
4. Describe the test ride procedures, safety, ethics and evaluation.

SECTION FIVE: .....WHEEL AND TIRES..... 13%

A. Wheels and Tires Service and Repair..... 100%

Outcome: Perform wheel and tire maintenance.

1. Identify the types of wheels used for modern motorcycles.
2. Describe tire applications, sizes, designs, policies, disclaimers and compatibility.
3. Perform a visual inspection and measurement of wheels.
4. Demonstrate wheel bearing replacement.
5. Perform wire spoke tension adjustment to correct wheel rim run-out.
6. Replace wire spoke rim and true to specifications.
7. Describe procedures required with bead lock devices.
8. Describe the criteria for determining repair or replacement for tires and rims.
9. Perform a flat tire repair on tube type tires.
10. Perform tire removal, mounting and balancing.
11. Remove and replace wheel assemblies.

SECTION SIX:.....BRAKE SYSTEMS 13%

A. Brake Service and Repair 100%

Outcome: Repair and maintain brake systems.

1. Identify the components and operation of brake systems.
2. Describe brake fluids characteristics and classification.
3. Describe Pascal's law as it applies to hydraulic brakes.
4. Describe hydraulic and mechanical pressures in a multi-piston caliper system.
5. Perform brake hose replacement and bleeding.
6. Perform inspection, service and repair of drum and disc brake systems.
7. Rebuild master cylinders, wheel cylinders and callipers.

SECTION SEVEN: .....ASSEMBLY AND PRE-DELIVERY 12%

A. Receiving Procedures 10%

Outcome: Handle crated motorcycles.

1. Describe lifting devices and procedures for handling crated units.
2. Describe inspection of incoming shipments for receiving.
3. Demonstrate procedures to report missing, damaged or duplicate parts.

B. Assembly Procedures 80%

Outcome: Perform assembly, pre-delivery inspections and related tasks.

1. Identify manufacturer’s policies relating to PDI.
2. Describe assembling a new motorcycle.
3. Describe the care and cleaning of chrome, anodized and polished metal surfaces.

4. Perform minor clear coat paint damage repair.
5. Perform minor abrasion repair to plastic windshields.
6. Perform a pre-delivery inspection.

C. Storage Procedures 10%

Outcome: Prepare motorcycles for storage.

1. Prepare units for extended period of heated or unheated storage.

SECOND PERIOD TECHNICAL TRAINING
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SECTION ONE:..... CHARGING AND STARTING SYSTEMS 19%

A. Charging Systems 60%

Outcome: Repair alternator charging systems.

1. Describe AC generator and lighting systems design, characteristics and operation.
2. Identify the location of charging and lighting system components.
3. Trace charging circuits using manufacturer's wiring diagrams.
4. Test vehicle charging systems for problem diagnosis and performance analysis.
5. Perform bench tests and inspections for diagnosis and performance analysis.
6. Describe alternator component removal inspection, repair and installation.
7. Describe the theory of operation of the flywheel magneto AC lighting system.
8. Demonstrate flywheel removal, inspection and installation.
9. Perform AC lighting system testing.
10. Describe installation procedures for lighting coils.

B. Electric Starting Systems 40%

Outcome: Repair electric starter systems.

1. Describe the components, operation and testing of electric start systems.
2. Identify the starter system design using wiring diagrams.
3. Perform starter motor removal and installation.
4. Remove and replace free running clutch.
5. Perform disassembly, inspection and reassembly of starter motors.
6. Test starter motor safety interlock systems.

SECTION TWO:..... TWO STROKE TOP END RECONDITIONING 12%

A. Teardown and Inspection 33%

Outcome: Prepare a two stroke engine for repair.

1. Prepare the unit for top end reconditioning.
2. Describe the test equipment used for engine diagnosis.
3. Perform tests, measurements and procedures to diagnose serviceability and problems.
4. Disassemble and inspect for defects, damage, deposits and other problems.
5. Visually inspect the crankshaft and connecting rod for problems.
6. Describe the removal, inspection and measurement of a cylinder reed valve assembly.

B. Reconditioning and Reassembly 67%

Outcome: Recondition two stroke engine top ends.

1. Describe cylinder base gasket construction, materials and removal methods.
2. Describe the testing, servicing and adjustments of exhaust power valve assemblies.
3. Recondition cylinder surfaces.
4. Assemble top end parts and related components.
5. Perform an initial start up and testing procedures for rebuilt two strokes.
6. Describe the break-in procedures used during tests on-road test or with a dynamometer.

SECTION THREE: .....FRAMES AND SUSPENSIONS 25%

A. Frame Design and Wheel Alignment 15%

Outcome: Perform chassis inspection and alignment.

1. Describe types, materials and design features of motorcycle frames.
2. Describe steering damper systems and their function.
3. Describe wheel and chassis alignment effects on vehicle handling and tire wear.
4. Describe ATV steering mechanical and electronic systems.
5. Perform wheel and chassis alignment tests.
6. Describe rear suspension lift and lowering kits effects on ground clearance and handling.

B. Front Suspension Procedures 55%

Outcome: Perform inspections, service and overhaul of the front suspension systems.

1. Describe the designs, components and operation of front suspension systems.
2. Inspect a front suspension for leaks, wear, damage and misalignment.
3. Perform a front suspension fluid change.
4. Adjust front suspension air pressure.
5. Perform a fork seal replacement.
6. Perform overhaul and spring adjustments of front forks.
7. Perform a steering head bearing inspection and adjustment.
8. Perform alignment of front suspension components.
9. Describe routing of control cables and handlebar wiring.

C. Rear Suspension Procedures..... 30%

Outcome: Perform inspection, service and overhaul of the rear suspension system.

1. Describe the design, operation and adjustments of rear suspensions.
2. Inspect rear suspension components for leaks, wear, damage and misalignments.
3. Adjust suspension pressures using an on-board air compressor.
4. Service single shock units and linkages.
5. Service swing arm bushings or bearings.
6. Adjust dual shock systems.

7. Demonstrate ATV shock servicing and replacement.
8. Perform a suspension balance inspections and adjustments.

SECTION FOUR: .....LUBRICATION, COOLING AND FUELS..... 12%

A. Lubrication Systems 57%

Outcome: Perform service and repair of lubrication systems.

1. Describe motorcycle oil ratings and additive functions.
2. Identify manufacturer's lubrication requirements and service intervals
3. Describe engine lubrication systems design, components, operation and requirements.
4. Describe oil pumps design, operation, and testing.
5. Perform a lubrication filtration systems service.
6. Perform an inspection and overhaul on common oil pump types.
7. Describe 2-stroke engine lubrication systems, ratios and mixing methods.

B. Cooling Systems..... 33%

Outcome: Perform service and repair of cooling systems.

1. Describe the physical principles involved in heat transfer.
2. Describe the coolant properties, additives, mixing and disposal.
3. Describe motorcycle cooling system components, operation and problems.
4. Perform the testing, replacement and bleeding of coolant.
5. Perform cooling system tests and scheduled services.
6. Repair radiator cooling fins.
7. Describe auxiliary oil cooling system services.

C. Fuels..... 10%

Outcome: Select fuel for a specific application.

1. Describe the composition, characteristics, ratings, additives and applications of fuels.

SECTION FIVE: .....CLUTCHES AND PRIMARY DRIVES 13%

A. Clutch Systems..... 50%

Outcome: Perform inspection, service and overhaul of clutch systems.

1. Describe the function, components and operation of clutch systems.
2. Overhaul clutches and release mechanisms.

B. Primary Kick-Start Systems..... 10%

Outcome: Perform the service and repair of primary type kick-start systems.

1. Describe the design, classification and operation of common kick-start systems.
2. Perform an external inspection and diagnosis of kick-starter systems.

C. Primary Drive Systems 40%

Outcome: Inspect service and repair primary drive systems.

1. Describe the design, components, operation and diagnostics of primary drives.
2. Perform inspection and adjustment of an external primary drives
3. Describe the operation and service of primary drive shock absorbers and constant velocity transmissions.
4. Perform diagnostic tests of an internal gear driven primary drive system.

SECTION SIX: ..... FINAL DRIVES 19%

A. Final Drive Service and Repair 49%

Outcome: Perform the inspection, service and repair final drive systems.

1. Describe the design, operation, inspection, service and repair of chain drives.
2. Perform roller chain cleaning, lubrication and adjustment.
3. Describe the design, characteristics and cleaning of belt drives.
4. Perform Inspection, adjustment, service and repair of belt drives.
5. Describe the design, operation, characteristics and lubrication of shaft drives.
6. Perform inspections, diagnosis, measurements and repairs on shaft drives.

B. ATV Four Wheel Drivelines 51%

Outcome: Perform the diagnosis, service and repair of ATV drive lines.

1. Describe the design, operation and features of four wheel drive systems and components.
2. Inspect and service ATV front differentials and four wheel drive components.
3. Describe the design and operation of final drive shock damping systems.
4. Inspect the chain type final drive rear wheel cush drive couplings.
5. Inspect propeller shaft cam type damper mechanisms.
6. Identify the parts and components in a secondary bevel gear drive system.
7. Describe the inspections and measurements required to overhaul the secondary bevel gear system.
8. Identify similarities between secondary bevel gear drives and final drive gear case components.
9. Describe the operation of the cam type damper in secondary bevel gear systems.

THIRD PERIOD TECHNICAL TRAINING
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SECTION ONE:..... FOUR STROKE VALVE TRAIN DIAGNOSIS AND SERVICE 33%

A. Valve Train Diagnosis, Service and Repair 100%

Outcome: Perform four stroke engine top end diagnostics, repair and adjustments.

1. Perform compression and leak down tests.
2. Perform an oil pressure test.
3. Describe dynamometer theory.
4. Perform dynamometer preparation, testing and diagnosis.
5. Describe camshaft features, measurement, and inspection.
6. Measure a camshaft and related components to determine serviceability.
7. Describe the effect of camshaft design, valve seat angles and port shape on performance.
8. Perform cam chain and belt drive system inspections and adjustments.
9. Perform camshaft removal and replacement procedures.
10. Describe new camshaft set-up and break-in procedures.

SECTION TWO:..... FOUR STROKE TOP END RECONDITIONING 34%

A. Head Disassembly and Reconditioning 50%

Outcome: Perform engine top end disassembly, inspection and reconditioning.

1. Perform removal, inspection and storage of components.
2. Perform engine top end component disassembly, cleaning, inspection, fastener repair, measurement and storage.
3. Describe cylinder head reconditioning procedures.
4. Perform valve and guide cleaning, check for cracks and measure stem to guide clearance.
5. Perform cleaning carbon from the valve seats and ports.
6. Perform valve spring testing.
7. Adjust hydraulic valve lash.
8. Perform valve guide reconditioning.
9. Perform valve seat cutting.
10. Perform valve reconditioning and seating.
11. Perform cylinder head reassembly.

B. Engine Gear Case and Camshaft Service 10%

Outcome: Perform gear case inspections and camshaft fitment.

1. Describe tappets inspection, service and repair procedures.

2. Perform inspection, measurement and adjustment of camshaft end play and backlash.
3. Perform camshaft bearing and bushing replacement.
4. Perform reassembly and adjustment of the gear case.

C. Cylinder, Piston and Connecting Rod Service 15%

Outcome: Inspect and recondition cylinders, pistons and connecting rod assemblies.

1. Describe checking for connecting rod trueness.
2. Describe repairing coated cylinder bores.
3. Hone a cylinder.
4. Describe cylinder boring.
5. Describe cylinder sleeve installation.
6. Perform piston ring installation and piston assembly installation.

D. Integrated Cylinder Service 5%

Outcome: Remove and repair an integrated cylinder and crankcase assembly.

1. Describe inspection, honing and service for integrated cylinder and crankcase assemblies.
2. Describe connecting rod and piston service in an integrated cylinder and crankcase assembly.

E. Top End Assembly and Engine Installation 10%

Outcome: Perform final assembly and install engine.

1. Perform cylinder head assembly and related parts installation.
2. Perform engine installation into the chassis.

F. Start Up and Break-In Procedures 10%

Outcome: Perform start up, break-in procedure.

1. Perform pre-start checks and initial start-up procedures.
2. Perform engine warm-up engine for initial break-in.
3. Perform running the engine on a dynamometer.
4. Describe break-in procedures, re-adjustment requirements and customer communications.

SECTION THREE: .....IGNITION AND SAFETY INTERLOCK SYSTEMS..... 33%

A. Ignition Diagnosis and Service 50%

Outcome: Inspect, diagnose, service and repair ignition systems.

1. Describe ignition system components, construction, functions, features, operation and testing.
2. Use ignition wiring schematics to describe current flow and voltages.
3. Verify engine timing mark alignment for a single cylinder engine.
4. Demonstrate the use of manufacturers' ignition system wiring diagrams in diagnostics.
5. Perform tests of ignition systems.
6. Demonstrate the use of an inductive tachometer to verify rpm.
7. Demonstrate the testing of ignition modules and systems.

8. Describe the operation of engine rpm limiters.
9. Describe the symptoms of a no spark or weak spark problem.
10. Demonstrate testing to determine the cause of a no spark condition.
11. Describe the symptoms of an intermittent spark under load condition problem.
12. Demonstrate testing for an intermittent spark under load problem.
13. Describe the symptoms of an engine rpm cut-off circuit malfunction.
14. Diagnose an engine rpm cut-off circuit malfunction.
15. Demonstrate verifying ignition cut-off circuit operation using special equipment.

B. Engine Management Control Systems 30%

Outcome: Inspect and diagnose engine management systems.

1. Describe the components, operation and feedback features of engine management systems.
2. Perform related sensor tests.
3. Demonstrate the use of on-board diagnostic systems.
4. Use fault codes to guide diagnostic procedures and repairs.

C. Kill and Interlock Systems 10%

Outcome: Troubleshoot ignition interlock shutoff systems.

1. Demonstrate the test procedures for side-stand ignition cut-off circuit and ignition kill switch circuit.
2. Describe the system overlapping of the starter motor clutch switch and neutral switch to the ignition system.
3. Describe the system overlapping of an ATV that uses parking brake switch, neutral parking switch and an ignition starter control relay.
4. Describe a security system interlock operation.

D. New Electronic Technology 10%

Outcome: Describe new electronic systems found on motorcycles and ATVs.

1. Describe features and operation of on-board systems.
2. Describe features and operation of new electronic systems introduced on motorcycles or ATVs.

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UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....FUEL, EXHAUST AND EMISSION CONTROLS..... 33%

A. Induction and Fuel Delivery..... 12%

Outcome: Test and repair fuel and air delivery systems.

1. Demonstrate component identification and inspection of a pressurized air box system.
2. Perform a pressure test and service to the fuel system.
3. Describe the operation of an in tank fuel level gauges and sensors.
4. Perform electrical testing for all fuel pump circuit components.
5. Inspect intake air system air control valves, damper mechanisms and vacuum switches.

B. Advanced Carburetion 8%

Outcome: Identify mechanical compensating circuits, electrical feedback sensors.

1. Describe flat slide carburetor circuits and the operation of throttle position sensors.
2. Describe a multiple carburetors synchronization procedure.
3. Describe hot start and other compensating systems.

C. Fuel Injection..... 43%

Outcome: Diagnose and repair electronic fuel injection systems.

1. Describe the concepts, components and operation of fuel injection systems.
2. Describe the inspection, test procedures and replacement of sensors and modules.
3. Retrieve and identify malfunction codes to aid diagnostic procedures.
4. Perform throttle valve synchronization, throttle cable and fast idle cable adjustments.
5. Perform fuel injector servicing
6. Perform a rear wheel dynamometer tests to test programmed fuel injection system.
7. Perform an inspection of fuel system components.
8. Perform initial base data recording and diagnostic tests using scan tool.

D. Exhaust and Emission Controls..... 27%

Outcome: Test exhaust and emission control systems.

1. Describe the construction, operation, service and maintenance of exhaust systems.
2. Describe the operation of oxygen sensors.
3. Describe exhaust system noise levels and testing.
4. Describe combustion emissions and the effect of engine wear or modifications.
5. Describe crankcase breather, exhaust port fresh air injection and air shot systems.

6. Describe the exhaust gas analyzer operation.
7. Perform exhaust gas analyzer diagnosis procedures and maintenance.

E. Emergent Technology and Trends..... 10%

Outcome: Diagnose and service emergent technology in motorcycles.

1. Describe emergent technology available on new motorcycles.
2. Demonstrate emergent service procedures or equipment.
3. Describe trends in the motorcycle industry.

SECTION TWO:.....TROUBLESHOOTING SYSTEMS..... 17%

A. Diagnostic Techniques 14%

Outcome: Diagnose malfunctions using a systematic procedure.

1. Describe the steps in a systematic troubleshooting.
2. Identify symptoms of a problem and overlapping systems.
3. Describe the testing procedures and record keeping for continuous and intermittent problems.
4. Describe the verification procedure used after repairs are completed.

B. Diagnosis of Electrical Problems..... 40%

Outcome: Diagnose electrical problems using a systematic procedure.

1. Perform the test procedures and record the data for charging, starting and lighting systems.
2. Describe the test equipment and procedures to diagnose wiring harness related problems.
3. Perform EFI diagnosis procedures to repair a problem.

C. Diagnosis of Chassis, Suspension and Brake Problems..... 13%

Outcome: Diagnose chassis, suspension and brake problems using a systematic procedure.

1. Describe the symptoms and the test procedures for chassis and engine misalignment.
2. Describe the test procedures to solve a high speed weave problem.
3. Describe the test procedures to solve braking problems.
4. Perform the test procedures to solve a front fork bottoming problem.

D. Diagnosis of Driveline Problems..... 13%

Outcome: Diagnose driveline problems using a systematic procedure.

1. Describe the symptoms and testing to diagnose a transmission jumping out of gear.
2. Describe the symptoms and testing to diagnose an engine knocking under load.
3. Perform the testing and data recording for a noisy primary drive problem.
4. Perform the testing and data recording for poor acceleration for an ATV with a CVT transmission.
5. Perform the testing and date recording for a noisy shaft driven final drive.

E. Instrumentation, Warning Lights and Diagnostic Systems 20%

Outcome: Interpret problems using on board diagnostics, indicators and displays.

1. Describe the operation, diagnosis and repair of instrumentation.
2. Identify problems with warning lights and on-board diagnostic systems
3. Identify liquid crystal displays (LCD) and diagnostics with proper sequencing of data.

SECTION THREE: .....LOWER END SERVICE 33%

A. Engine Diagnostics..... 5%

Outcome: Perform engine diagnostics

1. Demonstrate dynamometer diagnosis for engine, clutch and transmission problems.
2. Perform an oil pressure test for crankshaft bearing or connecting rod wear problems.
3. Perform an engine sounds test.

B. Built Up Crankshaft Overhaul..... 15%

Outcome: Overhaul of a single cylinder engine bottom end.

1. Describe measuring crankshaft and transmission shaft end plays, bearing clearance.
2. Describe measuring connecting rod clearances and trueness.
3. Demonstrate the crankcase splitting.
4. Perform the connecting rod replacement for single cylinder crankshafts.
5. Describe crankcase and crankshaft seal or bearing replacement.
6. Demonstrate crankshaft installation

C. V-twin Engine Bottom End Overhaul 20%

Outcome: Recondition V twin engines bottom end.

1. Describe disassembly, inspection, cleaning, measurement and storage of components.
2. Describe camshaft and gear case disassembly and reassembly.
3. Demonstrate crankshaft end float and pinion shaft run-out measurement procedures.
4. Describe 3 piece crankshaft disassembly, reassembly and alignment.
5. Describe main bearing and seal selection and replacement procedures.
6. Describe the procedure for installing the crankshaft and balancer.

D. Multi-Cylinder Bottom End Overhaul..... 20%

Outcome: Recondition multi-cylinder engine bottom end.

1. Perform crankshaft and connecting rod bearing measurement, selection and alignment procedures.
2. Describe the inspection of engine balancer clearances and timing.
3. Describe the theory of obtaining a crankshaft static balance factor.
4. Describe the operation of crankshaft balancer systems.

E. Transmission and Manual Shift Mechanisms 40%

Outcome: Perform transmission inspection and overhaul.

1. Identify the components, operation, inspection and service of transmission shift mechanisms.
2. Perform inspection and adjustment of shift mechanisms.
3. Identify the parts of multi-speed transmissions.
4. Describe transmission ratios and power flow in each ratio.
5. Describe the inspection, measurement for transmission gears and shafts.
6. Perform the disassembly, inspection and reassembly of transmissions.
7. Identify transmission wear and causes.
8. Describe transmission neutral locating systems and verification.
9. Perform transmission shim installation for gear engagement.
10. Identify transmission seals, replacement procedures and leak inspections.

SECTION FOUR: ..... INSPECTIONS AND CERTIFICATION 17%

A. Accessory Systems 20%

Outcome: Troubleshoots vehicle speed control systems.

1. Identify cruise control components and adjustments.
2. Describe the operation of electric and vacuum cruise control systems.
3. Perform cruise control diagnostic tests.
4. Perform cruise control cable lubrication and adjustments
5. Describe installation and operation of a sidecar.
6. Identify legalities related to accessories such as trailer hitches and sidecars.

B. Collision Damage Estimates 30%

Outcome: Perform an inspection and damage estimate of a collision damaged unit.

1. Describe the collision damage inspection.
2. Write up an estimate of repairs for a collision damaged motorcycle.
3. Describe verifying front fork tube trueness on the motorcycle.
4. Describe verifying rear swing arm tolerances and motor mount condition.
5. Perform verification of frame alignment and wheel offset.
6. Describe road test safety considerations and riding manoeuvres before and after repairs.

C. Vehicle Inspections 17%

Outcome: Perform Out-of-Province and Salvage Inspections.

1. Describe regulations and procedures for out-of-province and salvage Inspection.
2. Perform an out-of-province or salvage inspection.

E. Workplace Coaching Skills 13%

Outcome: Use coaching skills when training an apprentice.

1. Describe the process for coaching an apprentice.

F. Interprovincial Red Seal Standards Program 20%

Outcome: Discuss Red Seal / Interprovincial standards.

1. Identify Red Seal products used to develop interprovincial examinations.
2. Use Red Seal products to prepare for an interprovincial examination.

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