

# C.H. McCann Technical School

70 Hodges Cross Road  
North Adams, Ma. 01247  
CIP Code 470604

## Automotive Technology

### Instructors

Jeremy Curley

Michael McCarron

September 1st 2011

## Assessment Plan

The students are assessed in a number of ways, 70% of the total grade is a shop grade and 30 % is a theory grade.

The theory grade is computed as follows.

Weekly assignments	10%
Theory Test	20%

The shop grade is based on the following criteria:

Morning Theory	5%
Proper Shop Attire	20%
Individual Competency	30%
Staying on Task	15%
Safety	15%
Clean-Up	10%
Afternoon Theory	5%

At the end of each shop week each student will receive a grade average resulting from all work done the previous week. Tests, writing assignments, and shop grade will be put into a student's individual folder. Each folder will track the competencies of the student's progress throughout the school year. Semester projects will be graded and averaged in at the end of that grading period. Extra credit will be done in the shop only. Time after school will be given for extra credit and projects.

# Automotive Curriculum Syllabus

## Freshman

### 1<sup>st</sup> Marking Period

#### Exploratory

Introduction to automotive  
Preventive maintenance

### 2<sup>nd</sup> Marking Period

#### Exploratory 2<sup>nd</sup> tier

Introduction to automotive technology  
Safety and shop operation  
Tools, terms and techniques  
Basic diagnosis skills

### 3<sup>rd</sup> Marking Period

Engines, past to the future  
Diagnosis and repair

### 4<sup>th</sup> Marking Period

Cooling systems, diagnosis and repair

## Sophomores

### 1<sup>st</sup> Marking Period

#### **Cooling System Review**

Check coolant condition, test for leaks and proper system operation

#### **Mass Frameworks Strands:**

2.AA.13 - Verify engine operating temperature; determine necessary action.

2.AA.14 - Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

2.EE.16 - Remove and replace thermostat.

2.EE.17 - Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

#### **NATEF Tasks:**

IA5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

ID3. Perform engine cooling system pressure tests; check coolant

condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

ID5. Inspect and replace engine cooling and heater system hoses.

ID6. Inspect, test, and replace thermostat and gasket.

ID7. Test coolant; drain and recover coolant; flush and refill cooling

system with recommended coolant; bleed air as required.

ID8. Inspect, test, remove, and replace water pump.

ID9. Remove and replace radiator.

ID10. Inspect and test fans (electrical or mechanical), fan clutch,

fan shroud, and air dams.

VII.C.1. Diagnose temperature control problems in the heater/ventilation system; determine necessary action.

VII.C.2. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

VII.C.3. Inspect engine cooling and heater system hoses and belts; perform necessary action.

VII.C.4. Inspect, test, and replace thermostat and gasket.

VII.C.5. Determine coolant condition and coolant type for vehicle application; drain and recover coolant.

VII.C.6. Flush system; refill system with recommended coolant; bleed system.

VII.C.7. Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action.

VII.C.8. Inspect and test electrical cooling fan, fan control system, and circuits; determine necessary action.

VII.C.9. Inspect and test heater control valves; perform necessary action.

	<p>VII.C.10. Remove, inspect, and reinstall heater core. VIII.F.3. Remove and replace thermostat and gasket/seal</p>
<p><b>Automotive belts and hoses</b> Check condition and adjustment of belts and condition of hoses</p>	<p><b>Mass Frameworks Strands:</b> 2.F.11 Remove, inspect, replace, and adjust power steering pump belt. 2.V.03 Remove, inspect, replace, and adjust Generator(alternator) belt, idlers and tensioners. 2.EE.15 Remove and replace timing belt; verify correct camshaft timing. <b>NATEF Tasks:</b> I.D.4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. I.D.5. Inspect and replace engine cooling and heater system hoses. IV.B.13. Remove, inspect, replace, and adjust power steering pump belt. VIII.F.2. Remove and replace timing belt; verify correct camshaft timing.</p>
<p><b>Automotive Plumbing: Tubing and Pipe</b> Inspect and replace brake, fuel, and evaporative emissions tubing.</p>	<p><b>Mass Frameworks Strands</b> 2.M.06 Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action. 2.M.07 Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed. 2.M.08 Select, handle, store, and fill brake fluids to proper level. 2.M.10 Bleed (manual, pressure, vacuum or surge) brake system. <b>NATEF Tasks:</b> V.B.6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, or wear; tighten loose fittings and supports; determine necessary action. V.B.7. Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed. V.B.8. Select, handle, store, and fill brake fluids to proper level.</p>

## 2<sup>nd</sup> Marking Period

### Electrical Theory and Repairs

Diagnosis and repair of general electrical systems.

#### **Mass Frameworks Strands:**

- 2.S.01 Identify and interpret electrical/electronic system concern; determine necessary action.
- 2.S.02 Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
- 2.S.03 Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).
- 2.S.04 Use wiring diagrams during diagnosis of electrical circuit problems.
- 2.S.05 Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.
- 2.S.06 Check electrical circuits with a test light; determine necessary action.
- 2.S.07 Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
- 2.S.08 Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
- 2.S.09 Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action.
- 2.S.10 Check electrical circuits using fused jumper wires; determine necessary action.
- 2.S.11 Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
- 2.S.12 Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.
- 2.S.13 Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
- 2.S.14 Inspect and test switches, connectors, relays, solid state devices, and wires of electrical/electronic circuits; perform necessary action.
- 2.S.15 Repair wiring harnesses and connectors.
- 2.S.16 Perform solder repair of electrical wiring.

#### **NATEF Tasks:**

- VI.A.1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- VI.A.2. Identify and interpret electrical/electronic system concern; determine necessary action.
- VI.A.3. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history,

Electrical Theory and Repairs (cont.)

Diagnosis and repair of general electrical systems.

service precautions, and technical service bulletins.

VI.A.4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).

VI.A.5. Diagnose electrical/electronic integrity for series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).

VI.A.6. Use wiring diagrams during diagnosis of electrical circuit problems.

VI.A.7. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.

VI.A.8. Check electrical circuits with a test light; determine necessary action.

VI.A.9. Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

VI.A.10. Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.

VI.A.11. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter; determine necessary action.

VI.A.12. Check electrical circuits using fused jumper wires; determine necessary action.

VI.A.13. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

VI.A.14. Measure and diagnose the causes of abnormal key-off battery drain (parasitic draw); determine necessary action.

VI.A.15. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.

VI.A.16. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action.

VI.A.17. Remove and replace terminal end from connector.

VI.A.18. Repair wiring harnesses and connectors and terminal ends.





Service

action.  
2.U.02 Perform starter circuit voltage drop tests; determine necessary action.  
2.U.03 Inspect and test starter relays and solenoids; determine necessary action.  
2.U.04 Remove and install starter in a vehicle.  
2.U.05 Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.  
2.U.06 Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.  
**NATEF Tasks:**  
VI.C.1. Perform starter current draw tests; determine necessary action.  
VI.C.2. Perform starter circuit voltage drop tests; determine necessary action.  
VI.C.3. Inspect and test starter relays and solenoids; determine necessary action.  
VI.C.4. Remove and install starter in a vehicle.  
VI.C.5. Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.  
VI.C.6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.

3<sup>rd</sup> Marking Period

<p>Charging System Fundamentals and Service</p>	<p><b>Mass Frameworks Strands:</b>                  2.V.01 Perform charging system output test; determine necessary action.                  2.V.02 Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.                  2.V.03 Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.                  2.V.04 Remove, inspect, and install generator (alternator)                  2.V.05 Perform charging circuit voltage drop tests; determine necessary action  <b>NATEF Tasks:</b>                  VI.D.1. Perform charging system output test; determine necessary action.                  VI.D.2. Diagnose charging system for the cause of undercharge, nocharge, and overcharge conditions.                  VI.D.3. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.                  VI.D.4. Remove, inspect, and install generator (alternator).                  VI.D.5. Perform charging circuit voltage drop tests; determine necessary action.</p>
<p>Lighting and Wiring Fundamentals</p>	<p><b>Mass Frameworks Strands:</b>                  2.W.01 Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.                  2.W.02 Inspect, replace, and aim headlights and bulbs.                  2.W.03 Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.  <b>NATEF Tasks:</b>                  VI.E.1. Diagnose the cause of brighter-than-normal, intermittent, dim, or no-light operation; determine necessary action.                  VI.E.2. Inspect, replace, and aim headlights and bulbs.                  VI.E.3. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.                  VI.E.4. Identify system voltage and safety precautions associated with high-intensity discharge headlights.</p>
<p>Safety, Security, Comfort Systems, and Electrical Accessories                  Diagnosis and repair gauges, warning devices, driver information systems, horn, wiper/washer systems, and accessories.</p>	<p><b>Mass Frameworks Strands:</b>                  2.W.01 Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.                  2.W.02 Inspect, replace, and aim headlights and bulbs.                  2.W.03 Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.                  2.Y.01 Diagnose incorrect horn operation; perform necessary action.</p>

Safety, Security, Comfort Systems, and Electrical Accessories (cont.)

Diagnosis and repair gauges, warning devices, driver information systems, horn, wiper/washer systems, and accessories.

2.Y.02 Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.

2.Y.03 Diagnose incorrect washer operation; perform necessary action.

2.Z.01 Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action

2.Z.02 Diagnose incorrect heated glass operation; determine necessary action

2.Z.03 Diagnose incorrect electric lock operation; determine necessary action

2.Z.04 Diagnose incorrect operation of cruise control systems; determine necessary action

2.Z.05 Disarm and enable the airbag system for vehicle service

2.Z.06 diagnose radio static and weak, intermittent, or no radio reception; determine necessary action

2.Z.07 Diagnose body electronic system circuits using a scan tool; determine necessary action

2.Z.08 Check for module communication errors using a scan tool.

**NATEF Tasks:**

VI.F.1. Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings; determine necessary action.

VI.F.2. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.

VI.F.3. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action

VI.F.4. Inspect and test sensors, connectors, and wires of electronic (digital) instrument circuits; determine necessary action.

VI.G.1. Diagnose incorrect horn operation; perform necessary action.

VI.G.2. Diagnose incorrect wiper operation; diagnose wiper speed

control and park problems; perform necessary action.

VI.G.3. Diagnose incorrect windshield washer operation; perform necessary action.

VI.H.1. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.

VI.H.2. Diagnose incorrect heated glass, mirror, or seat operation; determine necessary action.

VI.H.3. Diagnose incorrect electric lock operation; determine necessary action.

VI.H.4. Diagnose incorrect operation of cruise control systems;

repair as needed.

VI.H.5. Diagnose supplemental restraint system (SRS) concerns;

determine necessary action. (*Note:* Follow manufacturer's safety

procedures to prevent accidental deployment.)

VI.H.6. Disarm and enable the air bag system for vehicle service.

VI.H.7. Diagnose radio static and weak, intermittent, or no radio

reception; determine necessary action.

VI.H.8. Remove and reinstall door panel.

VI.H.9. Diagnose body electronic system circuits using a scan tool;

determine necessary action.

VI.H.10. Check for module communication (LAN/CAN/BUS) errors using a scan tool.

VI.H.11. Diagnose the cause of false, intermittent, or no operation of anti-theft system.

4<sup>th</sup> Marking Period

Heating and Air-Conditioning  
Fundamentals and Service

**Mass Frameworks Strands:**

**NATEF Tasks:**

- VII.A.1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
- VII.A.2. Identify and interpret heating and air-conditioning (A/C) concerns; determine necessary action.
- VII.A.3. Research applicable vehicle and service information, such as heating and A/C operation, vehicle service history, service precautions, and technical service bulletins.
- VII.A.4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration labels).
- VII.A.5. Performance-test A/C system; diagnose A/C system malfunctions using principles of refrigeration.
- VII.A.6. Diagnose abnormal operating noises in the A/C system; determine necessary action.
- VII.A.7. Identify refrigerant type; select and connect proper gauge set; record pressure readings.
- VII.A.8. Leak-test A/C system; determine necessary action.
- VII.A.9. Inspect the condition of discharged oil; determine necessary action.
- VII.A.10. Determine recommended oil for system application.
- VII.A.11. Using scan tool, observe and record related heating, ventilation, and A/C (HVAC) data and trouble codes.
- VII.B.1.1. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.
- VII.B.1.2. Inspect and replace A/C compressor drive belts; determine necessary action.
- VII.B.1.3. Inspect, test, and/or replace A/C compressor clutch components and/or assembly.
- VII.B.1.4. Remove, inspect, and reinstall A/C compressor and mountings; determine required oil quantity.
- VII.B.1.5. Identify hybrid vehicle AC system electrical circuits, and service and safety precautions.
- VII.B. 2.1. Determine need for an additional A/C system filter; perform necessary action.
- VII.B. 2.2. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform

Heating and Air-Conditioning  
Fundamentals and Service (cont.)

necessary action.

VII.B. 2.3. Inspect A/C condenser for airflow restrictions; perform

necessary action.

VII.B. 2.4. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine required oil quantity.

VII.B. 2.5. Remove and install expansion valve or orifice (expansion) tube.

VII.B. 2.6. Inspect evaporator housing water drain; perform necessary action.

VII.B. 2.7. Remove, inspect, and reinstall evaporator; determine required oil quantity.

VII.B. 2.8. Remove, inspect, and reinstall condenser; determine required oil quantity.

VII.C.1. Diagnose temperature control problems in the heater/ventilation system; determine necessary action.

VII.C.2. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

VII.C.3. Inspect engine cooling and heater system hoses and belts; perform necessary action.

VII.C.4. Inspect, test, and replace thermostat and gasket.

VII.C.5. Determine coolant condition and coolant type for vehicle application; drain and recover coolant.

VII.C.6. Flush system; refill system with recommended coolant; bleed system.

VII.C.7. Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action.

VII.C.8. Inspect and test electrical cooling fan, fan control system, and circuits; determine necessary action.

VII.C.9. Inspect and test heater control valves; perform necessary action.

VII.C.10. Remove, inspect, and reinstall heater core.

VII.D.1. Diagnose malfunctions in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action.

VII.D.2. Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary

	<p>action.</p> <p>VII.D.3. Test and diagnose A/C compressor clutch control systems; determine necessary action.</p> <p>VII.D.4. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the HVAC system; determine necessary action.</p> <p>VII.D.5. Inspect and test A/C-heater control panel assembly; determine necessary action.</p> <p>VII.D.6. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action.</p> <p>VII.D.7. Inspect and test A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.</p> <p>VII.D. 8. Check operation of automatic and semiautomatic HVAC control systems; determine necessary action.</p> <p>VII.E.1. Perform correct use and maintenance of refrigerant handling equipment.</p> <p>VII.E.2. Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant.</p> <p>VII.E.3. Recycle refrigerant.</p> <p>VII.E.4. Label and store refrigerant.</p> <p>VII.E.5. Test recycled refrigerant for noncondensable gases.</p> <p>VII.E.6. Evacuate and charge A/C system.</p>
<p>Ignition System Fundamentals and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.CC.01 Identify ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with electronic ignition (distributorless) systems.</p> <p>2.CC.02 Identify ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with distributor ignition (DI) systems.</p> <p>2.CC.03 Inspect and test ignition primary circuit wiring and solid state components; perform necessary action.</p> <p>2.CC.04 Inspect, test and service distributor.</p> <p>2.CC.05 Inspect and test ignition system secondary circuit wiring and components; perform necessary action.</p> <p>2.CC.06 Inspect and test ignition coil(s); perform necessary action.</p> <p>2.CC.07 Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action.</p> <p><b>NATEF Tasks:</b></p>

VIII.C.1. Diagnose ignition system related problems such as no starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with electronic ignition (distributorless) systems; determine necessary action.

VIII.C.2. Diagnose ignition system related problems such as no starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action.

VIII.C.3. Inspect and test ignition primary circuit wiring and solid state components; perform necessary action.

VIII.C.4. Inspect, test, and service distributor.

VIII.C.5. Inspect and test ignition system secondary circuit wiring and components; perform necessary action.

VIII.C.6. Inspect and test ignition coils; perform necessary action.

VIII.C.7. Check and adjust ignition system timing and timing advance/retard (where applicable).

VIII.C.8. Inspect and test ignition system pickup sensor or triggering devices; perform necessary action.



## Junior

### 1<sup>st</sup> Marking Period

Brake Fundamentals and Service  
Anti-Lock Brakes, Traction, and Stability  
Bearings, Seals, and Grease

### 2<sup>nd</sup> Marking Period

Tire and Wheel Theory and Service  
Suspension Fundamentals and Service

### 3<sup>rd</sup> Marking Period

Steering Fundamentals and Service  
Wheel Alignment Fundamentals and Service

### 4<sup>th</sup> Marking Period

Clutch Fundamentals, Diagnosis, and Service  
Manual Transmission Fundamentals, Diagnosis, and Repair

Seniors

1<sup>st</sup> Marking Period

Automatic Transmission Fundamentals, Diagnosis, and Service.

**Mass Frameworks Strands:**

2.E.01 Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.

2.E.02 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).

**NATEF Tasks:**

II.A.1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

II.A.2. Identify and interpret transmission/transaxle concern; differentiate between engine performance and transmission/transaxle concerns; determine necessary action.

II.A.3. Research applicable vehicle and service information, such as transmission/transaxle system operation, fluid type, vehicle service history, service precautions, and technical service bulletins.

II.A.4. Locate and interpret vehicle and major component identification numbers

II.A.5. Diagnose fluid loss and condition concerns; check fluid level in transmissions with and without dip-stick; determine necessary action.

II.A.6. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action.

II.A.7. Perform stall test; determine necessary action.

II.A.8. Perform lock-up converter system tests; determine necessary action.

II.A.9. Diagnose noise and vibration concerns; determine necessary action.

II.A.10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.

II.A.12. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).

II.A.13. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.

II.B.1. Inspect, adjust, and replace manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch.

	<p>II.B.2. Inspect and replace external seals, gaskets, and bushings.</p> <p>II.B.3. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits, including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses.</p> <p>II.B.4. Diagnose electronic transmission control systems using a scan tool; determine necessary action.</p> <p>II.B.5. Inspect, replace, and align powertrain mounts.</p> <p>II.B.6. Service transmission; perform visual inspection; replace fluid and filters.</p> <p>II.C.1. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces.</p> <p>II.C.6. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings.</p> <p>II.C.7. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.</p> <p>II.C.8. Install and seat torque converter to engage drive/splines.</p> <p>II.C.9. Inspect, measure, and reseal oil pump assembly and components.</p> <p>II.C.19. Measure clutch pack clearance; determine necessary action.</p> <p>II.C.20. Air test operation of clutch and servo assemblies.</p> <p>II.C.22. Inspect bands and drums; determine necessary action.</p> <p>II.C.23. Describe the operational characteristics of a continuously variable transmission (CVT)</p> <p>II.C.24. Describe the operational characteristics of a hybrid vehicle drive train.</p>
<p>Driveline Operation, Diagnosis, and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.E.01 Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.</p> <p>2.E.02 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).</p> <p><b>NATEF Tasks:</b></p> <p>III.E.1.1. Diagnose noise and vibration concerns; determine necessary action.</p> <p>III.E.1.2. Diagnose fluid leakage concerns; determine necessary action.</p> <p>III.E.1.3. Inspect and replace companion flange and pinion</p>

	<p>seal; measure companion flange runout.</p> <p>III.E.1.4. Inspect ring gear and measure runout; determine necessary action.</p> <p>III.E.1.5. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings.</p> <p>III.E.1.7. Measure and adjust drive pinion bearing preload.</p> <p>III.E.1.8. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly</p> <p>III.E.1.9. Check ring and pinion tooth contact patterns; perform necessary action.</p> <p>III.E.1.10. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.</p> <p>III.E.1.11. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.</p> <p>III.E.2.1. Diagnose noise, slippage, and chatter concerns; determine necessary action.</p> <p>III.E.2.2. Clean and inspect differential housing; refill with correct lubricant and/or additive.</p> <p>III.E.2.3. Inspect and reinstall limited slip differential components.</p> <p>III.E.2.4. Measure rotating torque; determine necessary action.</p> <p>III.E.3.1. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action.</p> <p>III.E.3.2. Inspect and replace drive axle shaft wheel studs.</p> <p>III.E.3.3. Remove and replace drive axle shafts.</p> <p>III.E.3.4. Inspect and replace drive axle shaft seals, bearings, and retainers.</p> <p>III.E.3.5. Measure drive axle flange runout and shaft end play; determine necessary action.</p>
<p>Transaxle and CV Joint Fundamentals and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.E.01 Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.</p> <p>2.E.02 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).</p> <p><b>NATEF Tasks:</b></p> <p>III.D.1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.</p> <p>III.D.2. Diagnose universal joint noise and vibration concerns;</p>

	<p>perform necessary action.</p> <p>III.D.3. Remove and replace front wheel drive (FWD) front wheel bearing.</p> <p>III.D.4. Inspect, service, and replace shafts, yokes, boots, and CV joints.</p> <p>III.D.5. Inspect, service, and replace shaft center support bearings.</p> <p>III.D.6. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.</p> <p>III.C.1. Remove and reinstall transmission/transaxle.</p> <p>III.C.4. Diagnose noise concerns using transmission/transaxle powerflow principles.</p> <p>III.C.5. Diagnose hard shifting and jumping out of gear concerns; determine necessary action.</p> <p>III.C.6. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.</p> <p>III.C.7. Inspect, replace, and align powertrain mounts.</p> <p>III.C.8. Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces.</p> <p>III.C.10. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs.</p> <p>III.C.11. Measure end play or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action.</p> <p>III.C.12. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.</p> <p>III.C.13. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.</p> <p>III.C.14. Remove, inspect, measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly.</p> <p>III.C.15. Inspect lubrication devices (oil pump or slingers); perform necessary action.</p> <p>III.C.16. Inspect, test, and replace transmission/transaxle sensors and switches.</p>
--	--

2<sup>nd</sup> Marking Period

<p>Driveline Vibration and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.E.01 Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.</p> <p>2.E.02 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels,</p>
--	--

	<p>calibration decals).</p> <p><b>NATEF Tasks:</b></p> <p>II.A.9. Diagnose noise and vibration concerns; determine necessary action.</p> <p>III.B.1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.</p> <p>III.D.1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.</p> <p>III.D.2. Diagnose universal joint noise and vibration concerns; perform necessary action.</p> <p>III.D.6. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.</p> <p>III.E.1.1. Diagnose noise and vibration concerns; determine necessary action.</p> <p>III.E.2.1. Diagnose noise, slippage, and chatter concerns; determine necessary action.</p> <p>III.E.3.1. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action.</p> <p>III.F.1. Diagnose noise, vibration, and unusual steering concerns; determine necessary action.</p>
<p>Fuels, Alternative Fuels, Advanced Transportation Technologies. Fuel System Fundamentals and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.DD.01 Diagnose hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles.</p> <p>2.DD.02 Identify hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems.</p> <p>2.DD.03 Inspect and test mechanical and electrical fuel pumps and pump control systems for pressure, regulation and volume; perform necessary action.</p> <p>2.DD.04 Replace fuel filters.</p> <p><b>NATEF Tasks:</b></p> <p>VIII.D.1. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action.</p>

	<p>VIII.D.2. Check fuel for contaminants and quality; determine necessary action.</p> <p>VIII.D.3. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.</p> <p>VIII.D.4. Replace fuel filters.</p>
--	--

### 3<sup>rd</sup> Marking Period

<p>Intake and Exhaust System/ Turbo and Supercharges</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.DD.05. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.</p> <p>2.DD.06. Check idle speed and fuel mixture.</p> <p>2.DD.07. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.</p> <p>2.DD.08. Perform exhaust system back-pressure test; determine necessary action.</p> <p><b>NATEF Tasks:</b></p> <p>VIII.D.5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.</p> <p>VIII.D.6. Inspect and test fuel injectors.</p> <p>VIII.D.7. Verify idle control operation.</p> <p>VIII.D.8. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.</p> <p>VIII.D.9. Perform exhaust system back-pressure test; determine necessary action.</p> <p>VIII.D.10. Test the operation of turbocharger/supercharger systems; determine necessary action</p>
<p>Emissions Control System Fundamentals and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.EE.01. Diagnose oil leaks, emissions, and driveability problems resulting from malfunctions in the positive crankcase ventilation (PCV) system; determine necessary action.</p> <p>2.EE.02. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.</p> <p>2.EE.03. Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system.</p> <p>2.EE.04. Inspect, test, service and replace components</p>

of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.

2.EE.05. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

2.EE.06. Inspect and test mechanical components of secondary air injection systems; perform necessary action.

2.EE.07. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.

2.EE.08. Inspect and test catalytic converter performance.

2.EE.09. Inspect and test components of intake air temperature control system; perform necessary action.

2.EE.10. Inspect and test components of early fuel evaporation control system; perform necessary action.

2.EE.11. Identify emissions and driveability problems resulting from malfunctions in the evaporative emissions control system.

2.EE.12. Inspect and test components and hoses of evaporative emissions control system; perform necessary action.

2.EE.13. Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action.

2.EE.14. Adjust valves on engines with mechanical or hydraulic lifters.

2.EE.15. Remove and replace timing belt; verify correct camshaft timing.

2.EE.16. Remove and replace thermostat.

2.EE.17. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action

**NATEF Tasks:**

VIII.E.1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.

VIII.E.2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.

VIII.E.3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.



	<p>VIII.E.4. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.</p> <p>VIII.E.5. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.</p> <p>VIII.E.6. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action.</p> <p>VIII.E.7. Inspect and test mechanical components of secondary air injection systems; perform necessary action.</p> <p>VIII.E.8. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.</p> <p>VIII.E.9. Inspect and test catalytic converter efficiency.</p> <p>VIII.E.10. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action.</p> <p>VIII.E.11. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.</p> <p>VIII.E.12. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.</p>
<p>Electronics and Computer System Fundamentals and Service</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.BB.01. Retrieve and record stored OBD I diagnostic trouble codes; clear codes.</p> <p>2.BB.02. Retrieve and record stored OBD II diagnostic trouble codes; clear codes.</p> <p>2.BB.03. Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes.</p> <p>2.BB.04. Identify emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes.</p> <p>2.BB.05. Check for module communication errors using a scan tool.</p> <p>2.BB.06. Obtain and interpret scan tool data.</p> <p>2.BB.07. Access and use service information to perform step-by-step diagnosis.</p> <p><b>NATEF Tasks:</b></p> <p>VIII.B.1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when</p>

	<p>applicable.</p> <p>VIII.B.2. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.</p> <p>VIII.B.3. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action.</p> <p>VIII.B.4. Check for module communication (including CAN/BUS systems) errors using a scan tool.</p> <p>VIII.B.5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action.</p> <p>VIII.B.6. Access and use service information to perform step-by-step diagnosis.</p> <p>VIII.B.7. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action.</p> <p>VIII.B.8. Perform active tests of actuators using a scan tool; determine necessary action.</p> <p>VIII.B.9. Describe the importance of running all OBDII monitors for repair verification.</p>
--	---

4<sup>th</sup> Marking Period

<p>Advanced Emissions and OBD Diagnosing Engine Performance Problems Diagnosing Engine Mechanical Problems</p>	<p><b>Mass Frameworks Strands:</b></p> <p>2.AA.01. Identify and interpret engine performance concern; determine necessary action.</p> <p>2.AA.02. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.</p> <p>2.AA.03. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).</p> <p>2.AA.04. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.</p> <p>2.AA.05. Identify abnormal engine noise or vibration concerns; determine necessary action.</p> <p>2.AA.06. Identify abnormal exhaust color, odor, and sound; determine necessary action.</p> <p>2.AA.07. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.</p> <p>2.AA.08. Perform cylinder power balance test; determine</p>
--	--

necessary action.

2.AA.09. Perform cylinder compression tests; determine necessary action.

2.AA.10. Perform cylinder leakage test; determine necessary action.

2.AA.11. Identify engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and/or engine diagnostic equipment.

2.AA.12. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.

2.AA.13. Verify engine operating temperature; determine necessary action.

2.AA.14. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

2.AA.15. Verify correct camshaft timing.

**NATEF Tasks:**

VIII.A.1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

VIII.A.2. Identify and interpret engine performance concern; determine necessary action.

VIII.A.3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.

VIII.A.4. Locate and interpret vehicle and major component identification numbers.

VIII.A.5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

VIII.A.6. Diagnose abnormal engine noise or vibration concerns; determine necessary action.

VIII.A.7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action.

VIII.A.8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.

VIII.A.9. Perform cylinder power balance test; determine necessary action.

VIII.A.10. Perform cylinder cranking and running compression tests; determine necessary action.

VIII.A.11. Perform cylinder leakage test; determine necessary action.

VIII.A.12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.

	<p>VIII.A.13. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.</p> <p>VIII.A.14. Verify engine operating temperature; determine necessary action.</p> <p>VIII.A.15. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.</p> <p>VIII.A.16. Verify correct camshaft timing.</p> <p>VIII.F.1. Adjust valves on engines with mechanical or hydraulic lifters.</p> <p>VIII.F.2. Remove and replace timing belt; verify correct camshaft timing.</p> <p>VIII.F.3. Remove and replace thermostat and gasket/seal.</p> <p>VIII.F.4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.</p> <p>VIII.F.5. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert.</p> <p>VIII.F.6. Perform engine oil and filter change.</p> <p>VIII.F.7. Identify hybrid vehicle internal combustion engine service precautions.</p>
--	---

There is also advancement for all levels in other areas through the curriculum in;

Maintenance technician

Detail technician

Tire technician

Small engine repair

Service writer