





Multiple Category Scope and Sequence: Scope and Sequence Report For Course Standards and Objectives, Content, Skills, Vocabulary

Wednesday, August 20, 2014, 2:09PM



Unit	Course Standards and Objectives	Content	Skills	Vocabulary
<p>District Advanced <u>Maintenance/Light Repair (MLR) - Engines/Chassis</u> <u>(District)</u> 2014-2015 <u>Collaboration</u></p> <p><u>Safety</u> (Week 1, 3 Weeks)  </p>	<p>UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, Introduction to Automotive STANDARD 47060401 Students will be able to understand general shop safety.</p> <ul style="list-style-type: none"> ▪ 470604-0101 Learn safe working habits and procedures. Pass a safety test with 100 percent. ▪ 470604-0102 Comply with safety rules for working with automotive chemicals. ▪ 470604-0103 Identify the gasses encountered in the automotive field and the hazards they present. ▪ 470604-0104 Identify the hazards and control of asbestos dust. <p>STANDARD 47060402 Students will be able to understand basic hand tools, fasteners, and shop equipment.</p> <ul style="list-style-type: none"> ▪ 470604-0205 Properly raise and support vehicles. using jack stands and a frame 	<p><u>General Safety</u></p> <ul style="list-style-type: none"> ▪ Personal Protective Equipment (PPE) ▪ Ventilation/hazardous materials ▪ Workplace safety/shop procedures <p><u>Tools Usage and Safety</u></p> <ul style="list-style-type: none"> ▪ Lifting and jacking ▪ Hand tools ▪ Power tools ▪ Machine operation 	<p><u>General Safety</u></p> <ul style="list-style-type: none"> ▪ Demonstrate consistent use of personal protective equipment ▪ Locate Material Safety Data Sheets (MSDS) for specific chemicals ▪ Assess and appropriately respond to automobile dangers <p><u>Tools Usage and Safety</u></p> <ul style="list-style-type: none"> ▪ Lift a vehicle safely using a floor jack and a hoist ▪ Demonstrate the proper use of tools 	<ul style="list-style-type: none"> ▪ Amperage ▪ Bench Grinder ▪ Carbon Monoxide ▪ Chocks ▪ Clockwise ▪ Combustible ▪ Counter clockwise ▪ Creeper ▪ Floor Jack ▪ Refrigerant ▪ Hydraulic ▪ Jack stand/safety stand ▪ Lathe ▪ Ohms ▪ Radiator ▪ Solvent ▪ Spark plug wire ▪ Spontaneous combustion ▪ Stabilize ▪ Twin post lift ▪ Voltage

contact hoist.

Steering/suspension



(Week 4, 4 Weeks)

UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, ASE Chassis MLR Standard 4
Students will be able to understand, inspect, diagnose, and service basic suspension and steering systems.

- Objective 1: General
a. Disable and enable supplemental restraint system (SRS).
- Objective 2: Related suspension and steering service.
a. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
b. Flush, fill, and bleed power steering system.
c. Inspect for power steering fluid leakage; determine necessary action.
d. Remove, inspect, replace, and adjust power steering pump drive belt.
e. Inspect and replace power steering hoses and fittings.
f. Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage

Suspension

- Parts
- Function of parts
- Inspection of parts
- Proper removal and replacement

Steering

- Parts
- Function of parts
- Inspection of parts
- Proper removal and replacement
- Supplemental restraint system (SRS)

Alignment

- Steps in pre-alignment check

Wheels & Tires

- Inflation
- Inspection
- Wheel runout
- Tire pressure monitor system (TPMS)

Steering

- Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
- b. Flush, fill, and bleed power steering system.
- c. Inspect for power steering fluid leakage; determine necessary action.
- d. Remove, inspect, replace, and adjust power steering pump drive belt.
- e. Inspect and replace power steering hoses and fittings.
- f. Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.
- g. Inspect tie rod ends (sockets), tie rod sleeves, and clamps.
- s. Inspect electric power-assisted steering.
t. Identify hybrid vehicle power steering system electrical circuits and safety precautions.
u. Describe the function of the power steering pressure switch.

Suspension

- Air shocks
- Bellows
- Jounce
- Rebound
- Active Suspension
- Ball joint
- Spindle
- Stabilizer bar
- Hydraulics
- Leaf springs
- Coil spring
- Torsion bars/MacPherson struts
- Shackle
- Shock absorber
- Sub-frame
- Control arms
- A arms
- SRS

Steering

- Rack & pinion
- Tie rod (inner/outer)
- Conventional
- Pitman arm
- Idler arm
- Drag link
- Knuckle
- Spindle
- Power steering pump
- Hydraulics
- Electric motors
- Stability control
- Steering shock
- Center link
- Drag link

Alignment

- Caster
- Camber
- Toe

damper.
g. Inspect tie rod ends (sockets), tie rod sleeves, and clamps.
h. Inspect and replace rebound and jounce bumpers.
i. Inspect track bar, strut rods/radius arms, and related mounts and bushings.
j. Inspect upper and lower ball joints (with or without wear indicators).
k. Inspect suspension system coil springs and spring insulators (silencers).
l. Inspect suspension system torsion bars and mounts.
m. Inspect and replace front stabilizer bar (sway bar) bushings, brackets, and links.
n. Inspect strut cartridge or assembly.
o. Inspect front strut bearing and mount.
p. Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms.
q. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center

Suspension

h. Inspect and replace rebound and jounce bumpers.
i. Inspect track bar, strut rods/radius arms, and related mounts and bushings.
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o. Inspect front strut bearing and mount.
p. Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms.
q. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.
r. Inspect, remove, and replace shock absorbers; inspect mounts and bushings.

Wheel alignment

a. Perform pre-alignment inspection and measure vehicle ride height; determine necessary action.

Wheels and tires

b. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.
c. Identify and test tire

- SAI
- Thrust angle
- Included angle
- Setback
- Wheel base
- Toe out on turns

Wheels & Tire

- Review from beginning auto
- TPMS

pins/bolts, and mounts.

r. Inspect, remove, and replace shock absorbers; inspect mounts and bushings.

s. Inspect electric power-assisted steering.

t. Identify hybrid vehicle power steering system electrical circuits and safety precautions.

u. Describe the function of the power steering pressure switch.

- Objective 3:
Wheel alignment.
 - a. Perform pre-alignment inspection and measure vehicle ride height; determine necessary action.
- Objective 4:
Wheels and tires.
 - b. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.
 - c. Identify and test tire pressure monitoring systems (indirect and direct) for operation; verify operation of instrument panel lamps.
 - d. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure

pressure monitoring systems (indirect and direct) for operation; verify operation of instrument panel lamps.

d. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system.

monitoring system.

Standard 5

Students will be able to understand, inspect, diagnose, and service basic brake systems.

- Objective 6: Miscellaneous (wheel bearings, parking brakes, electrical, etc.)
 - a. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.
 - b. Replace wheel bearing and race.
 - c. Inspect and replace wheel studs.

Brakes  (Week 8, 7 Weeks) 

UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, ASE Chassis MLR
Standard 5
Students will be able to understand, inspect, diagnose, and service basic brake systems.

- Objective 1: General
 - a. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).
- Objective 2: Hydraulic system.
 - a. Identify components of brake warning light system.

Disc Brakes

- Caliper
- Pads
- Rotor
- Service/Inspection
- Measurements
- Runout
- Disc thickness variation
- Caliper bracket
- Lubrication
- Seating/break-in
- Materials

Drum Brakes

- Wheel cylinder
- Shoes
- Backing plates
- Service & inspection
- Hardware
- Park brake
- Measurements

Objective 1: General

- a. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).

Disc Brakes

a. Remove and clean caliper assembly; inspect for leaks and damage/wear to caliper housing; determine necessary action.
b. Clean and inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action.
c. Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks.
d. Clean and inspect rotor, measure rotor thickness, thickness variation, and lateral runout; determine

Disc Brakes

- Caliper
- Pads
- Rotor
- Runout
- Disc thickness variation
- Caliper bracket
- Wear indicators
- Floating/non floating
- Hub & hubless
- Vented/non-vented
- Caliper hardware

Drum Brakes

- Wheel cylinder
- Shoes
- Backing plates
- Hardware
- Park brake
- Brake drum
- Self energizing and servo

- b. Bleed and/or flush brake system.
- c. Test brake fluid for contamination.
- Objective 3: Drum brakes.
 - a. Remove, clean, inspect, and measure brake drum diameter; determine necessary action.
 - b. Refinish brake drum and measure final drum diameter; compare with specifications.
 - c. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
 - d. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.
 - e. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; make final checks and adjustments.
- Objective 4: Disc brakes
 - a. Remove and clean caliper assembly; inspect for leaks and damage/wear to caliper housing; determine necessary action.
 - b. Clean and

- Brake drum
- Lubrication

Power Assist

- Vacuum
- Hydraulics
- Electric assist
- Power steering pump
- Hydro-boost
- Forces
- Newton's Law
- Inspection

ABS

- Electricity
- Function
- Purpose
- Diagnostics
- Regenerative braking

Hydraulic System

- Pascal's law
- Brake fluid type
- Thermodynamics
- Proper bleeding
- Lines & hoses
- Valves
- Master cylinder

- necessary action.
- e. Remove and reinstall rotor.
- f. Refinish rotor on vehicle; measure final rotor thickness and compare with specifications.
- g. Refinish rotor off vehicle; measure final rotor thickness and compare with specifications.
- h. Retract and re-adjust caliper piston on an integral parking brake system.
- i. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.

Drum Brakes

- a. Remove, clean, inspect, and measure brake drum diameter; determine necessary action.
- b. Refinish brake drum and measure final drum diameter; compare with specifications.
- c. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
- d. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.
- e. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; make final checks and adjustments.

Hydraulic System.

- a. Identify components of brake warning light system.
- b. Bleed and/or flush brake

- Duo servo

Power Assist

- Vacuum
- Hydraulics
- Power steering pump
- Hydro-boost
- Forces
- diaphragm
- Check valve
- Belts
- Lines & hoses
- Relief valve

ABS

- Electricity
- Regenerative braking
- Sensors
- Computer
- Frequency
- Tone ring
- Variable reluctance
- Correct tire size

Hydraulic System

- Pascal's law
- Brake fluid type
- Thermodynamics
- Lines & hoses
- Valves
- Master cylinder
- Boiling point
- Hygroscopic
- Glycol
- DOT
- Injection injury
- Friction
- Traction
- Heat

inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action.

c. Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks.

d. Clean and inspect rotor, measure rotor thickness, thickness variation, and lateral runout; determine necessary action.

e. Remove and reinstall rotor.

f. Refinish rotor on vehicle; measure final rotor thickness and compare with specifications.

g. Refinish rotor off vehicle; measure final rotor thickness and compare with specifications.

h. Retract and re-adjust caliper piston on an integral parking brake system.

i. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.

- Objective 5:
Power-assist units
a. Check brake pedal travel with, and without,

system.
c. Test brake fluid for contamination.

Power-Assist Units

- a. Check brake pedal travel with, and without, engine running to verify proper power booster operation.
- b. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.

Objective 6: Miscellaneous (wheel bearings, parking brakes, electrical, etc.)

- a. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.
- b. Replace wheel bearing and race.
- c. Inspect and replace wheel studs

ABS

- a. Identify traction control/vehicle stability control system components.
- b. Describe the operation of a regenerative braking system.

engine running to verify proper power booster operation.
 b. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.

- Objective 7: Electronic brakes traction and stability control systems.
 - a. Identify traction control/vehicle stability control system components.
 - b. Describe the operation of a regenerative braking system.

Engines  (Week 15, 6 Weeks) 

UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, ASE Engine MLR Standard 2
 Students will be able to understand, inspect, diagnose, and service the basics of engine repair.

- Objective 1: General
 - a. Verify operation of the instrument panel engine warning indicators.
 - b. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
 - c. Install engine covers using gaskets, seals, and sealers as required.
 - d. Remove and replace timing belt;

Design

- Configuration
 - V
 - Straight
 - Flat
 - OHV
 - OHC

Otto Cycle

- Intake
- Compression
- Power
- Exhaust
- Timing

Valve Timing

- Gears
- Chains
- Belts

Diagnostic Tools

Design

- Visually identify engine configuration correctly

Otto Cycle

- Name the four strokes in the correct order

Valve Timing

- Adjust valves (mechanical or hydraulic lifters)

Diagnostic Tools

- Verify operation of the instrument panel engine warning indicators
- Inspect engine

- OBD
- Gaskets
- Seals
 - Internal
 - External
- DTC
- Bearings
- Continuity tester
- EGR
- Cat converter
- Compression
- Secondary ignition
- Primary ignition
- Sensors (all types)
- Sensors (map, maf, iat, tps, etc)
- Ecosystem

verify correct camshaft timing.
e. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
f. Identify hybrid vehicle internal combustion engine service precautions.

- Objective 2: Cylinder head and valve train.
 - a. Adjust valves (mechanical or hydraulic lifters).
- Objective 3: Lubrication and cooling systems.
 - a. Remove, inspect, and replace thermostat and gasket/seal.
 - b. Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

Standard 5
Students will be able to understand, inspect, diagnose, and service basic engine performance systems.

- Objective 1: General
 - a. Perform engine absolute (vacuum/boost) manifold pressure tests; determine

- What it is
- How it works
- Why are you using it
 - Compression tester
 - Vacuum gauge
 - Leakage tester
 - Secondary ignition tester
 - Timing light
 - Scan tool
 - DVOM meter

Fuel System

- Fuel Filter
- DEF
- Fuel pressure gauge

Exhaust & EGR System

- Manifold
- Muffler
- EGR valve
- Cat converter

Cooling System

- Water pump
- Thermostat
- Heater core
- Radiator
- Hoses
- Hydrometer
- Pressure tester

Sensors

- Temperature
- Pressure
- Speed
- Location
- Audio
- Chemical
- Flow

- assembly for fuel, oil, coolant, and other leaks; determine necessary action
- Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action
- Perform cylinder power balance test; determine necessary action
- Perform cylinder cranking and running compression tests; determine necessary action
- Perform cylinder leakage test; determine necessary action
- Verify engine operating temperature

Fuel System

- Replace the fuel filter
- Locate and evaluate DEF condition

Exhaust & EGR System

- Inspect exhaust system visually for cracks and leaks

Cooling System

- Remove, inspect, and replace thermostat and gasket/seal
- Inspect and test

necessary action
b. Perform cylinder power balance test; determine necessary action.
c. Perform cylinder cranking and running compression tests; determine necessary action.
d. Perform cylinder leakage test; determine necessary action.
e. Verify engine operating temperature.
f. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.

- Objective 2: Computerized controls.
 - a. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.
 - b. Describe the importance of operating all OBDII monitors for repair verification.
- Objective 3: Fuel, air induction, and exhaust systems.
 - a. Replace fuel filter(s).
 - b. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine

coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required

Sensors

- Retrieve sensor data using a scan tool

Engine Operation

- Define and describe the Otto Cycle

Maintenance

- Install engine covers using gaskets, seals, and sealers as required
- Remove and replace timing belt
- Verify correct camshaft timing
- Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert
- Remove and replace spark plugs; inspect secondary ignition components for wear and damage

Hybrids

necessary action.
 c. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; repair or replace as needed.
 d. Check and refill diesel exhaust fluid (DEF).

Electrical  (Week
 21, 12 Weeks) 

UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, ASE Engine MLR Standard 3
 Students will be able to understand, inspect, diagnose, and service the basics of Electrical/electronic systems.

- Objective 1: General
 - a. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).
 - b. Use wiring diagrams to trace electrical/electronic circuits.
 - c. Demonstrate proper use of a digital multi-meter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance.
 - d. Demonstrate knowledge of the causes and effects from shorts,

- Identify hybrid vehicle internal combustion engine service precautions

General

- What a circuit is (source, path, load, control)
- How to read a wiring diagram
- How to use a meter
- How to test circuits with a meter
- How to find power with a test light
- How to test for a parasitic draw
- What a short is and why all circuits must be protected
- Understand the three faults of a circuit (open, short, high resistance)
- Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).

Battery service

- Basic construction of a battery
- Why you do a service
- How to remove a battery safely
- Know where to find manufacturer's recommendations/specification
- Understand hydrometer testing
- Know the dangers of orange marked circuits
- How to use a keep-alive memory system

Starting system

- Basics of how the starting systems work
 Objective 5: Lighting system.
 - a. Aim headlights.
 - b. Identify system voltage and safety

General

- Use a jumper wire with a fuse or circuit breaker to isolate shorts
- Perform a solder repair of electrical wiring
- Replace electrical connectors and terminal ends
- Build a simple circuit
- Measure component/circuit resistance

Battery service

- Perform a battery capacity test and determine necessary action
- Complete a battery service
- Interpret battery markings and labels
- Perform slow/fast battery charge according to manufacturer's recommendations

Starting system

- Test a starting

General

- amperage (amp)
- voltage (volt)
- resistance (ohms)
- short
- open
- circuit
- control
- switch
- relay
- rheostat
- load
- parallel
- series-parallel
- fuse
- parasitic draw

Battery service

- electrolyte
- hydrometer
- load test
- acid
- neutralizers
- charge rate
- cold cranking amps
- sulfation

Starting system

- solenoid
- relay
- starter drive
- over running clutch
- neutral safety switch

grounds, opens, and resistance problems in electrical/electronic circuits.

e. Check operation of electrical circuits with a test light.

f. Check operation of electrical circuits with fused jumper wires.

g. Measure key-off battery drain (parasitic draw).

h. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.

i. Perform solder repair of electrical wiring.

j. Replace electrical connectors and terminal ends.

- Objective 2: Battery service.
 - a. Confirm proper battery capacity for vehicle application; perform battery capacity test; determine necessary action.
 - b. Maintain or restore electronic memory functions.
 - c. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.
 - d. Perform slow/fast battery charge according to manufacturer's recommendations.
 - e. Identify high-voltage circuits of electric or hybrid

precautions associated with high-intensity discharge headlights.

Charging system

- Understand the basic operation of the alternator

Lighting system

- Basic functions of a headlight
- How to replace the bulbs properly

Accessories

- How to conduct a proper inspection of window washers and wipers, indicator lamp operations, keyless entry/remote-start systems, panel gauges and warning/indicator lights
- How to reset the maintenance indicators
- How to find the proper information to disable and enable an airbag system

system

Charging system

- Test a charging system

Lighting system

- Replace bulb
- Complete an inspection for cracked bulb, lenses or burned out bulbs
- Aim headlights
- Complete an inspection

Accessories

- Complete a multi-point inspection
- Replace a wiper blade

- ignition switch

Charging system

- stator
- rotor
- regulator
- rectifier
- voltage drop
- pulleys
- generator/alternator

Lighting system

- LED
- halogen
- HID (high intensity discharge)
- DRL (daytime running lamps)

Accessories

- key-fob
- keyless entry or ignition
- airbag (SRS - supplemental restraint system)

electric vehicle and related safety precautions.

f. Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery.

g. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.

- Objective 3:
Starting system.
 - a. Perform starter current draw test; determine necessary action.
 - b. Perform starter circuit voltage drop tests; determine necessary action.
 - c. Inspect and test starter relays and solenoids; determine necessary action.
 - d. Remove and install starter in a vehicle.
 - e. Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action.
- Objective 4:
Charging System.
 - a. Perform charging system output test; determine necessary action.
 - b. Inspect, adjust, or replace generator

(alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.

c. Remove, inspect, and re-install generator (alternator).

d. Perform charging circuit voltage drop tests; determine necessary action.

- Objective 5:
Lighting system.
 - a. Aim headlights.
 - b. Identify system voltage and safety precautions associated with high-intensity discharge headlights.
- Objective 6:
Accessories
 - a. Disable and enable airbag system for vehicle service; verify indicator lamp operation.
 - b. Remove and reinstall door panel.
 - c. Describe the operation of keyless entry/remote-start systems.
 - d. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators.
 - e. Verify windshield wiper and washer operation; replace

wiper blades.

Transmission



(Week 33, 2 Weeks) 

UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, ASE Chassis MLR

Standard 2

Students will be able to understand, inspect, diagnose, and service the basics of automatic transmissions and transaxles.

- Objective 1: In-vehicle transmission and transaxle.
 - a. Inspect, adjust, and replace external manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch.
 - b. Inspect for leakage at external seals, gaskets, and bushings.
 - c. Inspect replace and align power train mounts.
 - d. Drain and replace fluid and filter(s).
- Objective 2: Off-vehicle transmission and transaxle.
 - a. Describe the operational characteristics of a continuously variable transmission (CVT).
 - b. Describe the operational characteristics of a hybrid vehicle

Transmission

- Why a car has a transmission

Maintenance & Service

- How to identify transmission types
- How to check fluids
- How to service/replace fluids
- How to adjust and replace linkage

Inspect, diagnose, and service the basics of automatic transmissions and transaxled

- Inspect for leakage at external seals, gaskets, and bushings
- Inspect replace and align power train mounts
- Drain and replace fluid and filter(s) (where possible)

Inspect, diagnose and service the basics of manual drive train and axles

- Drain and refill manual transmission/trans axle and final drive unit
- Check for system leaks
- Drain and refill differential housing
- Inspect and replace drive axle wheel studs
- Inspect front-wheel bearings and locking hubs

- Transmission
- Fly wheel
- Clutch disc
- Pressure plate
- Pilot bearing
- Torque converter

drive train.

Standard 3

Students will be able to understand, inspect, diagnose, and service the basics of manual drive train and axles.

- Objective 1:
General
 - a. Drain and refill manual transmission/trans axle and final drive unit.
- Objective 2:
Clutch.
 - a. Check for system leaks.
- Objective 3:
transmission/trans axle.
 - a. Describe the operational characteristics of an electronically-controlled manual transmission/trans axle.
- Objective 5:
Differential case assembly
 - a. Drain and refill differential housing.
 - b. Inspect and replace drive axle wheel studs.
- Objective 6: Four-wheel drive/all-wheel drive
 - a. Inspect front-wheel bearings and locking hubs.

HVAC  (Week 35, 4 Weeks) 

UT: CTE: Skilled and Technical Sciences, UT: Grades 9-12, ASE Engine MLR
Standard 4

Refrigeration Cycle

- Refrigerant
- Compressor

Diagnostic

- Inspect A/C-heater ducts, doors,

- Condenser
- Evaporator
- Ducts
- Cabin Filter

Students will be able to understand, inspect, diagnose, and service heating and air conditioning systems.

- Objective 1: Refrigeration system components.
 - a. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.
 - b. Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions.
 - c. Inspect A/C condenser for airflow restrictions; determine necessary action.
- Objective 2: Operating systems and related controls.
 - a. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.
 - b. Identify the source of A/C system odors.

- Condenser
- Evaporator
- Restriction
- Receiver/dryer/accumulator

AC Drives

- Belt
- Motor

Air Flow

- Condenser
- Evaporator
- Ducts
- Cabin Filter
- Blower fan
- Cooling fan

Diagnostic

- Sources of smells

hoses, cabin filters, and outlets; perform necessary action
Identify the source of A/C system odors

- Blower fan
- Cooling fan
- Refrigerant
- Compressor
- Restriction

Refrigeration and Airflow system components

- Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action
- Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions
- Inspect A/C condenser for airflow restrictions; determine necessary action.