Florida Department of Education
Curriculum Framework

Program Title: **Master Automotive Service Technology 2**
Program Type: **Career Preparatory**
Career Cluster: **Transportation, Distribution and Logistics**

Career Certificate Program		
Program Number	T400800	
CIP Number	0647060412	
Grade Level	30, 31	
Program Length	750 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Transportation, Distribution and Logistics career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Transportation, Distribution and Logistics career cluster.

The content includes but is not limited to broad, transferable skills and stresses understanding and demonstration of the following elements of the **Automotive** industry, planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

NOTE: It is recommended that students complete **OCP-A (Automobile Services Assistor) of Automotive Service Technology 1** and/or demonstrate mastery of the outcomes in **OCP-A (Automobile Services Assistor) of Automotive Service Technology 1** prior to enrolling in additional Automotive Service Technology courses. **The sequence of OCP's, after completing and/or demonstrating mastery of OCP-A (Automobile Services Assistor) of Automotive Service Technology 1, is at the discretion of the instructor.**

For institutions using this framework, the Automotive Service Excellence (ASE) Education Foundation highly recommends the Master Automotive Service Technology (MAST) program Certification/Accreditation. Florida Statute (F.S.) 1004.925 – Automotive service technology education programs; certification. – requires all automotive service technology education programs shall be industry certified in accordance with rules adopted by the State Board of Education.

Benchmarks identified with a designation of P-1, P-2, or P-3 are ASE tasks.

When offered at the postsecondary level, this program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	AER0503	Automotive Engine Performance Technician	AUTO IND @7 %7 %G AUTO MECH @7 7G	300 hours
B	AER0257	Automatic Transmission and Transaxle Technician		150 hours
C	AER0274	Manual Drivetrain and Axle Technician		150 hours
D	AER0172	Automotive Heating and Air Conditioning Technician		150 hours

National Standards

Industry or National Standards corresponding to the standards and/or benchmarks for the Automotive Service Technology program can be found using the following link: https://www.aseeducationfoundation.org/program-accreditation

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Explain and apply proficiently the diagnosis, service and repair of engines, ignition, fuel, air induction, exhaust, computer engine and emission control systems.
02.0 Explain and apply proficiently the diagnosis, service, repair and overhaul of automatic transmissions/transaxles.
03.0 Explain and apply proficiently the operation, assembly, diagnosis, service and repair of manual drivetrains, clutches, transmissions/transaxles, drive and half-shaft universals, constant velocity joints, rear axle differential assembly, limited slip, four-wheel drive and all-wheel drive.
04.0 Explain and apply proficiently the diagnosis, service and repair of heating and air conditioning, refrigeration, compressors, compressor clutches, evaporators, receiver driers, accumulators, condensers, heating and engine cooling, related control systems, refrigerant recovery, and recycling and handling.

Florida Department of Education
Student Performance Standards

Program Title: **Automotive Service Technology 2**
Career Certificate Program Number: **T400800**

Course Description: The Automotive Engine Performance Technician course prepares students for entry into the automotive service industry. Students explore career opportunities and requirements of a professional auto mechanic. Students study the diagnosis, service and repair of engines, ignition, fuel, air induction, exhaust, computer engine and emission control systems.

Abbreviations:
EP = Engine Performance

For every task in Automotive Engine Performance Technician course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

EP Task List:	
P-1 =	34
P-2 =	13
P-3 =	2
Total	49

Course Number: AER0503 Occupational Completion Point: A Automotive Engine Performance Technician – 300 Hours		Priority Number
01.0	Explain and apply proficiently the diagnosis, service and repair of engines, ignition, fuel, air induction, exhaust, computer engine and emission control systems. The student will be able to:	
General: Engine Diagnosis		
01.01	Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).	P-1
01.02	Identify heating, ventilation, and air conditioning (HVAC) components and configurations.	P-1
01.03	Identify and interpret engine performance concerns; determine needed action.	P-1
01.04	Diagnose abnormal engine noises or vibration concerns; determine needed action.	P-2
01.05	Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action.	P-2
01.06	Perform engine absolute manifold pressure tests (vacuum/boost); determine needed action.	P-1
01.07	Perform cylinder power balance test; determine needed action.	P-1

01.08	Perform cylinder cranking and running compression tests; determine needed action.	P-1
01.09	Perform cylinder leakage test; determine needed action.	P-1
01.10	Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.	P-1
01.11	Verify proper engine cooling system operation; determine needed action.	P-1
01.12	Verify correct camshaft timing including engines equipped with variable valve timing systems (VVT).	P-1
01.13	Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.	
01.14	Demonstrate knowledge of using a 4 or 5 gas analyzer, interpret readings, and determine necessary action.	
01.15	Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.	
Computerized Controls Diagnosis and Repair		
01.16	Identify computerized control system components and configurations.	P-1
01.17	Retrieve and record diagnostic trouble codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable.	P-1
01.18	Access and use service information to perform step-by-step (troubleshooting) diagnosis.	P-1
01.19	Perform active tests of actuators using a scan tool; determine needed action.	P-1
01.20	Describe the use of OBD monitors for repair verification.	P-1
01.21	Diagnose the causes of emissions or drive-ability concerns with stored or active diagnostic trouble codes (DTC); obtain, graph, and interpret scan tool data.	P-1
01.22	Diagnose emissions or drive-ability concerns without stored or active diagnostic trouble codes; determine needed action.	P-1
01.23	Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multi-meter (GMM)/digital storage oscilloscope (DSO); perform needed action.	P-1
01.24	Diagnose drive-ability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, HVAC, automatic transmissions, non-OEM installed accessories, or similar systems); determine needed action.	P-2
01.25	Check for module communication (including CAN/BUS systems) errors using a scan tool.	
01.26	Describe the process for reprogramming or recalibrating the powertrain/engine control module (PCM/ECM).	P-1
Ignition System Diagnosis and Repair		
01.27	Identify ignition system components and configurations.	P-1
01.28	Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.	P-1

01.29	Inspect and test crankshaft and camshaft position sensor(s); determine needed action.	P-1
01.30	Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram/initialize as needed.	P-2
01.31	Remove and replace spark plugs; inspect secondary ignition components for wear and damage.	P-1
01.32	Inspect and test ignition primary and secondary circuit wiring and solid state components; test ignition coil(s); perform necessary action.	
Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair		
01.33	Identify fuel, air induction, and exhaust system components and configurations.	P-1
01.34	Diagnose (troubleshoot) hot or cold no-starting, hard starting, poor drive-ability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine needed action.	P-2
01.35	Check fuel for contaminants; determine needed action.	P-2
01.36	Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; perform needed action.	P-1
01.37	Replace fuel filter(s) where applicable.	P-2
01.38	Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.	P-2
01.39	Inspect, test, and/or replace fuel injectors on low- and high-pressure systems.	P-1
01.40	Verify idle control operation.	P-1
01.41	Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform needed action.	P-1
01.42	Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.	P-1
01.43	Perform exhaust system back-pressure test; determine needed action.	P-2
01.44	Check and refill diesel exhaust fluid (DEF).	P-3
01.45	Test the operation of turbocharger/supercharger systems; determine needed action.	P-2
Emissions Control Systems Diagnosis and Repair		
01.46	Identify emission control system components and configurations.	P-1
01.47	Diagnose oil leaks, emissions, and drive-ability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.	P-2
01.48	Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform needed action.	P-2
01.49	Diagnose emissions and drive-ability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; determine needed	P-1

	action.	
01.50	Diagnose emissions and drive-ability concerns caused by the secondary air injection system; inspect, test, repair, and/or replace electrical/electronically-operated components and circuits of secondary air injection systems; determine needed action.	P-2
01.51	Diagnose emissions and drive-ability concerns caused by the evaporative emissions control (EVAP) system; determine needed action.	P-1
01.52	Diagnose emission and drive-ability concerns caused by catalytic converter system; determine needed action.	P-1
01.53	Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.	P-1
01.54	Inspect and test electrical/electronically operated components and circuits of secondary air injection systems; determine needed action.	P-3
01.55	Adjust valves on engines with mechanical or hydraulic lifters; as applicable.	
01.56	Remove and replace timing belt; verify correct camshaft timing.	
01.57	Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.	
01.58	Inspect engine oil and/or filter for condition and determine necessary action.	
01.59	Identify hybrid electric vehicle internal combustion engine service precautions.	

Course Description: The Automatic Transmission and Transaxle Technician prepare students for entry into the automotive service industry. Students explore career opportunities and requirements of a professional auto mechanic. Students study diagnostics, repair, service, and operation of automatic transmission/transaxles.

Abbreviations:
AT = Automatic Transmission/Transaxle

For every task in Automatic Transmission and Transaxle Technician course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

AT Task List:	
	P-1 = 13
	P-2 = 27
	P-3 = 0
Total	**40**

Course Number: AER0257 Occupational Completion Point: B Automatic Transmission and Transaxle Technician – 150 Hours		**Priority Number**
02.0	Explain and apply proficiently the diagnosis, service, repair and overhaul of automatic transmissions/transaxles.	

The student will be able to:	
General: Transmission and Transaxle Diagnosis	
02.01 Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).	P-1
02.02 Identify automatic transmission and transaxle components and configurations.	P-1
02.03 Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.	P-1
02.04 Inspect transmission fluid condition; check level; inspect for leaks on transmission or transaxle equipped with a dipstick.	P-1
02.05 Inspect transmission fluid condition; check level; inspect for leaks on transmission or transaxle not equipped with a dipstick.	P-1
02.06 Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine needed action.	P-1
02.07 Diagnose noise and vibration concerns; determine needed action.	P-2
02.08 Perform stall test; determine needed action.	P-2
02.09 Perform lock-up converter system tests; determine needed action.	P-2
02.10 Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.	P-1
02.11 Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.	P-1
02.12 Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).	P-1
In-Vehicle Transmission/Transaxle Maintenance and Repair	
02.13 Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.	P-1
02.14 Inspect for leakage; replace external seals, gaskets, and bushings.	P-2
02.15 Perform relearn procedures.	P-2
02.16 Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits.	P-1
02.17 Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.	P-1
02.18 Inspect, replace and align powertrain mounts.	P-2
02.19 Diagnose electronic transmission control systems using a scan tool; determine necessary action.	
Off-Vehicle Transmission and Transaxle Repair	
02.20 Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear	P-2

	crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces.	
02.21	Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.	P-1
02.22	Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.	P-2
02.23	Describe the operational characteristics of a continuously variable transmission (CVT).	P-2
02.24	Describe the operational characteristics of a hybrid electric vehicle drive train.	P-2
02.25	Disassemble, clean, and inspect transmission/transaxle.	P-2
02.26	Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, switches, solenoids, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets).	P-2
02.27	Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine needed action.	P-2
02.28	Assemble transmission/transaxle.	P-2
02.29	Inspect, measure, and reseal oil pump assembly and components.	P-2
02.30	Measure transmission/transaxle end play and/or preload; determine needed action.	P-2
02.31	Inspect, measure, and/or replace thrust washers and bearings.	P-2
02.32	Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls.	P-2
02.33	Inspect bushings; determine needed action.	P-2
02.34	Inspect and measure planetary gear assembly components; determine needed action.	P-2
02.35	Inspect case bores, passages, bushings, vents, and mating surfaces; determine needed action.	P-2
02.36	Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform needed action.	P-2
02.37	Inspect measure, repair, adjust or replace transaxle final drive components.	P-2
02.38	Inspect clutch drum, piston, check-balls, springs, retainers, seals, friction plates, pressure plates, and bands; determine needed action.	P-2
02.39	Measure clutch pack clearance; determine needed action.	P-2
02.40	Air test operation of clutch and servo assemblies.	P-2
02.41	Inspect one-way clutches, races, rollers, sprags, springs, cages, retainers; determine needed action.	P-2
02.42	Install and seat torque converter to engage drive/splines.	
02.43	Inspect bands and drums; determine necessary action.	

Course Description: The Manual Drivetrain and Axle Technician prepare students for entry into the automotive service industry. Students explore career opportunities and requirements of a professional auto mechanic. Students study diagnostics and repair of drive train, clutch, transmission, transaxle, half shaft universal, constant-velocity joint, rear axle, ring and pinion gears, differential case assemble, limited slip differential, drive shaft, and four wheel drive/all-wheel drive.

Abbreviations:
MD = Manual Drivetrain and Axles

For every task in Manual Drivetrain and Axle Technician course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

MD Task List:	
P-1	**16**
P-2	**30**
P-3	**6**
Total	**52**

Course Number: AER0274 **Occupational Completion Point: C** **Manual Drivetrain and Axle Technician – 150 Hours**	**Priority Number**
03.0 Explain and apply proficiently the operation, assembly, diagnosis, service and repair of manual drivetrains, clutches, transmissions/transaxles, drive and half-shaft universals, constant velocity joints, rear axle differential assembly, limited slip, four-wheel drive and all-wheel drive. The student will be able to:	
General: Drive Train Diagnosis	
03.01 Identify and interpret drive train concerns; determine needed action.	P-1
03.02 Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).	P-1
03.03 Check fluid condition; check for leaks; determine needed action.	P-1
03.04 Identify manual drive train and axle components and configurations.	P-1
03.05 Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.	P-1
03.06 Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.	P-1
03.07 Diagnose fluid loss, level, and condition concerns; determine necessary action.	
Clutch Diagnosis and Repair	
03.08 Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.	P-2
03.09 Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform needed action.	P-2

03.10	Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).	P-2
03.11	Bleed clutch hydraulic system.	P-2
03.12	Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.	P-2
03.13	Inspect flywheel and ring gear for wear, cracks, and discoloration; determine needed action.	P-2
03.14	Measure flywheel runout and crankshaft end play; determine needed action.	P-2
03.15	Describe the operation and service of a system that uses a dual mass flywheel.	P-3
03.16	Inspect hydraulic clutch slave and master cylinders, lines, and hoses; determine necessary action.	
03.17	Describe the operation and service of an electronically controlled dual clutch system.	
03.18	Inspect engine block, core plugs, rear main engine oil seal, clutch (bell) housing, transmission/transaxle case mating surfaces, and alignment dowels; determine necessary action.	
Transmission/Transaxle Diagnosis and Repair		
03.19	Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.	P-2
03.20	Describe the operational characteristics of an electronically-controlled manual transmission/transaxle.	P-2
03.21	Diagnose noise concerns through the application of transmission/transaxle powerflow principles.	P-2
03.22	Diagnose hard shifting and jumping out of gear concerns; determine needed action.	P-2
03.23	Diagnose transaxle final drive assembly noise and vibration concerns; determine needed action.	P-2
03.24	Disassemble, inspect clean, and reassemble internal transmission/transaxle components.	P-3
03.25	Remove and reinstall manual transmission/transaxle.	
03.26	Inspect transmission/transaxle case, extension housing, case mating surfaces, bores, bushings, and vents; perform necessary action.	
03.27	Inspect, replace, and align powertrain mounts.	
03.28	Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces.	
03.29	Remove and replace transaxle final drive.	
03.30	Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs.	
03.31	Measure end play or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action.	
03.32	Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.	
03.33	Inspect lubrication devices (oil pump or slingers); perform necessary action.	
03.34	Inspect, test, and replace transmission/transaxle sensors and switches.	

Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-Wheel, and Four-Wheel drive)	
03.35 Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action.	P-1
03.36 Diagnose universal joint noise and vibration concerns; perform needed action.	P-1
03.37 Inspect, remove, and/or replace bearings, hubs, and seals.	P-1
03.38 Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints.	P-1
03.39 Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles; determine needed action.	P-2
03.40 Inspect, service, and replace shaft center support bearings.	
Drive Axle Diagnosis and Repair – Ring and Pinion Gears and Differential Case Assembly	
03.41 Clean and inspect differential housing; check for leaks; inspect housing vent.	P-1
03.42 Check and adjust differential housing fluid level; use proper fluid type per manufacturer specification.	P-1
03.43 Drain and refill differential housing; use proper fluid type per manufacturer specifications.	P-1
03.44 Diagnose noise and vibration concerns; determine needed action.	P-2
03.45 Inspect and replace companion flange and/or pinion seal; measure companion flange runout.	P-2
03.46 Inspect ring gear and measure runout; determine needed action.	P-2
03.47 Remove, inspect, reinstall and/or drive pinion and ring gear, spacers, sleeves, and bearings.	P-2
03.48 Measure and adjust drive pinion depth.	P-2
03.49 Measure and adjust drive pinion bearing preload.	P-2
03.50 Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).	P-2
03.51 Check ring and pinion tooth contact patterns; perform needed action.	P-2
03.52 Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.	P-2
03.53 Reassemble and reinstall differential case assembly; measure runout; determine needed action.	P-2
03.54 Diagnose noise and vibration concerns; determine necessary action.	
Drive Axle Diagnosis and Repair – Limited Slip Differential	
03.55 Diagnose noise, slippage, and chatter concerns; determine needed action.	P-3
03.56 Measure rotating torque; determine needed action.	P-3
03.57 Inspect and reinstall limited slip differential components.	

03.58 Identify operational characteristics of electronic control differentials.	
Drive Axle Diagnosis and Repair – Drive Axles	
03.59 Inspect and replace drive axle wheel studs.	P-1
03.60 Remove and replace drive axle shafts.	P-1
03.61 Inspect and replace drive axle shaft seals, bearings, and retainers.	P-2
03.62 Measure drive axle flange runout and shaft end play; determine needed action.	P-2
03.63 Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine needed action.	P-2
Four-Wheel Drive/All-Wheel Drive Component Diagnosis and Repair	
03.64 Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.	P-2
03.65 Inspect locking mechanisms; determine needed action.	P-3
03.66 Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.	P-2
03.67 Identify concerns related to variations in tire circumference and/or final drive ratios.	P-1
03.68 Diagnose noise, vibration, and unusual steering concerns; determine needed action.	P-2
03.69 Diagnose, test, adjust, and/or replace electrical/electronic components of four-wheel drive/all-wheel drive systems.	P-2
03.70 Disassemble, service, and reassemble transfer case and components.	P-3
03.71 Remove and reinstall transfer case.	

Course Description: The Automotive Heating and Air Conditioning Technician prepare students for entry into the automotive service industry. Students explore career opportunities and requirements of a professional auto mechanic. Students study the diagnosis, service and repair of heating and air conditioning, refrigeration, compressors, compressor clutches, evaporators, receiver driers, accumulators, condensers, heating and engine cooling, related control systems, refrigerant recovery, and recycling and handling.

Abbreviations:
HA = Heating and Air Conditioning

For every task in Automotive Heating and Air Conditioning Technician course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in

HA Task List:	
P-1	**20**
P-2	**14**
P-3	**2**
Total	**36**

accordance with local, state, and federal safety and environmental regulations.

Course Number: AER0172 Occupational Completion Point: D Automotive Heating and Air Conditioning Technician – 150 Hours	**Priority Number**
04.0 Explain and apply proficiently the diagnosis, service and repair of heating and air conditioning, refrigeration, compressors, compressor clutches, evaporators, receiver driers, accumulators, condensers, heating and engine cooling, related control systems, refrigerant recovery, and recycling and handling. The student will be able to:	
General: A/C System Diagnosis and Repair	
04.01 Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).	P-1
04.02 Identify heating, ventilation, and air conditioning (HVAC) components and configurations.	P-1
04.03 Retrieve and record DTCs, OBD monitor status, and freeze frame data; clear codes and data when directed.	P-1
04.04 Identify and interpret heating and air conditioning problems; determine needed action.	P-1
04.05 Performance test A/C system; identify problems.	
04.06 Identify abnormal operating noises in the A/C system; determine needed action.	P-2
04.07 Identify refrigerant type; test for sealant; select and connect proper gauge set/test equipment; record temperature and pressure readings.	P-1
04.08 Leak test A/C system; determine needed action.	P-1
04.09 Inspect condition/quantity of refrigerant oil removed from A/C system; determine needed action.	P-2
04.10 Determine recommended oil and oil capacity for system application and component(s) replacement.	P-1
Refrigeration System Component Diagnosis and Repair	
04.11 Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners and visually inspect A/C components for signs of leaks; determine needed action.	P-1
04.12 Inspect, test, and/or service A/C compressor clutch components and mountings; determine needed action.	P-2
04.13 Remove, inspect, reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity.	P-2
04.14 Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.	
04.15 Determine need for an additional A/C system filter; perform needed action.	P-3
04.16 Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform needed action.	P-2
04.17 Inspect for proper A/C condenser airflow; determine needed action.	P-1

04.18	Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity.	P-2
04.19	Remove, inspect, and install expansion valve or orifice (expansion) tube.	P-1
04.20	Inspect evaporator housing water drain; perform needed action.	P-1
04.21	Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action.	P-1
04.22	Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.	P-2
04.23	Perform cooling system pressure tests; check coolant condition, inspect and test radiator, cap (pressure/vacuum), coolant recovery tank, and hoses; perform necessary action.	
Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair		
04.24	Inspect engine cooling and heater systems hoses and pipes; perform needed action.	P-1
04.25	Inspect and test heater control valve(s); perform needed action.	P-2
04.26	Diagnose temperature control problems in the HVAC system; determine needed action.	P-2
04.27	Determine procedure to remove, inspect, reinstall, and/or replace heater core.	P-2
04.28	Inspect, test, and replace thermostat and gasket/seal.	
04.29	Determine coolant condition and coolant type for vehicle application; drain and recover coolant.	
04.30	Flush system; refill system with recommended coolant; bleed system.	
04.31	Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action.	
04.32	Inspect and test electric cooling fan, fan control system and circuits; determine necessary action.	
Operating Systems and Related Controls Diagnosis and Repair		
04.33	Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.	P-1
04.34	Diagnose A/C compressor clutch control systems; determine needed action.	P-1
04.35	Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine needed action.	P-2
04.36	Inspect., test remove and/or replace HVAC system control panel; determine needed action.	P-2
04.37	Inspect and test HVAC system control cables, motors, and linkages; perform needed action.	P-3
04.38	Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; perform needed action.	P-1
04.39	Identify the source of HVAC system odors.	P-2
04.40	Check operation of automatic HVAC control systems; determine needed action.	P-2

Refrigerant Recovery, Recycling, and Handling	
04.41 Demonstrate awareness of the need to recover, recycle, and handle refrigerant using roper equipment and procedures.	P-1
04.42 Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards.	P-1
04.43 Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required.	P-1
04.44 Recycle, label, and store refrigerant.	P-1

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

Benchmarks identified with a designation of P-1, P-2, or P-3 are ASE tasks.

It is recommended students complete Automotive Service Technology 1, or demonstrate mastery of the outcomes in that program, prior to enrollment in Automotive Service Technology 2.

It is recommended that the program be Automotive Service Excellence (ASE) Education Foundation Master Certified (MAST) and the instructors be A1-A8 ASE Master and Advanced Engine Performance (L1) ASE Certified.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting

the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.9, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.