

Automotive Technology Mississippi Curriculum Framework

Program CIP: 47.0604 – Automotive/Automotive Mechanics Technology/Technician

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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

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ADOPTION OF NATIONAL CERTIFICATION STANDARDS AUTOMOBILE TECHNICIAN TRAINING ACCREDITATION PROGRAM

The Board of Trustees of the National Automotive Technicians Education Foundation (NATEF) is responsible for accreditation of automotive (automobile, collision repair & refinish, medium/heavy truck) programs at secondary and post-secondary levels. NATEF will grant accreditation to programs that comply with the evaluation procedure, meet established standards, and adhere to the policies in this document. Program accreditation is under the direct supervision of the NATEF Board of Trustees and such personnel designated or employed by NATEF.

On January 1, 2011, NATEF assumed the role of accreditation of automotive programs as an extension of its role as the evaluation organization with the family of organizations of the National Institute for Automotive Service Excellence (ASE). The ASE standards for automobile program certification were introduced in 1982. Standards for collision repair & refinish programs were launched in 1989 and truck standards followed in 1992. NATEF's role in the process was to work with industry and education to update the standards on a regular basis and evaluate programs against those standards. Based on a positive evaluation, programs were "certified" by ASE for a period of five (5) years.

After a lengthy process that included discussions with industry, employers, and educators, NATEF conducted a series of workshops and webinars to review the automobile standards. In June 2012 NATEF published a new model for automobile program standards. This new model introduced standards based on three (3) levels rather than by automobile area (brakes, electrical/electronic systems, etc.). The three levels are: Maintenance & Light Repair (MLR), Automobile Service Technician (AST), and Master Automobile Service Technician (MAST). Each successive level includes all the tasks of the previous level in addition to newly designated tasks. In other words, the AST task list includes all of the MLR tasks plus additional tasks. The MAST task list includes all of AST tasks plus additional tasks specifically for MAST.

The Automobile Service Excellence (ASE) Student Certification test series for the 2008 NATEF Automobile Program Standards is comprised of eight examinations covering light vehicle diagnosis and repair. The task lists are simply lists of the tasks involved in the process of diagnosing and repairing problems in the various vehicle systems. The tasks may also be thought of as competencies. Each question found in the tests is keyed to one of these tasks. The tasks are organized into content categories, and these content categories, along with the number of questions included in each category, comprise the test specifications. Every form of the exams will be built to meet these specifications.

The new Maintenance and Light Repair test (MLR), launched in Spring 2013. This test aligns with the corresponding level of the 2012 NATEF Automobile Standards for program accreditation. Every form of the exams will be built to meet these specifications.

For more information related to implementing ASE Student Certification at your local campus, please visit <http://www.asestudentcertification.com>.

INDUSTRY JOB PROJECTION DATA

Automotive service technicians and mechanics' occupations require an education level of a postsecondary career and technical certificate. There is a 12.27% increase in occupational demand at the regional level and a 12.28% increase at the state level. Median annual income for automotive service technicians and mechanics is \$31,615.33 at the state level. A summary of occupational data from the State Workforce Investment Board Data Center is displayed below:

Table 1: Education Level

Program Occupations	Education Level
Electrical and electronics installers and repairers, transportation equipment	Postsecondary Career and Technical Award
Electronic equipment installers and repairers, motor vehicles	Postsecondary Career and Technical Award
Automotive service technicians and mechanics	Postsecondary Career and Technical Award

Table 2: Occupational Overview

	Region	State	United States
2010 Occupational Jobs	4188	4437	597,750
2020 Occupational Jobs	4,702	4,982	619,094
Total Change	514	545	21,344
Total % Change	12.27%	12.28%	3.57%
2010 Median Hourly Earnings	\$16.68	\$15.20	\$17.94
2010 Median Annual Earnings	\$34,694.40	\$31,615.33	\$37,316.35
Annual Openings	51	54	2,134

Table 3: Occupational Breakdown

Description	2010 Jobs	2020 Jobs	Annual Openings	2010 Hourly Earnings	2010 Annual Earnings 2,080 Work Hours
Automotive service technicians and mechanics	4059	4573	51	\$13.15	\$27,352.00
Electrical and electronics installers and repairers, transportation equipment	69	69	0	\$19.39	\$40,331.20
Electronic equipment installers and repairers, motor vehicles	60	60	0	\$17.50	\$36,400.00
TOTAL	4,188	4,702	51	\$16.68	\$34,694.40

Table 4: Occupational Change

Description	Regional Change	Regional % Change	State % Change	National % Change
Electrical and electronics installers and repairers, transportation equipment	0	0.00%	2.78%	2.89%
Electronic equipment installers and repairers, motor vehicles	0	0.00%	5.81%	-0.01%
Automotive service technicians and mechanics	514	12.66%	12.66%	3.68%

ARTICULATION

Secondary curriculum does not cover content to the same depth as the postsecondary curriculum; therefore, there is no statewide articulation agreement. Local agreements and dual credit partnerships are encouraged.

TECHNICAL SKILLS ASSESSMENT

The cost to each program for accreditation will be as reasonable as possible to encourage program participation. This cost will include program evaluation materials, application (processing) fee, on-site team evaluation materials, and the honorarium and expenses of the Evaluation Team Leader (ETL).

Colleges should report the following for students who complete the program with a career certificate, technical certificate, or an Associate of Applied Science Degrees for technical skills attainment:

ASE Student Certification - \$30.00 per student per year (price subject to change).

1. Electrical/Electronics
2. Engine Repair
3. Brakes

OR

Pass 3 ASE Student Certification Exams

OR

Maintenance and Light Repair ASE student certification

OR

MS-CPAS2

ONLINE AND BLENDED LEARNING OPPORTUNITIES

Course content includes lecture and laboratory semester credit hours. Faculty members are encouraged to present lecture related content to students in an online or blended learning environment. Training related to online and blended learning will be available to faculty members through the MS Community College Board.

INSTRUCTIONAL STRATEGIES

The ASE student certification task lists based on NATEF standards were adopted and provide instructional strategies to faculty members implementing the curriculum.

ASSESSMENT STRATEGIES

The NATEF Standards were adopted for the ASE Student Certification Task Lists and provide assessment strategies to faculty members implementing the curriculum. Additionally, performance tasks were included in course content when appropriate.

CREDIT BY EXAMINATION

Credit by examination will be considered for courses that correlate with the ASE Technician Training Accreditation Program. The student must hold a valid and current ASE Technician Certification in any area that is to be considered.

PROGRAM DESCRIPTION

The Automotive Technology program is an instructional program that prepares individuals to engage in the servicing and maintenance of all types of automobiles. Instruction includes the diagnosis of malfunctions of all eight areas of ASE/NATEF certification (Engine Repair, Electrical and Electronic Systems, Engine Performance, Brakes, Steering and Suspension Systems, Manual Drive Trains and Axles, Automatic Transmissions and Transaxles, Heating and Air Conditioning). Automotive Technology may be taught as either a career certificate program or as a technical program.

The curriculum for Postsecondary Automotive Technology is based upon the task list published in ASE Certification for Automobile Training Programs and the National Automotive Technicians Education Foundation, Inc. (NATEF). This task list serves as a national standard for certification of automobile technician training programs and is regularly reviewed and validated by technicians and engineers in the automotive industry. The task list is based upon the following assumptions, which also apply to the model curriculum:

1. In all areas, appropriate theory, safety, and support instruction is required for performing each task. It is assumed that this instruction has included identification and use of appropriate tools and testing and measuring equipment required to accomplish certain tasks. It is also assumed that the student has received necessary training to locate and use current reference and training materials from accepted industry publications (in most cases, published by the vehicle manufacturer), which present manufacturers' recommended or required specifications and procedures for performing various tasks.
2. All diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures and specifications.
3. The individual training program being evaluated for certification should have written and detailed performance standards for each task taught in the curriculum. Learning progress of students should be monitored and evaluated against these performance standards. A system should be in place which informs all students of their individual progress through all phases of the training program.
4. It is recognized that individual courses of study will differ across automobile technician training programs. The development of appropriate learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.

For additional information on ASE Student Certification, contact the following:

National Automotive Technicians Education Foundation
13505 Dulles Technology Drive
Herndon, VA 22071-3415
(702) 713-010

For more information related to implementing ASE Student Certification at your local campus, please visit <http://www.asestudentcertification.com>.

Industry standards are based on the *Standards and Guidelines for Automotive Programs*.

SUGGESTED COURSE SEQUENCE

Accelerated Pathway Credential

Course Number	Course Name	Semester Credit Hours	SCH Breakdown		Total Clock Hours	Clock Hour Breakdown		Certification Information
			Lecture	Lab		Lecture	Lab	Certification Name
ATT 1811	Introduction, Safety, and Employability Skills	1	1		15	15		
ATT 1214	Brakes	4	2	4	150	30	120	Brakes
ATT 2334	Steering and Suspension	4	2	4	150	30	120	Suspension & Steering
	Electives	6						
	TOTAL	15	5	8	315	75	240	

Career Certificate Required Courses

Course Number	Course Name	Semester Credit Hours	SCH Breakdown			Total Clock Hours	Clock Hour Breakdown			Certification Information
			Lecture	Lab	Clinical/ Internship		Lecture	Lab	Clinical/ Internship	Certification Name
ATT 1124	Basic Electrical/Electronic	4	2	4		150	30	120		
ATT 1134	Advanced Electrical/Electronic Systems	4	2	4		150	30	120	Electrical/Electronic Systems	
ATT 1214	Brakes	4	2	4		150	30	120	Brakes	
ATT 1424	Engine Performance I	4	2	4		150	30	120		
ATT 1715	Engine Repair	5	2	6		210	30	180	Engine Repair	
ATT 1811	Introduction, Safety, and Employability skills	1	1			15	15	0		
ATT 2434	Engine Performance II	4	2	4		150	30	120		
	Elective	4								
	TOTAL	30	13	26		975	195	780		

Technical Certificate Required Courses

Course Number	Course Name	Semester Credit Hours	SCH Breakdown			Total Clock Hours	Clock Hour Breakdown			Certification Information
			Lecture	Lab	Clinical/ Internship		Lecture	Lab	Clinical/ Internship	Certification Name
ATT 1313	Manual Drive Trains/Transaxles	3	1	4		135	15	120		Manual Drive Trains & Axles
ATT 2444	Engine Performance III	4	2	4		150	30	120		Engine Performance
ATT 2614 ATT 2334	Heating & Air Conditioning OR Steering and Suspension	4	2	4		150	30	120		Heating & Air Conditioning OR Suspension & Steering
ATT 2324	Automatic Transmissions/Transaxles	4	2	4		150	30	120		Automatic Transmission & Transaxle
	Total	15				585	105	480		

General Education Core Courses

To receive the Associate of Applied Science Degree, a student must complete all of the required coursework found in the Career Certificate option, Technical Certificate option and a minimum of 15 semester hours of General Education Core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college. The Southern Association of Colleges and Schools (SACS) Commission on Colleges Standard 2.7.3 from the Principles of Accreditation: Foundations for Quality Enhancement¹ describes the general education core.

Section 2.7.3 In each undergraduate degree program, the institution requires the successful completion of a general education component at the collegiate level that (1) is substantial component of each undergraduate degree, (2) ensures breadth of knowledge, and (3) is based on a coherent rationale. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours or the equivalent. These credit hours are to be drawn from and include at least one course from the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. The courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

¹

Southern Association of Colleges and Schools Commission on Colleges. (2012). *The principles of accreditation: Foundations for quality enhancement*. Retrieved from <http://www.sacscoc.org/pdf/2012PrinciplesOfAccreditation.pdf>

Technical Electives

Course Number	Course Name	Semester Credit Hours	SCH Breakdown			Total Clock Hours	Clock Hour Breakdown			Certification Information
			Lecture	Lab	Clinical/ Internship		Lecture	Lab	Clinical/ Internship	Certification Name
ATT 291(1-6)	Special Problem I in Automotive Tech.	1-6		2-12		60-360		60-360		
ATT 293(1-6)	Special Problem II in Automotive Tech.	1-6		2-12		60-360		60-360		
ATT 292(1-6)	Supervised Work Experience in Automotive Tech	1-6			3-18	135-810			135-810	
WBL 191(1-3) WBL 192(1-3) WBL 193(1-3) WBL 291(1-3) WBL 292(1-3) WBL 293(1-3)	Work-Based Learning	1-6			3-18	135-810			135-810	
IMM 1935	Manufacturing Skills Basic	5	2	6		210	30	180		
CTE 1143	Fundamentals of Construction and Manufacturing	3	3			45	45			
IST 1113	Fundamentals of Information Technology	3	2	2		90	30	60		
BOT 1133	Microcomputer Application	3	3			45	45			
CSC 1123	Computer Applications I	3	2	2		90	30	60		
	Other instructor approved courses									

CAREER CERTIFICATE REQUIRED COURSES

Course Number and Name: ATT 1124 Basic Electrical/Electronic Systems

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the components of the vehicle electrical system including lights, battery, starting and charging components.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Electrical/Electronic Systems* 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.

ELECTRICAL/ELECTRONIC SYSTEMS

A. General: Electrical System Diagnosis

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).
3. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.
4. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
5. Check operation of electrical circuits with a test light.
6. Check operation of electrical circuits with fused jumper wires.
7. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.
8. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.
9. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
10. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action.
11. Replace electrical connectors and terminal ends.
12. Repair wiring harness.
13. Perform solder repair of electrical wiring.
14. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs.
15. Repair CAN/BUS wiring harness.

ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery Diagnosis and Service

1. Perform battery state-of-charge test; determine necessary action.
2. Confirm proper battery capacity for vehicle application; perform battery capacity test; determine necessary action.
3. Maintain or restore electronic memory functions.
4. Inspect and clean battery; fill battery cells; check/repair battery cables, connectors, clamps, and hold-downs.
5. Perform slow/fast battery charge according to manufacturer's recommendations.
6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.
7. Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions.
8. Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery.
9. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.

ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System Diagnosis and Repair

1. Perform starter current draw tests; determine necessary action.
2. Perform starter circuit voltage drop tests; determine necessary action.
3. Inspect and test starter relays and solenoids; determine necessary action.
4. Remove and install starter in a vehicle.
5. Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action.
6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.

ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System Diagnosis and Repair

1. Perform charging system output test; determine necessary action.
2. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.
3. Inspect, adjust, or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.
4. Remove, inspect, and re-install generator (alternator).
5. Perform charging circuit voltage drop tests; determine necessary action.

ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems Diagnosis and Repair

1. Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action.
2. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.
3. Aim headlights.
4. Identify system voltage and safety precautions associated with high-intensity discharge headlights.

Course Number and Name: ATT 1134 Advanced Electrical/Electronic Systems

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the components of the vehicle electrical system including gauges, driver information systems, horn, wiper/washer systems, and accessories.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: ASE Student Certification Test, *Electrical/Electronic Systems*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Electrical/Electronic Systems* 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.

ELECTRICAL/ELECTRONIC SYSTEMS

A. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

1. Inspect and test gauges and gauge sending units for causes of abnormal gauge readings; determine necessary action.
2. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine necessary action.

ELECTRICAL/ELECTRONIC SYSTEMS

B. Horn and Wiper/Washer Diagnosis and Repair

1. Diagnose (troubleshoot) causes of incorrect horn operation; perform necessary action.
2. Diagnose (troubleshoot) causes of incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.
3. Diagnose (troubleshoot) windshield washer problems; perform necessary action.

ELECTRICAL/ELECTRONIC SYSTEMS

C. Accessories Diagnosis and Repair

1. Diagnose (troubleshoot) incorrect operation of motor-driven accessory circuits; determine necessary action.
2. Diagnose (troubleshoot) incorrect electric lock operation (including remote keyless entry); determine necessary action.
3. Diagnose (troubleshoot) incorrect operation of cruise control systems; determine necessary action.
4. Diagnose (troubleshoot) supplemental restraint system (SRS) problems; determine necessary action.
5. Disable and enable an airbag system for vehicle service; verify indicator lamp operation.
6. Remove and reinstall door panel.
7. Check for module communication errors (including CAN/BUS systems) using a scan tool.
8. Describe the operation of keyless entry/remote-start systems.
9. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators.
10. Verify windshield wiper and washer operation, replace wiper blades.
11. Diagnose (troubleshoot) radio static and weak, intermittent, or no radio reception; determine necessary action.

12. Diagnose (troubleshoot) body electronic system circuits using a scan tool; determine necessary action.
13. Diagnose the cause(s) of false, intermittent, or no operation of anti-theft systems.
14. Describe the process for software transfers, software updates, or flash reprogramming on electronic modules.

Course Number and Name: ATT 1214 Brakes

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the repair and maintenance of brake systems on automobiles. It includes instruction and practice in diagnosis of braking systems problems and the repair of brake systems.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: ASE Student Certification Test, *Brakes*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Brakes* 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.

BRAKES

A. General: Brake Systems Diagnosis

1. Identify and interpret brake system concerns; determine necessary action.
2. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
3. Describe procedure for performing a road test to check brake system operation; including an anti-lock brake system (ABS).
4. Install wheel and torque lug nuts.

BRAKES

B. Hydraulic System Diagnosis and Repair

1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).
2. Measure brake pedal height, travel, and free play (as applicable); determine necessary action.
3. Check master cylinder for internal/external leaks and proper operation; determine necessary action.
4. Remove, bench bleed, and reinstall master cylinder.
5. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.
6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, and wear; check for loose fittings and supports; determine necessary action.
7. Replace brake lines, hoses, fittings, and supports.
8. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).
9. Select, handle, store, and fill brake fluids to proper level.
10. Inspect, test, and/or replace components of brake warning light system.
11. Identify components of brake warning light system.
12. Bleed and/or flush brake system.
13. Test brake fluid for contamination.

BRAKES

C. Drum Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.
2. Remove, clean, inspect, and measure brake drum diameter; determine necessary action.
3. Refinish brake drum and measure final drum diameter; compare with specifications.
4. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
5. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.
6. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.

BRAKES

D. Disc Brake Diagnosis and Repair

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action.
2. Remove and clean caliper assembly; inspect for leaks and damage/wear to caliper housing; determine necessary action.
3. Clean and inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action.
4. Remove, inspect, and replace pads and retaining hardware; determine necessary action.
5. Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks.
6. Clean and inspect rotor; measure rotor thickness, thickness variation, and lateral runout; determine necessary action.
7. Remove and reinstall rotor.
8. Refinish rotor on vehicle; measure final rotor thickness and compare with specifications.
9. Refinish rotor off vehicle; measure final rotor thickness and compare with specifications.
10. Retract and re-adjust caliper piston on an integrated parking brake system.
11. Check brake pad wear indicator; determine necessary action.
12. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.

BRAKES

E. Power-Assist Units Diagnosis and Repair

1. Check brake pedal travel with, and without, engine running to verify proper power booster operation.
2. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine necessary action.
4. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine necessary action.
5. Measure and adjust master cylinder pushrod length.

BRAKES

F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair

1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.
2. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.
3. Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust or replace as needed.
4. Check parking brake operation and parking brake indicator light system operation; determine necessary action.
5. Check operation of brake stop light system.

6. Replace wheel bearing and race.
7. Remove and reinstall sealed wheel bearing assembly.
8. Inspect and replace wheel studs.

BRAKES

G. Electronic Brake, Traction and Stability Control Systems Diagnosis and Repair

1. Identify and inspect electronic brake control system components; determine necessary action.
2. Identify traction control/vehicle stability control system components.
3. Describe the operation of a regenerative braking system.
4. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action.
5. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action.
6. Depressurize high-pressure components of an electronic brake control system.
7. Bleed the electronic brake control system hydraulic circuits.
8. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data).
9. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

Additional Student Learning Outcome:

1. Discuss protection from hazards associated with asbestos brake pads and shoes.

Course Number and Name: **ATT 1424 Engine Performance I**

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide basic skills and knowledge related to the engine mechanicals, ignition system, fuel, air induction, exhaust systems, and emission systems. It includes instruction, diagnosis, and correction of problems associated with in these areas.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Engine Performance* 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.

ENGINE PERFORMANCE

A. General: Engine Diagnosis

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
2. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action
3. Perform cylinder power balance test; determine necessary action.
4. Perform cylinder cranking and running compression tests; determine necessary action.
5. Perform cylinder leakage test; determine necessary action.
6. Verify engine operating temperature.
7. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.

ENGINE PERFORMANCE

B. Computerized Controls Diagnosis and Repair

1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.
2. Describe the importance of operating all OBDII monitors for repair verification.

ENGINE PERFORMANCE

C. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Replace fuel filter(s).
2. Inspect, service, or replace air filters, filter housings, and intake duct work.
3. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action.
4. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; repair or replace as needed.
5. Check and refill diesel exhaust fluid (DEF).

ENGINE PERFORMANCE*D. Emissions Control Systems Diagnosis and Repair*

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

Course Number and Name: ATT 1715 Engine Repair

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the repair and rebuilding of automotive engines. It includes instruction and practice in the diagnosis and repair of engine components including valve trains, blocks, pistons and connecting rods, crankshafts, and oil pumps.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
5	2	6	210

National Assessment: ASE Student Certification Test, *Engine Repair*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Engine Repair* 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.

ENGINE REPAIR

A. General: Engine Diagnosis; Removal and Reinstallation (R & R)

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins.
3. Verify operation of the instrument panel engine warning indicators.
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
5. Install engine covers using gaskets, seals, and sealers as required.
6. Remove and replace timing belt; verify correct camshaft timing.
7. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
8. Inspect, remove and replace engine mounts.
9. Identify hybrid vehicle internal combustion engine service precautions.
10. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.

ENGINE REPAIR

B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures.
2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.
3. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.
4. Adjust valves (mechanical or hydraulic lifters).
5. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing.
6. Establish camshaft position sensor indexing.

7. Inspect valve springs for squareness and free height comparison; determine necessary action.
8. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action.
9. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.
10. Inspect valves and valve seats; determine necessary action.
11. Check valve spring assembled height and valve stem height; determine necessary action.
12. Inspect valve lifters; determine necessary action.
13. Inspect and/or measure camshaft for runout, journal wear and lobe wear.
14. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.

ENGINE REPAIR

C. Engine Block Assembly Diagnosis and Repair

1. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer).
2. Disassemble engine block; clean and prepare components for inspection and reassembly.
3. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.
4. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action.
5. Deglaze and clean cylinder walls.
6. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.
7. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action.
8. Inspect main and connecting rod bearings for damage and wear; determine necessary action.
9. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action.
10. Inspect and measure piston skirts and ring lands; determine necessary action.
11. Determine piston-to-bore clearance.
12. Inspect, measure, and install piston rings.
13. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.
14. Assemble engine block.

ENGINE REPAIR

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core and galley plugs; determine necessary action.
2. Identify causes of engine overheating.
3. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.
4. Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.
5. Inspect, remove, and replace water pump.
6. Remove and replace radiator.
7. Remove, inspect, and replace thermostat and gasket/seal.
8. Inspect and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.
9. Perform oil pressure tests; determine necessary action.
10. Perform engine oil and filter change.
11. Inspect auxiliary coolers; determine necessary action.
12. Inspect, test, and replace oil temperature and pressure switches and sensors.
13. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

Course Number and Name: ATT 1811 Introduction, Safety, and Employability Skills

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide knowledge of classroom and lab policies and procedures. Safety practices and procedures associated with the automotive program and automotive industry.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
1	1		15

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

The student will 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.

1. Describe employment opportunities and responsibilities.
 - a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements.
 - b. Describe basic employee responsibilities.
 - c. Design a resume and complete a job application.
2. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
3. Demonstrate effective teambuilding and leadership skills.
4. Practice appropriate work ethics.
5. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.

REQUIRED SUPPLEMENTAL TASKS

A. Shop and Personal Safety

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
11. Identify and wear appropriate clothing for lab/shop activities.
12. Secure hair and jewelry for lab/shop activities.
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).
15. Locate and demonstrate knowledge of material safety data sheets (MSDS).

REQUIRED SUPPLEMENTAL TASKS

B. Tools and Equipment

1. Identify tools and their usage in automotive applications.
2. Identify standard and metric designation.
3. Demonstrate safe handling and use of appropriate tools.
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper).

REQUIRED SUPPLEMENTAL TASKS

C. Preparing Vehicle for Service

1. Identify information needed and the service requested on a repair order.
2. Identify purpose and demonstrate proper use of fender covers, mats.
3. Demonstrate use of the three C's (concern, cause, and correction).
4. Review vehicle service history.
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

REQUIRED SUPPLEMENTAL TASKS

D. Preparing Vehicle for Customer

1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).

WORKPLACE EMPLOYABILITY SKILLS

A. Personal Standards

1. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand.
2. Dresses appropriately and uses language and manners suitable for the workplace.
3. Maintains appropriate personal hygiene.
4. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.
5. Demonstrates honesty, integrity and reliability.

WORKPLACE EMPLOYABILITY SKILLS

B. Work habits / Ethic

1. Complies with workplace policies/laws.
2. Contributes to the success of the team, assists others and requests help when needed.
3. Works well with all customers and coworkers.
4. Negotiates solutions to interpersonal and workplace conflicts.
5. Contributes ideas and initiative.
6. Follows directions.
7. Communicates (written and verbal) effectively with customers and coworkers.
8. Reads and interprets workplace documents; writes clearly and concisely.
9. Analyzes and resolves problems that arise in completing assigned tasks.
10. Organizes and implements a productive plan of work.
11. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks.
12. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed.

Course Number and Name: ATT 2434 Engine Performance II

Classification: Career Certificate Core Requirement

Description: This is a course designed to provide intermediate skills and knowledge related to the ignition system, fuel, air induction, exhaust systems, and emission systems. It includes instruction, diagnosis, and correction of problems associated with in these areas.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Engine Performance* 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.

ENGINE PERFORMANCE

A. General: Engine Diagnosis

1. Identify and interpret engine performance concerns; determine necessary action.
2. Diagnose abnormal engine noises or vibration concerns; determine necessary action.
3. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine necessary action.
4. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.
5. Verify correct camshaft timing.

ENGINE PERFORMANCE

B. Computerized Controls

1. Access and use service information to perform step-by-step (troubleshooting) diagnosis.
2. Perform active tests of actuators using a scan tool; determine necessary action.

ENGINE PERFORMANCE

C. Ignition System Diagnosis and Repair

1. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action.
2. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.
3. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary.

ENGINE PERFORMANCE

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Check fuel for contaminants; determine necessary action.
2. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.
3. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
4. Inspect and test fuel injectors.
5. Verify idle control operation.

ENGINE PERFORMANCE

E. Emissions Control Systems Diagnosis and Repair

1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.
2. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.
3. Inspect, test, service, and replace components of the EGR system including tubing, exhaust passages, vacuum/pressure controls, filters, and hoses; perform necessary action.
4. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.
5. Inspect and test catalytic converter efficiency.
6. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.
7. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.

TECHNICAL CERTIFICATE REQUIRED COURSES

Course Number and Name: ATT 1313 Manual Drive Trains/Transaxles

Classification: Technical Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the maintenance and repair of manual transmissions, transaxles, and drive train components. It includes instruction in the diagnosis of drive train problems, and the repair and maintenance of transmissions, transaxles, clutches, CV joints, differentials, and other components.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
3	1	4	135

National Assessment: ASE Student Certification Test, *Manual Drive Trains and Axles*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Manual Drive Trains and Axles* 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.

MANUAL DRIVE TRAIN AND AXLES

A. General: Drive Train Diagnosis

1. Identify and interpret drive train concerns; determine necessary action.
2. Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins.
3. Check fluid condition; check for leaks; determine necessary action.
4. Drain and refill manual transmission/transaxle and final drive unit.

MANUAL DRIVE TRAIN AND AXLES

B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.
3. Inspect and replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing and linkage, and pilot bearing/bushing (as applicable).
4. Bleed clutch hydraulic system.
5. Check and adjust clutch master cylinder fluid level; check for leaks.
6. Inspect flywheel and ring gear for wear and cracks; determine necessary action.
7. Measure flywheel runout and crankshaft end play; determine necessary action.

MANUAL DRIVE TRAIN AND AXLES

C. Transmission/Transaxle Diagnosis and Repair

1. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.
2. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle.
3. Diagnose noise concerns through the application of transmission/transaxle powerflow principles.

4. Diagnose hard shifting and jumping out of gear concerns; determine necessary action.
5. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.
6. Disassemble, inspect clean, and reassemble internal transmission/transaxle components.

MANUAL DRIVE TRAIN AND AXLES

D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair

1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.
2. Diagnose universal joint noise and vibration concerns; perform necessary action.
3. Inspect, remove, and replace front wheel drive (FWD) bearings, hubs, and seals.
4. Inspect, service, and replace shafts, yokes, boots, and universal/CV joints.
5. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.

MANUAL DRIVE TRAIN AND AXLES

E. Drive Axle Diagnosis and Repair

E.1 Ring and Pinion Gears and Differential Case Assembly

1. Clean and inspect differential housing; check for leaks; inspect housing vent.
2. Check and adjust differential housing fluid level.
3. Drain and refill differential housing.
4. Diagnose noise and vibration concerns; determine necessary action.
5. Inspect and replace companion flange and pinion seal; measure companion flange runout.
6. Inspect ring gear and measure runout; determine necessary action.
7. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings.
8. Measure and adjust drive pinion depth.
9. Measure and adjust drive pinion bearing preload.
10. 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).
11. Check ring and pinion tooth contact patterns; perform necessary action.
12. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.
13. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.

E.2 Limited Slip Differential

1. Diagnose noise, slippage, and chatter concerns; determine necessary action.
2. Measure rotating torque; determine necessary action.

E.3 Drive Axles

1. Inspect and replace drive axle wheel studs.
2. Remove and replace drive axle shafts.
3. Inspect and replace drive axle shaft seals, bearings, and retainers.
4. Measure drive axle flange runout and shaft end play; determine necessary action.
5. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action.

MANUAL DRIVE TRAIN AND AXLES

F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair

1. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.
2. Inspect front-wheel bearings and locking hubs; perform necessary action(s).
3. Check for leaks at drive assembly seals; check vents; check lube level.
4. Identify concerns related to variations in tire circumference and/or final drive ratios.

5. Diagnose noise, vibration, and unusual steering concerns; determine necessary action.
6. Diagnose, test, adjust, and replace electrical/electronic components of four-wheel drive systems.
7. Disassemble, service, and reassemble transfer case and components.

Additional Student Learning Outcome:

1. Discuss protection from hazards associated with asbestos clutch discs.

Course Number and Name: ATT 2614 Heating and Air Conditioning

Classification: Technical Certificate Core Requirement

Description: This course is designed to provide advanced skills and knowledge associated with the maintenance and repair of automotive heating and air conditioning systems. It includes instruction and practice in the diagnosis and repair of heating and air conditioning system components, and control systems.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: ASE Student Certification Test, *Heating and Air Conditioning*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Heating and Air Conditioning* 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.

HEATING AND AIR CONDITIONING

A. General: A/C System Diagnosis and Repair

1. Identify and interpret heating and air conditioning problems; determine necessary action.
2. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
3. Performance test A/C system; identify problems.
4. Identify abnormal operating noises in the A/C system; determine necessary action.
5. Identify refrigerant type; select and connect proper gauge set; record temperature and pressure readings.
6. Leak test A/C system; determine necessary action.
7. Inspect condition of refrigerant oil removed from A/C system; determine necessary action.
8. Determine recommended oil and oil capacity for system application.
9. Using a scan tool, observe and record related HVAC data and trouble codes.

HEATING AND AIR CONDITIONING

B. Refrigeration System Component Diagnosis and Repair

1. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.
2. Inspect, test, service or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.
3. Remove, inspect, and reinstall A/C compressor and mountings; determine recommended oil quantity.
4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.
5. Determine need for an additional A/C system filter; perform necessary action.
6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action.
7. Inspect A/C condenser for airflow restrictions; perform necessary action.
8. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil quantity.
9. Remove, inspect, and install expansion valve or orifice (expansion) tube.
10. Inspect evaporator housing water drain; perform necessary action.
11. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.
12. Determine procedure to remove and reinstall evaporator; determine required oil quantity.

13. Remove, inspect, and reinstall condenser; determine required oil quantity.

HEATING AND AIR CONDITIONING

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

1. Inspect engine cooling and heater systems hoses; perform necessary action.
2. Inspect and test heater control valve(s); perform necessary action.
3. Diagnose temperature control problems in the heater/ventilation system; determine necessary action.
4. Determine procedure to remove, inspect, and reinstall heater core.

HEATING AND AIR CONDITIONING

D. Operating Systems and Related Controls Diagnosis and Repair

1. Inspect and test A/C-heater blower motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.
2. Diagnose A/C compressor clutch control systems; determine necessary action.
3. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.
4. Inspect and test A/C-heater control panel assembly; determine necessary action.
5. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action.
6. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.
7. Identify the source of A/C system odors.
8. Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.

HEATING AND AIR CONDITIONING

E. Refrigerant Recovery, Recycling, and Handling

1. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards.
2. Identify and recover A/C system refrigerant.
3. Recycle, label, and store refrigerant.
4. Evacuate and charge A/C system; add refrigerant oil as required.

Course Number and Name: ATT 2334 Steering and Suspension Systems

Classification: Technical Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the inspection and repair of steering and suspension systems of automobiles. This course includes instruction and practice in the diagnosis of steering system problems and the repair/replacement of steering/suspension components.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: ASE Student Certification Test, *Suspension and Steering*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Suspension and Steering* 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.

SUSPENSION AND STEERING

A. General: Suspension and Steering Systems

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
2. Identify and interpret suspension and steering system concerns; determine necessary action.

SUSPENSION AND STEERING

B. Steering Systems Diagnosis and Repair

1. Disable and enable supplemental restraint system (SRS).
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).
3. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.
4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.
7. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.
8. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed.
9. Determine proper power steering fluid type; inspect fluid level and condition.
10. Flush, fill, and bleed power steering system.
11. Inspect for power steering fluid leakage; determine necessary action.
12. Remove, inspect, replace, and adjust power steering pump drive belt.
13. Remove and reinstall power steering pump.
14. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.
15. Inspect and replace power steering hoses and fittings.
16. Inspect and replace pitman arm, relay (center link/intermediate) rod, idler arm and mountings, and steering linkage damper.

17. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.
18. Test and diagnose components of electronically-controlled steering systems using a scan tool; determine necessary action.
19. Identify hybrid vehicle power steering system electrical circuits and safety precautions.
20. Inspect electric power-assisted steering.

SUSPENSION AND STEERING

C. Suspension Systems Diagnosis and Repair

1. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action.
2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action.
3. Inspect, remove and install upper and lower control arms, bushings, shafts, and rebound bumpers.
4. Inspect, remove and install strut rods and bushings.
5. Inspect, remove and install upper and/or lower ball joints (with or without wear indicators).
6. Inspect, remove and install steering knuckle assemblies.
7. Inspect, remove and install short and long arm suspension system coil springs and spring insulators.
8. Inspect, remove and install torsion bars and mounts
9. Inspect, remove and install front stabilizer bar (sway bar) bushings, brackets, and links.
10. Inspect, remove and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.
11. Inspect, remove and install track bar, strut rods/radius arms, and related mounts and bushings.
12. Inspect rear suspension system leaf spring(s), bushings, center pins/bolts, and mounts.

SUSPENSION AND STEERING

D. Related Suspension and Steering Service

1. Inspect, remove, and replace shock absorbers; inspect mounts and bushings.
2. Remove, inspect, and service or replace front and rear wheel bearings.
3. Describe the function of the power steering pressure switch.

SUSPENSION AND STEERING

E. Wheel Alignment Diagnosis, Adjustment, and Repair

1. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action.
2. Perform prealignment inspection and measure vehicle ride height; perform necessary action.
3. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber and toe as required; center steering wheel.
4. Check toe-out-on-turns (turning radius); determine necessary action.
5. Check SAI (steering axis inclination) and included angle; determine necessary action.
6. Check rear wheel thrust angle; determine necessary action.
7. Check for front wheel setback; determine necessary action.
8. Check front and/or rear cradle (subframe) alignment; determine necessary action.
9. Reset steering angle sensor

SUSPENSION AND STEERING

F. Wheels and Tires Diagnosis and Repair

1. Inspect tire condition; identify tire wear patterns; check for correct tire size and application (load and speed ratings) and adjust air pressure; determine necessary action.
2. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.
3. Rotate tires according to manufacturer's recommendations.
4. Measure wheel, tire, axle flange, and hub runout; determine necessary action.
5. Diagnose tire pull problems; determine necessary action.
6. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic).
7. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.
8. Inspect tire and wheel assembly for air loss; perform necessary action.
9. Repair tire using internal patch.
10. Identify and test tire pressure monitoring system (indirect and direct) for operation; calibrate system; verify operation of instrument panel lamps.
11. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system.

Course Number and Name: ATT 2444 Engine Performance III

Classification: Technical Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the ignition system, fuel, air induction, exhaust systems, and emission systems. It includes instruction, diagnosis, and correction of problems associated with in these areas.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: ASE Student Certification Test, *Engine Performance*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Engine Performance* 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.

ENGINE PERFORMANCE

A. Computerized Controls Diagnosis and Repair

1. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.
2. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action.
3. 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.
4. 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.

ENGINE PERFORMANCE

B. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Diagnose (troubleshoot) 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.
2. Test the operation of turbocharger/supercharger systems; determine necessary action.
3. Check and refill diesel exhaust fluid (DEF).

ENGINE PERFORMANCE

C. Emissions Control Systems Diagnosis and Repair

1. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action.
2. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action.
3. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

Course Number and Name: ATT 2324 Automatic Transmissions/Transaxles

Classification: Technical Certificate Core Requirement

Description: This is a course designed to provide advanced skills and knowledge related to the diagnosis of automatic transmissions and transaxles. This course includes instruction and practice of testing, inspecting, and repairing/replacing of these devices.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
4	2	4	150

National Assessment: ASE Student Certification Test, *Automatic Transmission and Transaxle*

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task in *Automatic Transmission and Transaxle* 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.

AUTOMATIC TRANSMISSION AND TRANSAXLE

A. General: Transmission and Transaxle Diagnosis

1. Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action.
2. Research applicable vehicle and service information fluid type, vehicle service history, service precautions, and technical service bulletins.
3. Diagnose fluid loss and condition concerns; determine necessary action.
4. Check fluid level in a transmission or a transaxle equipped with a dip-stick.
5. Check fluid level in a transmission or a transaxle not equipped with a dip-stick.
6. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action.
7. Diagnose noise and vibration concerns; determine necessary action.
8. Perform stall test; determine necessary action.
9. Perform lock-up converter system tests; determine necessary action.
10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.
11. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.
12. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).

AUTOMATIC TRANSMISSION AND TRANSAXLE

B. In-Vehicle Transmission/Transaxle Maintenance and Repair

1. Inspect, adjust, and replace external manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch.
2. Inspect for leakage; replace external seals, gaskets, and bushings.
3. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses.
4. Drain and replace fluid and filter(s).

5. Inspect, replace and align powertrain mounts.

AUTOMATIC TRANSMISSION AND TRANSAXLE

C. Off-Vehicle Transmission and Transaxle Repair

1. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces.
2. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings.
3. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.
4. Describe the operational characteristics of a continuously variable transmission (CVT).
5. Describe the operational characteristics of a hybrid vehicle drive train.
6. Disassemble, clean, and inspect transmission/transaxle.
7. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets).
8. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action.
9. Assemble transmission/transaxle.
10. Inspect, measure, and reseal oil pump assembly and components.
11. Measure transmission/transaxle end play or preload; determine necessary action.
12. Inspect, measure, and replace thrust washers and bearings.
13. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls.
14. Inspect bushings; determine necessary action.
15. Inspect and measure planetary gear assembly components; determine necessary action.
16. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action.
17. Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action.
18. Inspect, measure, repair, adjust or replace transaxle final drive components.
19. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates, bands and drums; determine necessary action.
20. Measure clutch pack clearance; determine necessary action.
21. Air test operation of clutch and servo assemblies.
22. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, retainers; determine necessary action.

TECHNICAL ELECTIVE COURSES

Course Number and Name: ATT 291(1-6) Special Problem I in Automotive Technology

Classification: Technical Elective

Description: A basic course to provide students with an opportunity to utilize basic skills and general knowledge gained in other Automotive Technology courses. The instructor and student work closely together to select a topic and establish criteria for completion of the project.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
1		2	60
2		4	120
3		6	180
4		8	240
5		10	300
6		12	360

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task completed in this 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.

1. Develop a written plan that details the activities and projects to be completed.
 - a. Use a written plan that details the activities and projects to be completed.
 - b. Perform written occupational objectives in the special problem.
2. Assess accomplishment of objectives.
 - a. Prepare daily written assessments of accomplishment of objectives.
 - b. Present weekly written reports to the instructor of activities performed and objectives accomplished.
3. Use and follow a set of written guidelines for the special problem.
 - a. Develop and follow a set of written guidelines for the special problem.

Course Number and Name: ATT 293(1-6) Special Problem II in Automotive Technology

Classification: Technical Elective

Description: A continuation of Special Problem I in Automotive Technology. An advanced course to provide students with an opportunity to utilize advanced skills and specific knowledge gained in other Automotive Technology courses. The instructor and student work closely together to select a topic and establish criteria for completion of the project.

Hour Breakdown:

Scheduled Hours	Lecture	Lab	Clock Hours
1		2	60
2		4	120
3		6	180
4		8	240
5		10	300
6		12	360

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task completed in this 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.

1. Develop a written plan that details the activities and projects to be completed.
 - a. Use a written plan that details the activities and projects to be completed.
 - b. Perform written occupational objectives in the special problem.
2. Assess accomplishment of objectives.
 - a. Prepare daily written assessments of accomplishment of objectives.
 - b. Present weekly written reports to the instructor of activities performed and objectives accomplished.
3. Use and follow a set of written guidelines for the special problem.
 - a. Develop and follow a set of written guidelines for the special problem.

Course Number and Name: ATT 292(1-6) **Supervised Work Experience in Automotive Technology**

Classification: Technical Elective

Description: A course that is a cooperative program between industry and education designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Scheduled Hours	Lecture	Externship	Clock Hours
1		3	135
2		6	270
3		9	405
4		12	540
5		15	675
6		18	810

National Assessment: None

Prerequisite: Instructor Approved

Student Learning Outcomes:

For every task completed in this 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.

1. Follow a set of instructor-written guidelines for the supervised work experience program.
2. Apply skills needed to be a viable member of the workforce.
 - a. Prepare a description of skills to be developed in the supervised work experience program.
 - b. Practice skills needed to be a viable member of the workforce.
3. Practice human relationship skills in the supervised work experience program.
4. Practice positive work habits, responsibilities, and ethics.
5. Develop written occupational objectives in the supervised work experience program.
6. Assess performance of occupational skills.
 - a. Prepare daily written assessments of work performance as specified in the occupational objectives.
 - b. Present weekly written reports to the instructor of activities performed and objectives accomplished.

RECOMMENDED TOOLS AND EQUIPMENT

(Contained in individual sets or the tool crib in sufficient quantities to permit efficient instruction.)

1. Air Blow Gun (meeting OSHA requirements)
2. Allen (Wrench or Socket) Set - Standard (.050" - 3/8")
3. Allen (Wrench or Socket) Set - Metric (2mm - 8mm, 10mm, 12mm)
4. Battery Post Cleaner
5. Battery Terminal Pliers
6. Battery Terminal Puller
7. Chisels
 - a. Cape 5/16"
 - b. Cold 3/8", 3/4"
8. Chisel Holder
 - a. Claw Type Pickup Tool
9. Combination Wrenches
 - a. Standard (1/4" - 1 1/4")
 - b. Metric (7mm - 24mm)
10. Crowfoot Wrench Set - Metric
 - a. Crowfoot Wrench Set - Standard
 - b. Ear Protection
11. Feeler Gauge (Blade Type)
 - a. .002" - .040"
 - b. .006mm - .070mm
12. Files
 - a. Coarse 6" and 12"
 - b. Fine 6" and 12"
 - c. Half Round 12"
 - d. Round 6" and 12"
13. Flare Nut (tubing) Wrenches:
 - a. 3/8" - 3/4"
 - b. 10mm - 17mm
14. Flashlight
15. Fuse Puller
16. Fused Jumper Wire Set (with various adapters)
17. Hack Saw
18. Hammers:
 - a. 16 oz. Ball Peen
 - b. Brass
 - c. Dead Blow Plastic Mallet
 - d. Plastic Tip
 - e. Rubber Mallet
19. Inspection Mirror
20. Magnetic Pickup Tool
21. Pliers:

- a. Combination 6"
 - b. Hose Clamp
 - c. Locking Jaw
 - d. Needle Nose 6"
 - e. Side Cutting
 - f. Slip Joint (Water Pump)
22. Pry Bars:
- a. Rolling Head
 - b. Straight
23. Punches:
- a. Center
 - b. Brass Drift
 - c. Pin 1/8", 3/16", 1/4", 5/16 "
 - d. Taper 3/8", 1/2", 5/8"
24. Safety Glasses (meeting OSHA requirements)
25. Scraper:
- a. Carbon 1"
 - b. Gasket 1"
26. Screwdriver - Blade Type:
- a. Stubby
 - b. 6", 9", 12"
 - c. Offset
27. Screwdriver - Phillips:
- a. Stubby #1, #2
 - b. 6" #1, #2
 - c. 12" #3
 - d. Offset #2
28. Screwdriver - Impact Driver Set
29. Screw Starter:
- a. Phillips
 - b. Standard
30. Socket Set - 1/4" Drive:
- a. 1/4" - 1/2" Standard Depth
 - b. 1/4" - 1/2" Deep
 - c. 6mm - 12mm Standard Depth
 - d. 6mm - 12mm Deep
 - e. Flex/Universal Type
 - f. 3", 6" Extensions
 - g. Ratchet
31. Socket Set - 3/8" Drive:
- a. 5/16" - 3/4" Standard Depth (6 point)
 - b. 3/8" - 3/4" Deep (6 point)
 - c. 10mm - 19mm Standard Depth
 - d. 10mm - 19mm Deep
 - e. 3", 5", 10" Extensions
 - f. Flexhead Ratchet
 - g. Ratchet
 - h. Spark Plug Sockets 5/8", 13/16"
 - i. Speed Handle
 - j. Universal Joint
 - k. Flexible Socket Set 3/8" - 3/4"
 - l. Flexible Socket Set 10mm - 19mm
32. Socket Set - 1/2" Drive:
- a. 7/16" - 1 1/8" Standard Depth
 - b. 7/16" - 1 1/8" Deep

- c. 10mm - 24mm Standard Depth
 - d. 10mm - 24mm Deep
 - e. 3", 6", 12" Extensions
 - f. Flex Handle (Breaker Bar)
 - g. Ratchet
33. Spark Plug Feeler Gauge (Gap Tool)
 34. Tape Measure – Standard and Metric
 35. Test Light (12V and self-powered)
 36. Tire Pressure Gauge
 37. Tire Tread Depth Gauge
 38. Torque Wrench:
 - a. 3/8" Drive (10 - 250 lb. in.)
 - b. 3/8" Drive (5 - 75 lb. ft.)
 - c. 1/2" Drive (50 - 250 lb. ft.)
 39. Torx Set (screwdrivers and/or sockets):
 - a. T-8 to T-60
 40. Wire Brush

GENERAL LAB/SHOP EQUIPMENT

The tools and equipment on this list are used in general lab/shop work but are not generally considered to be individually owned hand tools. A well-equipped, accredited program should have all of these general tools and equipment readily available and in sufficient quantity to provide quality instruction.

1. Air Chisel Set (various bits)
2. Air Compressor and Hoses
3. Air Pressure Regulator
4. Air Ratchet (3/8" drive)
5. Automotive Stethoscope (electronic recommended)
6. Axle Stands (Jack Stands)
7. Axle Support Stands (Screw Jacks)
8. Battery Charger
9. Battery/Starter/Charging System Tester
10. Bearing Packer (hand operated)
11. Belt Tension Gauge
12. Bench or Pedestal Grinder
13. Coolant/Combustion Gas Detector (recommended)
14. Coolant Tester
15. Cooling System Pressure Tester and Adapters
16. Creeper
17. Cylinder Leakage Tester
18. Dial Indicator with Flex Arm and Clamp Base
19. Digital Multimeter (DMM) with various lead sets (sufficient quantities to meet instruction goals)
20. Drain Pans
21. Drill - 3/8" variable speed, reversible
22. Drill - 1/2" variable speed, reversible
23. Electric Heat Gun
24. Engine Coolant Recovery Equipment or Recycler or Coolant Disposal Contract Service
25. Extension Cords
26. Face Shields
27. Fender Covers
28. Floor Jack (1½ Ton Minimum)
29. Hand Held Vacuum Pump
30. Hoist(s)
31. Hood Prop
32. Hydraulic Press with adapters
33. Impact Socket Sets - 3/8" Drive (Standard and Metric)
34. Impact Sockets - 1/2" Drive (7/16" - 1 1/8")
35. Impact Sockets - 1/2" Drive (12mm – 24mm)
36. Impact Sockets – 1/2" Drive Deep (30 mm, 32 mm, 36mm)
37. Impact Wrench - 1/2" Drive 146 7/1/2013 Impact Wrench - 3/8" Drive
38. Jumper Cables
39. Master Puller Set
40. Micrometer (Depth)
41. Micrometers - 0-1", 1-2", 2-3", 3-4", 4-5" (Outside Type)
42. Oil Can - Pump Type
43. Oil Filter Wrench and Sockets
44. Oxy-Acetylene Torch Set
45. Parts Cleaning Tank and Gloves (non-solvent based cleanser suggested)
46. Remote Starter Switch
47. Scan Tool OBDII w/CAN capability or Personal Computer (PC) with equivalent
48. interface (appropriate capability to support tasks taught)
49. Screw Extractor Set

50. Seat Covers
51. Serpentine Belt Tensioner Tools
52. Snap Ring Pliers Set - external
53. Snap Ring Pliers Set - internal
54. Soldering Gun
55. Soldering Iron (Pencil Tip)
56. Spark Plug Boot Puller
57. Tap and Die Set - Standard
58. Tap and Die Set – Metric
59. Temperature Sensing Device
60. Thread Repair Insert Kit
61. Tire Inflator Chuck
62. Trouble/Work Lights (Non-incandescent)
63. Tube Quick Disconnect Tool Set
64. Tubing Bender
65. Tubing Cutter/Flaring Set (Double-lap and ISO)
66. Twist Drill Set - 1/64" - 1/2"
67. Ultra Violet Leak Detection Device (Black Light)
68. Used Oil Receptacle with extension neck and funnel
69. Valve Core Removing Tool
70. Vernier Calipers
 - a. 0 - 6"
 - b. 0 - 125mm
71. Wheel Chocks
72. Workbenches with vises

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Cart, AV (for overhead projector) (1)
2. Cart, AV (for TV-VCR/DVD) (1)
3. Computer with operating software with multimedia kit (1)
4. Projector, overhead (1)
5. TV(Flat screen) (1)
6. VCR/CD/DVD (1)
7. Digital camera (1)
8. Interactive display board(1)
9. Instructor's laptop computer (rugged design) (1)

CURRICULUM DEFINITIONS AND TERMS

- Course Name – A common name that will be used by all community colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students
- Classification – Courses may be classified as the following:
 - Career Certificate Required Course – A required course for all students completing a career certificate.
 - Technical Certificate Required Course – A required course for all students completing a technical certificate.
 - Technical Elective – Elective courses that are available for colleges to offer to students.
- Description – A short narrative that includes the major purpose(s) of the course
- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
- Corequisites – A listing of courses that may be taken while enrolled in the course
- Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
 - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
 - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
 - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
 - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
 - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local college. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors. Programs that offer an Associate of Applied Science Degree must include all of the required Career Certificate courses, Technical Certificate courses AND a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.
- In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework
- Revising or extending the student learning outcomes
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)