**Automotive Repair Curriculum: From Novice to Knowledgeable**

This curriculum is designed for individuals with little to no prior experience in automotive repair. It progresses systematically, building foundational knowledge before moving on to more complex systems. Each module includes theoretical learning, practical exercises, and assessments to ensure comprehension and skill development. Safety is emphasized throughout.

**Phase 1: Foundations (Weeks 1-4)**

**Module 1: Introduction to Automotive Systems & Safety (1 Week)**

* **Theory:**
  + Basic automotive terminology (engine, transmission, chassis, etc.)
  + Overview of major vehicle systems (engine, cooling, lubrication, fuel, electrical, braking, steering, suspension, exhaust, HVAC)
  + Types of vehicles (cars, trucks, SUVs, hybrids, EVs)
  + Shop safety: Personal Protective Equipment (PPE) – gloves, safety glasses, hearing protection, closed-toe shoes
  + Safe use of tools and equipment
  + Hazardous materials handling (oil, coolant, battery acid, etc.) and disposal
  + Fire safety and extinguisher use
  + Lifting vehicles safely (jack stands, lifts)
  + Emergency procedures
* **Practical:**
  + Identify major vehicle components under the hood and under the vehicle.
  + Practice using PPE.
  + Practice using a fire extinguisher (simulated or real, under supervision).
  + Practice safely jacking up a vehicle and placing it on jack stands.
  + Locate and identify hazardous materials in a vehicle.
* **Assessment:**
  + Written test on safety procedures and basic terminology.
  + Practical demonstration of safe vehicle lifting.
  + Identification of major vehicle components.

**Module 2: Basic Tools and Equipment (1 Week)**

* **Theory:**
  + Hand tools: Wrenches (open-end, box-end, combination, adjustable, socket), ratchets, sockets (standard, deep, impact), extensions, universal joints, pliers (slip-joint, needle-nose, diagonal cutters, locking), screwdrivers (Phillips, flathead, Torx, Pozidriv), hammers (ball-peen, dead blow, rubber mallet), chisels, punches, pry bars.
  + Measuring tools: Tape measure, ruler, caliper (dial, digital), micrometer, feeler gauge, torque wrench.
  + Power tools: Impact wrench, drill, grinder, reciprocating saw (Sawzall).
  + Diagnostic tools: Multimeter, OBD-II scanner, compression tester.
  + Shop equipment: Engine hoist, engine stand, floor jack, jack stands, creeper, workbench, vise, air compressor, parts washer.
* **Practical:**
  + Practice using each hand tool on various fasteners.
  + Practice taking accurate measurements with various measuring tools.
  + Practice using power tools safely (under supervision).
  + Practice using a multimeter to check voltage, continuity, and resistance.
  + Practice using an OBD-II scanner to retrieve diagnostic trouble codes (DTCs).
* **Assessment:**
  + Written test on tool identification and usage.
  + Practical demonstration of using hand tools, measuring tools, and a multimeter.
  + Retrieving and interpreting DTCs from a vehicle.

**Module 3: Fasteners, Fluids, and Basic Maintenance (1 Week)**

* **Theory:**
  + Types of fasteners: Bolts, nuts, screws, studs, washers, clips, rivets.
  + Thread types (metric, SAE), pitch, and size.
  + Torque specifications and the importance of proper tightening.
  + Automotive fluids: Engine oil, coolant, brake fluid, power steering fluid, transmission fluid, windshield washer fluid.
  + Fluid levels, checking, and topping off.
  + Basic maintenance: Oil and filter change, air filter replacement, tire pressure check and inflation, wiper blade replacement.
* **Practical:**
  + Identify different types of fasteners.
  + Practice removing and installing fasteners with proper torque.
  + Check and top off all vehicle fluids.
  + Perform an oil and filter change.
  + Replace an air filter.
  + Check and adjust tire pressure.
  + Replace wiper blades.
* **Assessment:**
  + Written test on fasteners and fluids.
  + Practical demonstration of performing basic maintenance tasks.

**Module 4: Basic Electrical Systems (1 Week)**

* **Theory:**
  + Basic electrical principles: Voltage, current, resistance, Ohm's Law.
  + Circuits: Series, parallel, series-parallel.
  + Battery: Construction, operation, testing, charging.
  + Starting system: Starter motor, solenoid, ignition switch.
  + Charging system: Alternator, voltage regulator.
  + Wiring diagrams: Reading and interpreting basic schematics.
  + Fuses and relays: Purpose and testing.
* **Practical:**
  + Practice using a multimeter to measure voltage, current, and resistance in circuits.
  + Test a battery using a multimeter and a load tester.
  + Identify components of the starting and charging systems.
  + Trace circuits using a wiring diagram.
  + Test fuses and relays.
  + Jump-start a vehicle.
* **Assessment:**
  + Written test on basic electrical principles and components.
  + Practical demonstration of using a multimeter to diagnose electrical problems.
  + Tracing a circuit using a wiring diagram.

**Phase 2: Engine Systems (Weeks 5-8)**

**Module 5: Engine Fundamentals (1 Week)**

* **Theory:**
  + Four-stroke cycle: Intake, compression, combustion, exhaust.
  + Engine components: Cylinder block, cylinder head, pistons, connecting rods, crankshaft, camshaft, valves, valve springs, rocker arms, pushrods, timing belt/chain, intake manifold, exhaust manifold.
  + Engine types: Inline, V, boxer, rotary.
  + Displacement, compression ratio, horsepower, torque.
* **Practical:**
  + Identify engine components on a disassembled engine.
  + Perform a compression test.
  + Perform a leak-down test.
  + Inspect spark plugs.
* **Assessment:**
  + Written test on engine fundamentals and components.
  + Practical demonstration of performing a compression test.

**Module 6: Cooling System (1 Week)**

* **Theory:**
  + Purpose of the cooling system.
  + Components: Radiator, water pump, thermostat, hoses, coolant reservoir, radiator cap, cooling fan.
  + Types of coolant and their properties.
  + Cooling system operation and flow.
  + Overheating causes and diagnosis.
* **Practical:**
  + Identify cooling system components.
  + Pressure test the cooling system.
  + Test a thermostat.
  + Flush and refill the cooling system.
  + Inspect hoses and belts.
* **Assessment:**
  + Written test on cooling system components and operation.
  + Practical demonstration of pressure testing a cooling system.

**Module 7: Lubrication System (1 Week)**

* **Theory:**
  + Purpose of the lubrication system.
  + Components: Oil pump, oil filter, oil pan, oil passages, oil pressure sensor.
  + Types of engine oil and their properties (viscosity, additives).
  + Oil pressure: Normal operating range, causes of low/high pressure.
* **Practical:**
  + Identify lubrication system components.
  + Change engine oil and filter (repeated practice).
  + Check oil pressure with a gauge.
  + Inspect for oil leaks.
* **Assessment:**
  + Written test on lubrication system components and operation.
  + Practical demonstration of changing engine oil and filter.

**Module 8: Fuel System (1 Week)**

* **Theory:**
  + Fuel system types: Carbureted, fuel-injected (port, direct).
  + Components: Fuel tank, fuel pump, fuel filter, fuel lines, fuel injectors (or carburetor), fuel pressure regulator.
  + Fuel delivery and control.
  + Common fuel system problems and diagnosis.
* **Practical:**
  + Identify fuel system components.
  + Test fuel pressure.
  + Replace a fuel filter.
  + Inspect fuel lines for leaks.
  + (Optional, depending on available equipment): Clean fuel injectors.
* **Assessment:**
  + Written test on fuel system components and operation.
  + Practical demonstration of testing fuel pressure.

**Phase 3: Chassis Systems (Weeks 9-12)**

**Module 9: Braking System (1 Week)**

* **Theory:**
  + Braking system principles: Hydraulics, friction.
  + Components: Master cylinder, brake lines, brake calipers, brake rotors, brake pads, brake booster, ABS (Anti-lock Braking System).
  + Disc brakes vs. drum brakes.
  + Brake fluid: Types and properties.
* **Practical:**
  + Identify braking system components.
  + Inspect brake pads and rotors.
  + Replace brake pads and rotors.
  + Bleed brake lines.
  + Measure rotor thickness and runout.
* **Assessment:**
  + Written test on braking system components and operation.
  + Practical demonstration of replacing brake pads and rotors.

**Module 10: Steering System (1 Week)**

* **Theory:**
  + Steering system types: Rack and pinion, recirculating ball.
  + Components: Steering wheel, steering column, steering shaft, steering gear, tie rods, power steering pump, power steering fluid.
  + Steering angles: Caster, camber, toe.
* **Practical:**
  + Identify steering system components.
  + Inspect tie rods and ball joints.
  + Check and top off power steering fluid.
  + Check for steering play.
* **Assessment:**
  + Written test on steering system components and operation.
  + Practical demonstration of inspecting steering components.

**Module 11: Suspension System (1 Week)**

* **Theory:**
  + Purpose of the suspension system.
  + Components: Springs (coil, leaf, air), shock absorbers, struts, control arms, ball joints, sway bar, bushings.
  + Types of suspension systems: Independent, solid axle.
* **Practical:**
  + Identify suspension system components.
  + Inspect shocks and struts for leaks.
  + Inspect bushings and ball joints.
  + Replace shock absorbers/struts.
* **Assessment:**
  + Written test on suspension system components and operation.
  + Practical demonstration of inspecting suspension components.

**Module 12: Wheels and Tires (1 Week)**

* **Theory:**
  + Tire construction and markings (size, load rating, speed rating).
  + Wheel types and sizes.
  + Tire pressure and its importance.
  + Tire wear patterns and their causes.
  + Wheel alignment basics.
* **Practical:**
  + Read and interpret tire markings.
  + Mount and balance a tire.
  + Rotate tires.
  + Repair a tire puncture (plug or patch).
  + Inspect tires for wear and damage.
* **Assessment:**
  + Written test on tire and wheel information.
  + Practical demonstration of mounting and balancing a tire.

**Phase 4: Advanced Topics (Weeks 13-16)**

**Module 13: Advanced Electrical Systems & Diagnostics (1 Week)**

* **Theory:**
  + Advanced wiring diagrams and schematics.
  + Sensor operation and testing (crankshaft position sensor, camshaft position sensor, oxygen sensor, MAF sensor, MAP sensor, etc.).
  + Actuator operation and testing (fuel injectors, ignition coils, idle air control valve, etc.).
  + Using scan tools for advanced diagnostics (live data, freeze frame data).
  + Troubleshooting electrical circuits using a multimeter and wiring diagrams.
* **Practical:** \* Diagnose and repair electrical faults using a multimeter and wiring diagrams. \* Test various sensors and actuators. \* Use a scan tool to retrieve and interpret live data.
* **Assessment:**
  + Written test on advanced electrical concepts and diagnostics.
  + Practical demonstration of diagnosing and repairing an electrical fault.

**Module 14: Drivetrain (Transmission, Axles, Differential) (1 Week)**

* **Theory:**
  + Automatic and manual transmissions.
  + Axles, Differentials, and transfer cases.
  + Universal joints, CV Joints, and driveshafts.
* **Practical:** \* Identify the U-Joints and CV Joints \* Check the fluid on different drivetrain set ups. \* Change the oil in a manual transmission. \* Change the oil in an automatic transmission.
* **Assessment:** \* Written Test on Drivetrain concepts and operation. \* Practical Test on identifying wear and tear.

**Module 15: HVAC Systems (1 Week)**

* **Theory:**
  + HVAC system principles: Refrigeration cycle.
  + Components: Compressor, condenser, evaporator, expansion valve/orifice tube, receiver-drier/accumulator, blower motor, blend door actuator.
  + Refrigerant types and handling (R-134a, R-1234yf).
  + Common HVAC problems and diagnosis.
* **Practical:**
  + Identify HVAC system components.
  + Perform a basic HVAC performance test.
  + Use manifold gauges to check refrigerant pressures.
  + (Optional, requires specialized equipment and certification): Recover, evacuate, and recharge the A/C system.
* **Assessment:**
  + Written test on HVAC system components and operation.
  + Practical demonstration of performing a basic HVAC performance test.

**Module 16: Review and Comprehensive Project (1 Week)**

* **Theory:**
  + Review of all previous modules.
  + Emphasis on troubleshooting and problem-solving skills.
* **Practical:**
  + Comprehensive project: Students will diagnose and repair a vehicle with multiple simulated faults, incorporating knowledge and skills from all previous modules. This project should be completed under supervision, with an emphasis on safe work practices.
* **Assessment:**
  + Final written exam covering all topics.
  + Successful completion of the comprehensive practical project.
  + Evaluation of student's overall performance, safety practices, and professionalism.

**Important Considerations:**

* **Safety:** Safety should be the *highest priority* throughout the curriculum. Students should be constantly reminded of safety procedures and supervised during all practical activities.
* **Hands-On Experience:** This curriculum emphasizes hands-on learning. Access to vehicles, tools, and equipment is essential.
* **Flexibility:** This curriculum is a guideline and can be adapted to fit specific needs and resources. The duration of each module can be adjusted based on student progress and available time.
* **Instructor Qualifications:** Instructors should be experienced automotive technicians with strong teaching skills.
* **Resources:** Textbooks, service manuals (e.g., Haynes, Chilton, or factory service information), online resources (e.g., Identifix, AllData), and training videos should be utilized.
* **ASE Certification:** This curriculum can be used as a foundation for preparing students for Automotive Service Excellence (ASE) certification exams.
* **Continuing Education:** Encourage students to continue learning and stay up-to-date with the latest automotive technologies.

This comprehensive curriculum provides a solid foundation for aspiring automotive technicians. By combining theoretical knowledge with extensive hands-on practice, students will develop the skills and confidence needed to succeed in the automotive repair field. Remember that consistent practice and real-world experience are crucial for mastery.