

Wallenpaupack Area School District

COURSE: Power Mechanics I

GRADE LEVEL: 10

LENGTH OF COURSE: 180 days

TEXT: Automotive Technology – A Systems Approach, 3rd edition

PUBLISHER: Jack Erjavec

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COURSE DESCRIPTION:

An overview course designed to introduce the application of automotive technology for those interested in entering the career of professional automotive technician. Laboratory experiments are focused on the systems of engineering, science, and technology and on computer applications that apply to automotive diagnosis and service. Students will study automotive chemicals and their effects and safe use, the tools of the automotive trade, personal and shop safety, shop operation, and the career path available in the automotive industry. Content includes communication, design/problem solving, customer relations, technical writing, computer science, chemical and physical properties, reference material use, blueprints and diagrams, safety and hazard prevention, units of measurement and measurement systems, regulations, shop operation, teamwork, and the basic use of automotive related tools.

An overview of the internal combustion engine will expose the students to how the Automotive Internal combustion engine runs. This part of the course will break down the internal combustion engine into different systems allowing students to better understand how the internal combustion engine works.

A specific technical course designed to teach the principles of automotive engine performance and diagnosis. This course builds on the essential laws of physics, thermodynamics, and chemical reactions and teaches how these principles apply to the operation and diagnosis of engine performance systems. This course will cover distributor less (electronic ignition) and distributor ignition systems, fuel management, exhaust emission control, and computer input and output signals and will identify the different types of sensors used by automotive engine computers. The student will learn strategy-based diagnostic routines, to interpret and verify customer concerns, confirm proper operation, and perform tests and inspection using special tools and scan tools to determine the causes and make corrections related to starting, running, emissions, and drivability concerns on systems with/without diagnostic trouble codes (DTC). Courseware will also cover diagnostic trouble codes (DTC), interpretation of digital multimeter (DMM) readings and access and use of electronic service information (ESI). The student will learn to locate and interpret vehicle component identification numbers (VIN, vehicle certification labels, and calibration decals), check and adjust (where applicable) ignition system timing and timing advance/retard, emission component service, and computerized engine control system data and service. Through the process of inspection, testing, or measurement of components, the student will learn to apply this knowledge to determine and accomplish needed repairs.

CURRICULUM WRITING TEAM:

Mark C. Watson, Ph.D.

DATE OF REVISION:

2007

Wallenpaupack Area School District

Course: Power Mechanics I

Grade Level: Grade 10

Unit: Orientation

PA Standards: 13.1.11
13.2.11
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Topics:	Skills:
Introduce and Familiarize the students with the course, its objectives, machines and tools	Active listening strategies Drawing inferences Following directions
Activities:	Performance Assessments:
Class Lecture Shop Tour	Teacher Observation Oral/Written Response to questions Self-evaluation

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Grade Level: Grade 10

Unit: Automotive Fundamentals

PA Standards: 13.1.11
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Topics:	Skills:
<p>The Automotive Industry</p> <ul style="list-style-type: none"> • Job Classifications • Related Career Opportunities • Working as an automotive technician • Training for a career in Automotive Service • ASE Certification • Service Technician Society 	<p>Cognitive and Manipulative Development</p> <p>Active listening strategies</p> <p>Drawing inferences</p> <p>Following directions</p> <p>Describe the reasons why today's automotive industry is considered a global industry</p> <p>Explain how computer technology has changed the way vehicles are built and serviced</p> <p>Explain why the need for qualified automotive technicians is increasing</p> <p>Describe the major types of businesses that employ automotive technicians</p> <p>List some of the many job opportunities available to people with a background in automotive technology</p> <p>Describe what it takes to be a good technician</p> <p>Explain the role ASE now plays within the automotive service industry</p> <p>Describe the requirements for ASE certification as an automotive technician and master technician</p>
Activities:	Performance Assessments:
<p>Lecture</p> <ul style="list-style-type: none"> • Power Point • Smart board interaction • Student presentations <p>Shop demonstration</p>	<p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Unit: Automotive Fundamentals

PA Standards: 13.1.11
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Topics:	Skills:
Shop Operation	Cognitive and Manipulative Development Active listening strategies Drawing inferences Following directions
Activities:	Performance Assessments:
Lecture <ul style="list-style-type: none">• Power Point• Smart board interaction• Student presentations Shop demonstration	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none">• weekly grade

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Topics:	Skills:
<p>Shop Safety</p> <ul style="list-style-type: none"> • Personal safety • Tool and equipment safety • Work area safety • Manufacturer's warnings and government regulations 	<p>Cognitive and Manipulative Development</p> <p>Active listening strategies</p> <p>Drawing inferences</p> <p>Following directions</p> <p>Understand the importance of safety and accident prevention in an automotive shop</p> <p>Explain the basic principles of personal safety, including protective eye wear, clothing, gloves, shoes, and hearing protection</p> <p>Explain the procedures and precautions for safely using tools and equipment</p> <p>Explain the precautions that need to be followed to safely raise a vehicle on a lift</p> <p>Explain what should be done to maintain a safe working area</p> <p>Describe the purpose of the laws concerning hazardous wastes and material, including the right-to-know laws</p> <p>Describe your rights, as an employee and/or student, to have a safe place to work</p>
Activities:	Performance Assessments:
<p>Lecture</p> <ul style="list-style-type: none"> • Power Point • Smart board interaction • Student presentations <p>Shop demonstration</p>	<p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Automotive Tools <ul style="list-style-type: none">• Safety• Hand Tools• Power Tools• Specialty Tools	Cognitive and Manipulative Development Active listening strategies Drawing inferences Following directions
Activities:	Performance Assessments:
Lecture <ul style="list-style-type: none">• Power Point• Smart board interaction• Student presentations Shop demonstration	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none">• weekly grade

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Topics: Chemicals Haz-Mat	Skills: Cognitive and Manipulative Development Active listening strategies Drawing inferences Following directions
Activities: Lecture <ul style="list-style-type: none">• Power Point• Smart board interaction• Student presentations Shop demonstration	Performance Assessments: Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none">• weekly grade

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Topics:	Skills:
Measurements Conversions Work orders	Cognitive and Manipulative Development Active listening strategies Drawing inferences Following directions
Activities:	Performance Assessments:
Lecture <ul style="list-style-type: none">• Power Point• Smart board interaction• Student presentations• Demonstrations Shop demonstration	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none">• weekly grade

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<p>Topics:</p> <p>The student will master specified academic and technical content</p> <p>The student will practice effective communication skills</p> <p>The student will develop abilities to solve problems and think skillfully</p> <p>The student will practice skills required for working within a system</p> <p>The student will learn to manage resources and information</p> <p>The student will practice skills required for being a responsible person</p>	<p>Skills:</p> <p>Cognitive and Manipulative Development</p> <p>Active listening strategies</p> <p>Drawing inferences</p> <p>Following directions</p>
<p>Activities:</p> <p>Lecture</p> <ul style="list-style-type: none"> • Power Point • Smart board interaction • Student presentations <p>Shop demonstration</p>	<p>Performance Assessments:</p> <p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Unit: Engines

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Topics:	Skills:
Automotive Engines <ul style="list-style-type: none"> • Introduction to Engines • Engine Classifications • Engine Measurement and Performance • Engine Identification • Engine Diagnostics • Evaluating the Engine's Condition • Noise Diagnosis • Other Engine Designs 	Identify the major parts of a motor List parts Recognize the basic understanding of function of parts Identify cylinder block differences Identify the difference between in-line, V, slant, and opposed arrangement Identify the differences between 4, 6, 8, cylinders Identify various problems, diagnosis and services tips and procedures
Activities:	Performance Assessments:
Lecture <ul style="list-style-type: none"> • Power Point • Smart board interaction • Student presentations Shop demonstration	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Engine Disassembly <ul style="list-style-type: none"> • Preparing the Engine for Removal • Lifting an Engine • Engine Disassembly and Inspection • Cleaning Engine Parts • Crack Repair 	Identify the major parts of a motor List parts Recognize the basic understanding of function of parts Identify cylinder block differences Identify the difference between in-line, V, slant, and opposed arrangement Identify the differences between 4, 6, 8, cylinders Identify various problems, diagnosis and services tips and procedures
Activities:	Performance Assessments:
Lecture <ul style="list-style-type: none"> • Power Point • Smart board interaction • Student presentations Shop demonstration	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Short Blocks <ul style="list-style-type: none"> • Cylinder Block • Reconditioning • Crankshaft • Piston and Rings • Installation 	Identify the major parts of a motor List parts Recognize the basic understanding of function of parts Identify cylinder block differences Identify the difference between in-line, V, slant, and opposed arrangement Identify the differences between 4, 6, 8, cylinders Identify various problems, diagnosis and services tips and procedures
Activities:	Performance Assessments:
Shop demonstration Lecture View Smart board presentation Board demonstrations Open discussion Class debate Guided practice Shop demonstration Supervised shop work Group projects and individual projects Cooperative learning groups Homework	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Cylinder Head and Valves <ul style="list-style-type: none"> • Combustion Chamber • Intake and Exhaust Valves • Aluminum Cylinder Heads • Resurfacing • Grinding Valves / Reconditioning Guides, Seats • Valve Stem Seals • Assembling Cylinder Heads 	Describe the purpose of an engine's cylinder head, valve, and related parts Describe the types of combustion chamber shapes found on modern engines Explain the procedures involved in reconditioning cylinder heads, valve guides, seats, and faces Explain the steps in cylinder head and valve assembly
Activities:	Performance Assessments:
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Topics:	Skills:
Camshafts and Valve Trains <ul style="list-style-type: none"> • Camshafts • Camshafts and Valve Train Inspection • Installing the Camshaft, Cylinder Head and Valve Train • Adjusting Valves • Installing the Timing Components 	Describe the purpose, operation, and location of camshaft Identify the parts of the valve train and the purpose of each Inspect the camshaft, valve train, and timing components Describe the four types of camshaft drives Explain the factors involved in camshaft/crankshaft timing Explain how to adjust valve lash
Activities:	Performance Assessments:
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Topics:	Skills:
<p>Lubricating and Cooling Systems</p> <ul style="list-style-type: none"> • Lubrication • Oil pump Inspection, Service and Installation • Cooling Systems • Cooling System Servicing 	<p>Define the purposes of the lubricating system</p> <p>Identify the contaminants within the engine within the engine that must be removed by the system</p> <p>Analyze the characteristics of lubricating oil</p> <p>Compare the different ways oil can be classified</p> <p>Compare the advantages and disadvantages of synthetic oils</p> <p>Follow the flow of oil through an engine</p> <p>Examine and identify the parts of the system</p> <p>Identify problem, diagnosis and service procedure for the lubricating system</p> <p>Identify the purposes of the cooling system</p> <p>Compare the ways in which heat can be transferred</p> <p>Compare the different types of cooling systems</p> <p>Define the characteristics of coolant and antifreeze</p> <p>Describe the operation of water pumps</p> <p>State the purpose and operation of thermostats and pressure caps</p> <p>State the purpose and operation of radiators</p> <p>Compare the operation and design of fans, shrouds and belts</p> <p>Identify various problems, diagnosis and services tips and procedures</p>

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Topics:	Skills:
Intake and Exhaust Systems <ul style="list-style-type: none"> • The Air Induction System • Exhaust System components • Exhaust System Service • Turbochargers and Superchargers 	Explain the operation of the components in the air induction system Describe how the engine creates vacuum and how vacuum is used to control systems Inspect and troubleshoot vacuum and air induction systems Explain the operation of the exhaust system components Properly perform an exhaust inspection, and service and replace exhaust components Explain the purpose and operation of a turbo-charger Explain supercharger operation
Activities:	Performance Assessments:
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Topics:	Skills:
<p>Engine Sealing and Reassembly</p> <ul style="list-style-type: none"> • Torque Principles • Thread Repair • Gaskets • Adhesives, Sealants, and other Chemical Sealing Materials • Oil Seals • Engine Reassembly • Installing the Engine 	<p>Explain the purpose of the various gaskets used to seal an engine</p> <p>Identify the major gasket types and their uses</p> <p>Explain general gasket installation procedures</p> <p>Describe the methods used to seal the timing cover and rear main bearing</p> <p>Reassemble an engine</p> <p>Explain the ways to pre-lubricate a rebuilt engine</p> <p>Reinstall an engine and observe the correct starting and break-in procedures.</p>
Activities:	Performance Assessments:
<p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p>	<p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Fuel Systems <ul style="list-style-type: none"> • Gasoline • Fuel Performance • Basic Fuel Additives • Alternative Fuels • Fuel Delivery Systems • Carburetion <ul style="list-style-type: none"> ○ Basic Design ○ Circuits (Systems) ○ Types ○ Adjustments ○ Diagnosis 	Identify the total fuel flow Define the basic principles of carburetion Define the different types of vacuum produced from a carburetor Compare the different type of carburetors Analyze carburetor circuits State the design and purpose of common accessories Identify how carburetors are controlled by electronic controls and computers Define differences between open and closed loops Identify various problems, diagnosis and services tips and procedures
Activities:	Performance Assessments:
Shop demonstration Lecture View Smart board presentation Board demonstrations Open discussion Class debate Guided practice Shop demonstration Supervised shop work Group projects and individual projects Cooperative learning groups Homework	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Fuel System Diagnosis <ul style="list-style-type: none"> • Alcohol-in-Fuel Test • Fuel System Pressure Relief • Fuel Tanks • Fuel Lines • Fuel Filters • Fuel Pumps 	Analyze the parts and operation of the fuel tank and fuel metering parts Recognize the parts and operation of mechanical and electrical fuel pumps State the purpose and operation of fuel filters Identify various problems, diagnosis and services tips and procedures
Activities:	Performance Assessments:
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Topics:	Skills:
Electronic Fuel Injection <ul style="list-style-type: none"> • Types of Fuel Injection • Continuous Injection Systems • Basic EFI • Throttle Body Fuel Injection • Port Fuel Injection • Sequential Fuel Injection Systems • Central Multi-Port Fuel Injection (CMFI) • Gasoline Direct-Injection Systems • Input Sensor 	Define the purpose of EFI State the different types of fuel injection systems Analyze throttle body fuel injection Analyze the types of sensors used with computers Analyze port injection systems Describe the operation of the injector nozzles used on high high-pressure systems Identify various problems, diagnosis and services tips and procedures
Activities:	Performance Assessments:
Shop demonstration Lecture View Smart board presentation Board demonstrations Open discussion Class debate Guided practice Shop demonstration Supervised shop work Group projects and individual projects Cooperative learning groups Homework	Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
Fuel Injection System Diagnosis and Service <ul style="list-style-type: none"> • Preliminary Checks • Basic EFI Systems Checks • CIS Checks and Tests 	Perform a preliminary diagnostic procedure on a fuel injection system Remove, clean, inspect, and install a throttle body assembly Explain the results of incorrect fuel pressure in a TBI, MFI, or SFI system Clean injectors Perform an injector sound, ohmmeter, noid light, and scope test Perform and inject balance test Perform and injector leakage test Remove and replace the fuel rail, injectors, and pressure regulator Diagnose causes of improper idle speed on vehicles with fuel injection
Activities:	Performance Assessments:
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Topics:	Skills:
<p>Emission Control Systems</p> <ul style="list-style-type: none"> • Legislative History • Pollutants • Evaporative Emission Control Systems • Pre-combustion Systems • Post-combustion Systems 	<p>Explain why hydrocarbon (HC) emissions are released from an engine's exhaust</p> <p>Explain how carbon monoxide (CO) emissions are formed in the combustion chamber</p> <p>Describe oxygen (O₂) emissions in relation to air/fuel ratio</p> <p>Describe how carbon dioxide (CO₂) is formed</p> <p>Describe how oxides of nitrogen (NO_x) are formed</p> <p>Describe the operation of an evaporative control system during the canister purge and non-purge modes</p> <p>Explain the purpose of the positive crankcase ventilation system (PCV)</p> <p>Describe the operation of the detonation sensor and electronic spark control module</p> <p>Describe the operation of an Exhaust Gas Recirculation Valve (EGR)</p> <p>Define the purpose of a catalytic converter</p> <p>Describe the operation of a secondary air injection system</p>
Activities:	Performance Assessments:
<p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p>	<p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
<p>Emission Control Diagnosis and Service</p> <ul style="list-style-type: none"> • Emission Testing • PCV System Diagnosis and Service • EGR System Diagnosis and Service • Spark Control Systems • Intake Heat Control Diagnosis and Service • Catalytic Converter Diagnosis • Air Injection System Diagnosis and Service • Evaporative Emission Control System Diagnosis and Service 	<p>Describe oxygen (O₂) emissions in relation to air/fuel ration</p> <p>Describe how carbon dioxide (CO₂) is formed</p> <p>Describe how oxides of nitrogen (NO_x) are formed</p> <p>Describe the inspection and replacement of PCV system parts</p> <p>Diagnose spark control systems</p> <p>Diagnose and repair problems relating to EGR Operation</p> <p>Diagnose and repair problems relating to intake heat control systems</p> <p>Check the efficiency of a catalytic converter</p> <p>Diagnose and repair problems relating to secondary air injection systems</p> <p>Diagnose and service evaporative (EVAP) systems</p>
Activities:	Performance Assessments:
<p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p>	<p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
<p>On-Board Diagnostic Systems</p> <ul style="list-style-type: none"> • System Functions • System Components • Primary Sensors • Computer Outputs and Actuators • System Operation • OBD II Standards • Monitoring Capabilities • OBD II Diagnostics • OBD II Terms 	<p>Understand how a typical computerized engine control system operates</p> <p>Explain the operation of the various input and output sensors</p> <p>Explain what is meant by open loop and closed loop</p> <p>Explain the reasons and provisions for OBD II</p> <p>Explain the requirements to illuminate the malfunction indicator light in a OBD II</p> <p>Briefly describe the monitored systems in OBD II</p> <p>Describe an OBD II warm-up cycle</p> <p>Explain trip and drive cycle in an OBD II system</p> <p>Describe how engine misfires are detected</p> <p>Describe the differences between an A and B misfire</p> <p>Describe the purpose of multiple O₂ sensors</p> <p>Briefly describe what the comprehensive component monitor looks at</p>
Activities:	Performance Assessments:
<p>Shop demonstration</p> <p>Lecture</p> <p>View Smart board presentation</p> <p>Board demonstrations</p> <p>Open discussion</p> <p>Class debate</p> <p>Guided practice</p> <p>Shop demonstration</p> <p>Supervised shop work</p> <p>Group projects and individual projects</p> <p>Cooperative learning groups</p> <p>Homework</p>	<p>Quizzes</p> <p>Oral questioning</p> <p>Written test</p> <p>Shop assessment through observation</p> <ul style="list-style-type: none"> • weekly grade

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Topics:	Skills:
<p>ON-Board Diagnostic System Diagnosis and Service</p> <ul style="list-style-type: none"> • Electronic Service Precautions • Basic Diagnosis of Electronic Engine Control Systems • Self-Diagnostic Systems • Retrieving Trouble Codes • OBD II Diagnostics and Service • OBD II Diagnostics • Diagnosis of Computer Voltage Supply and Ground Wires • Testing Input Sensors • Variable Resistor-Type Sensors • Generating Sensors • Testing Actuators 	<p>Perform flash code diagnosis on various vehicles Obtain fault codes with an analog voltmeter Perform a scan tester diagnosis on various vehicles Conduct preliminary checks on an OBDII system Use a symptom chart to set up a strategic approach to troubleshooting a problem Define the terms associated with OBDII Diagnostics Identify the cause of an illuminate MIL Explain the basic format of OBD II DTCs Monitor the activity of OBD II system components Explain how to diagnose intermittent problems Diagnose computer voltage supply and ground wires Test and diagnose switch-type input sensors Test and diagnose variable resistance-type input sensors Test and diagnose generating-type input sensors Test and diagnose output devices (actuators)</p>
Activities:	Performance Assessments:
<p>Shop demonstration Lecture View Smart board presentation Board demonstrations Open discussion Class debate Guided practice Shop demonstration Supervised shop work Group projects and individual projects Cooperative learning groups Homework</p>	<p>Quizzes Oral questioning Written test Shop assessment through observation <ul style="list-style-type: none"> • weekly grade </p>