AUTO-2400: ENGINE PERFORMANCE

Cuyahoga Community College

Viewing: AUTO-2400 : Engine Performance

Board of Trustees:
January 2022

Academic Term:
Fall 2022

Subject Code
AUTO - Automotive Technology

Course Number:
2400

Title:
Engine Performance

Catalog Description:
Fundamentals of proper engine performance. Ignition, electrical, engine mechanical, and fuel and emission system principles of operation, related driveability symptoms, and proper testing to verify cause will be explored. Digital Volt Ohm Meter (DVOM), scan tool and special tools used throughout course. Emphasis on operational concepts and individual component testing.

Credit Hour(s):
3

Lecture Hour(s):
1

Lab Hour(s):
6

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
AUTO-1300 Automotive Engines and AUTO-1502 Automotive Electrical Fundamentals; or departmental approval: industry-related experience.

Outcomes

Course Outcome(s):
Applying the terminology and engineering principles of the subject matter in Engine Performance, and using the correct tools, equipment and service information; students can evaluate, diagnose and maintain vehicle performance taking into account safety, work ethics and behaviors, proper repair techniques and customer needs.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins in engine performance.
2. Apply knowledge of the operating parts and function of the four stroke engine; and how to test the components for proper operation.
3. Apply knowledge of the operating parts and function of automotive ignition control systems; and how to test the components and/or system for proper operation.
4. Apply knowledge of the operating parts and function of fuel, air induction and exhaust systems; and how to test the components and/or system for proper operation.

5. Apply knowledge of the operating parts and function of automotive emission control systems; and how to test the components and/or system for proper operation.
6. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins.
7. Verify correct camshaft timing including engines equipped with variable valve timing systems (VVT).
8. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram/initialize as needed.
9. Replace fuel filter(s) where applicable.
10. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.
11. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform needed action.
12. Diagnose emissions and driveablility concerns caused by the secondary air injection system; inspect, test, repair, and/or replace electrical/electronically-operated components and circuits of secondary air injection systems; determine needed action.

Course Outcome(s):

Demonstrate shop and personal safety while in an automotive repair environment.

Objective(s):

1. Wear personal protective equipment in the automotive lab.
2. Identify and select appropriate personal protective items for working in the automotive lab.
3. Demonstrate safe handling and use of appropriate tools.
4. Identify safety precautions when working around supplemental restraints (SRS) or high voltage circuits.
5. Demonstrate knowledge of fire safety and evacuation routes.

Methods of Evaluation:

1. Participation and discussion
2. Observation
3. Written assignments
4. Exams
5. Quizzes
6. Lab tasks
7. Classroom recitations

Course Content Outline:

1. Engine Performance Concepts
   a. General engine component function and testing
      i. Energy and power
      ii. Engine construction overview
      iii. Engine displacement
      iv. Compression ratio
      v. Torque and power
      vi. Horsepower and altitude
      vii. Principles of variable valve timing
      viii. Computer control of variable valve timing
      ix. Variable displacement system purpose and operation
      x. Mechanical and electrical workings of variable displacement systems
   b. Crankcase ventilation system function and testing
      i. Blowby gases and effect on engine and engine oil
      ii. Crankcase ventilation air flow and purging
      iii. Camshaft timing
   c. Ignition system component function and testing
      i. Primary and secondary ignition components
      ii. Pickup coil, magnetic sensor, optical sensor and Hall-effect sensor operation
      iii. Ignition system schematic reviews
      iv. Ignition timing effects on engine operation
      v. Ignition timing effects on engine emissions
      vi. Spark plug service

vii. Ignition scope pattern review
viii. Ignition control module

d. Fuel composition and analysis
   i. Refining process
   ii. Volatility
   iii. Combustion process
   iv. Octane rating
   v. Gasoline additives
   vi. Gasoline and alcohol blends
   vii. General gasoline recommendations
e. Fuel system component function and testing
   i. Fuel delivery system - fuel tanks, lines and filters
   ii. Fuel pump mechanicals and operation
   iii. Fuel delivery system electrical schematics
   iv. Speed density fuel injection systems
   v. Mass airflow fuel injection systems
   vi. Fuel pressure regulation
   vii. Fuel injector mechanicals and operation
   viii. Idle control in a fuel injection system
   ix. Gasoline direct injection systems
   x. Gasoline direct injection electronic controls
f. Air induction system component function and testing
   i. Air intake filtration
   ii. Port fuel injection intake manifold design
   iii. Variable intake manifolds
   iv. Plastic intake manifolds
   v. Electronic throttle control systems overview
   vi. Electronic throttle control sensors and throttle body motor operation
   vii. Volumetric efficiency and reasons for turbocharging and supercharging
   viii. Turbocharger design and operation
   ix. Supercharger design and operation
g. Exhaust system component function and testing
   i. Exhaust systems purpose and function
   ii. Exhaust manifold design
   iii. Exhaust manifold gaskets
   iv. Exhaust gas recirculation passages from exhaust to intake side
   v. Mufflers and resonators
   vi. Exhaust system hangers
h. Emission control system component function and testing
   i. Four basic computer functions
   ii. Computer input sensors and outputs
   iii. Temperature sensor purpose, function and operation
   iv. Throttle position sensor purpose, function and operation
   v. Manifold Absolute Pressure (MAP)/Barametric sensor purpose, function and operation
   vi. Mass air flow sensor purpose, function and operation
   vii. Oxygen sensor purpose, function and operation
i. Evaporative emission system component function and testing
   i. Emission standards in the United States
   ii. Combustion process and tailpipe emissions
   iii. Exhaust analysis and combustion efficiency
   iv. Exhaust gas recirculation systems and their effects on tailpipe emissions
   v. Crankcase ventilation and PCV effects on tailpipe emissions
   vi. Secondary air injection systems and their effects on tailpipe emissions
   vii. Catalytic converters and their effects on tailpipe emissions
   viii. Evaporative emission control system
   ix. Enhanced EVAP control and leak detection methods

2. Work Place Concepts

a. Shop and personal safety
b. Tools and equipment
c. Preparing vehicle for service
d. Preparing vehicle for customer

Resources

Erjavec, Jack. *Automotive Technology: A Systems Approach*. 7th ed. New York, NY: Cengage Learning, 2019.

Halderman, James D. *Automotive Engine Performance (Halderman Automotive Series)*. 5th ed. New York, NY: Pearson, 2017.

Duffy, James E. *Modern Automotive Technology.* 9th ed. Tinley Park, IL: Goodheart-Willcox, 2017.

Hatch, Steve V. *Computerized Engine Controls.* 10th ed. Boston, MA: Cengage Learning, 2017.

Resources Other

1. Homepage (toptiergas.com) (https://www.toptiergas.com/)
2. carbonfootprint.com - Home of Carbon Footprinting (https://www.carbonfootprint.com/)
3. Vehicle and Fuel Emissions Testing | US EPA (https://www.epa.gov/vehicle-and-fuel-emissions-testing/)
4. MOTOR | Automotive Data Solutions for all Industries (https://www.motor.com/)

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