AUTO 149: DIESEL ENGINE MANAGEMENT SYSTEMS

Citrus College Course Outline of Record

Heading	Value
Effective Term:	Fall 2023
Credits:	4
Total Contact Hours:	108
Lecture Hours :	54
Lab Hours:	54
Hours Arranged:	0
Outside of Class Hours:	108
Total Student Learning Hours:	216
Strongly Recommended:	ENGL 101; Integrated Math 3 or Algebra 1; AUTO 148 or AUTO 168.
Transferable to CSU:	Yes
Transferable to UC:	No
Grading Method:	Standard Letter, Pass/No Pass

Catalog Course Description

Intended for Automotive and Medium/Heavy Truck students, this course covers the theory of operation of 4-stroke diesel engines along with the theory of operation, testing and inspection, and service repair of air-inlet systems (including forced induction), exhaust systems, fuel-delivery systems (including mechanical and electronic engine controls), and emission-control systems. Course prepares students for ASE A9 certification. 54 lecture hours, 54 lab hours.

Course Objectives

- Cite the nominal, expected fuel pressures of port fuel-injected gasoline engines, direct injection equipped gasoline engines, and diesel engines.
- Demonstrate knowledge of on-vehicle diesel particulate filter cleaning procedures and perform the procedure.
- Describe and test the operation and advantages & disadvantages of the various types of diesel fuel injection systems including unit injection, hydraulic unit injection, hydraulic electronic unit injection, and common-rail fuel injection.
- Describe the operation and advantages & disadvantages of solenoid-type and piezo-type fuel injectors in common-rail applications.
- Cite and demonstrate the necessary safety precautions in working with high-pressure fuel systems.
- Describe homogeneous charge spark ignition.
- Describe homogeneous charge compression ignition.
- Describe heterogeneous charge compression ignition (diesel engine operation).
- Describe late-model diesel engine exhaust after-treatment systems including diesel particulate filters (DPF), urea injection, selective catalyst reduction, and oxidizing catalysts.
- Describe the benefits of forced induction including supercharging, turbocharging, and variable-vane turbochargers.
- Explain the importance of exhaust gas recirculation (EGR) in diesel engines for reduction of oxides of nitrogen (NOx) emissions.

Major Course Content

1. Diesel Engine Operation
   a. Diesel operational theory
   b. Four-stroke cycle
   c. PV and other thermodynamic considerations
   d. Diesel engine history
   e. Forced induction
2. Horsepower, Torque, and related Terms
   a. Power-related terminology
   b. Heat-energy equivalents
   c. ISO standards
3. Combustion Systems
   a. The combustion process
   b. Types of combustion chambers
   c. Fuel injection timing
   d. Glow plugs
   e. Exhaust emissions limits
4. Air Inlet and Exhaust Systems
   a. Intake and exhaust system flow
   b. Air cleaners
   c. Turbochargers
   d. Superchargers
   e. Aftercoolers/Intercoolers
   f. Exhaust mufflers and particulate traps
   g. Exhaust brake systems
   h. Compression brake ("jake brake") systems
5. Diesel Fuel, Filters, Water Separators
   a. Diesel fuel grades
   b. Specific gravity
   c. Heat (BTU) energy
   d. Fuel transfer pumps (supply pumps)
   e. Fuel filtration
   f. Water separators
   g. Fuel heaters/coolers
6. Types of Fuel Systems
   a. Basic fuel injection systems
   b. Distributor pump systems
   c. Diesel Common Rail (DCR) systems
   d. Solenoid injectors
   e. Piezo injectors
   f. Electronic Unit Injection (EUI) systems
   g. Hydraulic Electronic Unit Injection (HEUI) systems
   h. Injection nozzles
   i. Mechanical & electronic governor operation
7. Electronic Engine Management
   a. Electronic Engine Management overview
   b. Sensors
   c. ECM Serial Data
   d. CAN bus systems
   e. Engine Protection Systems (EPS)
8. Exhaust Emission Controls
   a. Exhaust Gas Recirculation (EGR) systems
   b. Oxidation catalysts

   c. Reduction catalysts
   d. Selective Catalytic Reduction (SCR) systems
   e. Diesel Particulate Filtration (DPF) systems
   f. Pressure Differential Sensors
   g. Urea Injection
9. Manufacturer Specific Content
   a. Robert Bosch Corporation
   b. Detroit Diesel
   c. Cummins
   d. Delphi
   e. International (Ford)
   f. GM/Isuzu Duramax

Lab Content

1. Engine Mechanical Inspections
   a. Compression inspections
   b. Fuel pressure and fuel return inspections
   c. Oil pressure inspections
2. Engine Electronic System Inspection
   a. Glow plug inspections
   b. Intake heater grid inspections
3. Engine Control System
   a. Scantool diagnostics
   b. Scantool programming
   c. Input sensor diagnostics
   d. Output actuator diagnostics
4. Aftertreatment Systems
   a. Aftertreatment system diagnostics
   b. DPF filter replacement
   c. DPF regeneration
   d. DEF inspection and maintenance
   e. SCR inspection

Suggested Reading Other Than Required Textbook

Technical articles--both peer-reviewed and other--published in periodicals and electronically.

Examples of Required Writing Assignments

Write a short essay describing the throttle positions sensor's role in the ECU's fuel management calculation. Include sensor operation, typical sensor output readings and common faults of the sensor and circuits in the essay.

Examples of Outside Assignments

End of chapter review questions: How will corrosion on the engine coolant temperature connector affect the ECM's temperature reading of the engine? What is the default temperature number used by the ECM if a diagnostic trouble code is recorded for an open circuit in the intake air temperature sensor circuit?

Instruction Type(s)

Lab, Lecture