Number: AUTO G175  TITLE: Automotive Diesel

ORIGINATOR: Paul Kelley  EFF TERM: Fall 2015
FORMERLY KNOWN AS: 
DATE OF OUTLINE/REVIEW: 03-03-2015
CROSS LISTED COURSE: AUTO G175  TOP NO: 0947.00

SEMESTER UNITS: 5.0  CID:
HRS LEC: 72.0  HRS LAB: 54.0  HRS OTHER: 0.0
CONTACT HRS TOTAL: 126.0
STUDY NON-CONTACT HRS RECOMMENDED: 144.0

CATALOG DESCRIPTION:
This is an introductory course that will allow students to understand diesel engines, diesel fuel systems, and the theory and operation of related diesel systems. Instruction will be given in the classroom setting as well as hands on laboratory learning. This will allow students to successfully perform diagnostics and repair on light duty trucks and passenger cars equipped with diesel engines. This course will prepare students to pass the Automotive Service Excellence (ASE) A9 Light Vehicle Diesel Engines test.

JUSTIFICATION FOR COURSE:

PREREQUISITES:
- AUTO G120: Electrical/Electronic Systems: Introductory Auto G120 will provide the student the basic knowledge of electricity and electronics that will be required in this course.
- AUTO G110: Engine Repair Auto G110 will provide the student with a thorough understanding of gasoline engines. This understanding will be crucial for understanding how diesel engines operate compared to traditional gasoline engines.

COREQUISITES:

ADVISORIES:
- AUTO G130: Engine Performance: Basic Theory/Diagnosis Auto G130 will provide the student with a basic understanding of engine performance and computerized fuel injection, which will be beneficial in this course.

ASSIGNED DISCIPLINES:
Automotive technology

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00
CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]
GRADING POLICY: Pass/No Pass [ ] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]
OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]
TRANSFER STATUS: CSU Transferable[X] UC/CSU Transferable[ ] Not Transferable[ ]
LEVELS BELOW TRANSFER: Not Applicable

CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable
NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course

OCCUPATIONAL (SAM) CODE: C

REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:

REQUISITED FOR DEGREE OR CERTIFICATE: No [ ] Yes [X]
Automotive Alternative Fuels Specialist Automotive Light Duty Diesel Specialist

GE AND TRANSFER REQUIREMENTS MET:
PROGRAM LEVEL LEARNING OUTCOME(S) Supported by this course:

demonstrate mastery of diagnostic tools and equipment used for automotive repair.

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. Analyze automotive diesel fuel systems and related components for correct system operation.
3. Compare precision measurements against factory specifications.
4. Identify system defects and employ strategy based diagnostics to solve problems.

COURSE OBJECTIVES:
1. Pass the SP-2 mechanical Safety and Mechanical Pollution Prevention Test.
2. Demonstrate safe work practices in the shop setting.
3. Describe the differences of diesel fuel in comparison to other fuels.
4. Perform precision measurements and compare to factory specifications on diesel engines.
5. Analyze and troubleshoot the complete diesel fuel system from the fuel tank to the fuel injectors.
6. Evaluate diesel engines and related subsystems including induction, cooling, lubrication, fuel, exhaust, and after-treatment systems for proper operation.
7. Perform diagnosis, service, and repair on diesel engines and associated subsystems.

COURSE CONTENT:

LECTURE CONTENT:

A. Safety Instruction
   1. Safety rules
   2. Shop safety and personal safety equipment in the lab
   3. Material Safety Data Sheets (MSDS)
   4. SP-2 Mechanical Safety and Mechanical Pollution Prevention Test

B. Diesel fuel fundamentals
   1. Fuel refinement process
   2. Diesel properties in comparison to gasoline
   3. Advantages of diesel fuel

C. Diesel engines
   1. Beginnings of the diesel engine
   2. Diesel engine evolution
      a. Heavy duty diesels
      b. Off-road light diesels
      c. Automotive diesels
      d. Newest automotive diesel updates
   3. Bottom end diesel engine designs
      a. Engine blocks
      b. Cylinders/liners designs
      c. Combustion chamber design
d. Piston technology

e. Connecting rod designs

4. Top end diesel engine designs
   a. Cylinder heads
   b. Intake and exhaust valves
   c. Timing systems

D. Diesel engine air induction systems
   1. Principles of diesel induction
   2. Air filtration
   3. Air delivery
   4. Superchargers
      a. Theory and operation
      b. Roots blowers
      c. Centrifugal designs
   5. Turbochargers
      a. Theory and operation
      b. Evolution of the turbocharger
      c. Turbocharger lubrication
      d. Turbocharger failure
   6. Charger air coolers

E. Diesel engine cooling
   1. Cooling system basics
   2. Antifreeze
   3. Radiators
   4. Heat exchangers
   5. Water pumps
   6. Cooling fans
      a. Thermistors
      b. Electric
      c. Variable pitch blades

F. Diesel engine lubrication
   1. Lubrication system basics
   2. Differences in diesel engine oil
   3. Oil pumps and pans
   4. Oil coolers
   5. Fuel/oil dilution

G. Diesel fuel subsystems
   1. Fuel tanks
   2. Fuel delivery
      a. Lift pumps
      b. Suction pumps
   3. Fuel filtration
4. Low side fuel system  
   a. Testing  
   b. Priming  
   c. Water in fuel sensors  
   d. Fuel return circuit  

H. Diesel high pressure fuel system  
   1. Pump function  
   2. Pump designs  
      a. Gear driven pumps  
      b. Camshaft driven plunger pumps  
      c. Rotary distributor pumps  
      d. Inline pumps  
   3. High pressure fuel lines  
   4. Fuel injector nozzles  
      a. History of the injector  
      b. Differences between injectors and nozzles  
      c. Pump-line-nozzle systems  
      d. Electronic diesel injection systems  
         i. Electrohydraulic nozzles  
         ii. Common rail fuel systems  
         iii. HEUI diesel injection  
         iv. Piezoelectric injectors  

I. Diesel starting systems  
   1. Block heaters  
   2. Glow plugs  

J. Diesel exhaust emissions basics  
   1. CARB  
   2. Smog  
   3. Contents of diesel engine exhaust emissions  

K. Diesel exhaust after treatment  
   1. Exhaust gas recirculation (EGR)  
   2. Diesel oxidation catalyst (DOC)  
   3. Diesel particulate filters (DPF)  
   4. Urea injection  

L. Preventative maintenance (PM)  
   1. Maintenance items  
   2. Fleet implication of PM schedules  

M. Practice exam based on industry standard ASE A9 Light Diesel certification test
LABORATORY CONTENT:

A. Safety
   1. Complete online safety training by SP-2
      a. Mechanical safety
      b. Mechanical pollution prevention
   2. Perform tasks related to shop safety
      a. MSDS
      b. Evacuation
      c. Fire prevention
      d. Chemical safety
      e. Shop tools and equipment safety

B. Diesel fuel fundamentals
   1. Perform diesel fuel quality test
   2. Measure Diesel fuel cetane rating

C. Diesel engines
   1. Disassemble a diesel engine
   2. Inspect and measure diesel engine components
   3. Compare measurements to factory specifications
   4. Perform a diesel engine compression test
   5. Perform a diesel engine cylinder leakage test

D. Diesel engine air induction systems
   1. Inspect a complete air induction system
   2. Measure turbocharger or supercharger boost pressure
   3. Check the operation of a turbocharger waste gate
   4. Remove and inspect a charge air cooler

E. Diesel engine cooling
   1. Check a diesel engine cooling system for proper operation
   2. Perform a cooling system pressure test
   3. Inspect a diesel radiator
   4. Inspect a diesel water pump
   5. Remove and inspect various types of cooling fans

F. Diesel engine lubrication
   1. Check diesel engine oil pressure
   2. Perform a diesel engine oil and filter change
   3. Inspect a diesel engine oil cooler
   4. Test diesel engine oil for fuel dilution

G. Diesel fuel subsystems
   1. Inspect the low pressure side of a diesel fuel system
   2. Perform a low side fuel pressure test
   3. Check water in fuel sensor for proper operation
   4. Change diesel fuel filters
   5. Prime a low side diesel fuel system

H. Diesel high pressure fuel systems
   1. Check a high pressure pump for correct operation
   2. Monitor a fuel rail pressure sensor
   3. Identify the different types of high pressure pumps
   4. Check diesel injectors for proper operation
   5. Remove and replace a diesel injector
   6. Set the lash on a cam driven pump or injector

I. Diesel starting systems
   1. Check block heater operation
   2. Check glow plugs for proper operation
   3. Remove and replace diesel engine glow plugs

J. Diesel exhaust emissions
1. Use a gas analyzer to measure diesel exhaust emissions

K. Diesel exhaust after treatment
   1. Inspect a diesel exhaust system
   2. Check operation of a diesel EGR system
   3. Check operation of a diesel oxidation catalyst
   4. Inspect a diesel particulate filter
   5. Perform an automated DPF regeneration
   6. Inspect and fill a urea injection system

L. Design a preventative maintenance (PM) schedule for a provided vehicle.

METHODS OF INSTRUCTION:
A. Lecture:
B. Lab:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:
Reading Assignments
   A. Required reading: Text
   B. Websites: Alldata online service manual, Mitchell online service manual, other topic specific websites as needed.

Out-of-class Assignments
   A. Weekly text based homework consisting of multiple choice and short answer questions.

Writing Assignments
   A. Use information and concepts learned in class to successfully pass a practicum or written test or assignment.
   B. Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during electrical diagnostic activities.

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Written Assignments
Objective Examinations
Projects (ind/group)
Problem Solving Exercises
Skills Demonstration

Demonstration of Critical Thinking:
   A. Analyze and troubleshoot diesel related systems for proper operation and determine the appropriate course of action based on knowledge of the system operation.
   B. Diagnose and repair vehicles based on symptoms provided on a repair order
   C. Interpret measurements and readings and determine the meaning of the measurement.
   D. Formulate logical conclusions based on strategy based diagnostics, record defects and appropriate steps based on knowledge of the system.

Required Writing, Problem Solving, Skills Demonstration:
   A. Create vehicle repair orders, perform math exercises for flat rate labor, parts and materials totals.
   B. Demonstrate an understanding of diesel engines and describe the operation of the engine and related subsystems.
   C. Use information and concepts learned in class to successfully pass a practicum or written test or assignment
   D. Use internet based service and repair information to compare factory specifications with actual readings and measurements acquired during lab diagnostic activities.
   E. Formulate logical conclusions based on diagnostic tests and knowledge of the system operation.
TEXTS, READINGS, AND RESOURCES:
TextBooks:

Other:
1. 
   A. Coveralls or other appropriate protective clothing
   B. Approved safety glasses
   C. Assortment of basic automotive hand tools

LIBRARY:
Adequate library resources include:

Comments:

Attachments:
Attached Files