

EASTERN ARIZONA COLLEGE

Vehicle Performance and Diagnosis

Course Design
2017-2018

Course Information

Division Industrial Technology Education
Course Number AUT 260
Title Vehicle Performance and Diagnosis
Credits 3
Developed by Brian Coppola
Lecture/Lab Ratio 2 Lecture/2 Lab

Transfer Status

ASU	NAU	UA
OMT Dept. Elective	CTE Departmental Elective	Non Transferable

Activity Course No
CIP Code 47.0604
Assessment Mode Pre/Post Test (25 Questions/100 Points)
Semester Taught Spring semester in even-numbered years
GE Category None
Separate Lab No
Awareness Course No
Intensive Writing Course No

Prerequisites

AUT 105 and AUT 110 or instructor approval

Educational Value

This course is designed to reinforce and apply information, processes, and ideas gained in other courses. The major intent of this course is to enhance an individual's abilities to work with and diagnosis concerns related to engine performance.

Description

This course provides instruction in computerized power train system operation and diagnostic procedures. Course includes an in-depth study in modern ignition, fuel, and power train computer-controlled systems. Course provides in-depth knowledge related to various onboard vehicle diagnostic processes. This course gives the student the opportunity to use industry-standard testing equipment such as PC-based scopes and hand-held scanners. Course requires an understanding of automotive electrical and electronic fundamentals and together with AUT 110, prepares the student for ASE certification test on engine performance.

Supplies

Safety glasses

Competencies and Performance Standards

1. Apply proper safety procedures and processes.

Learning objectives

What you will learn as you master the competency:

- a. Acquaint self with shop environment and hazards.
- b. Acquaint self with emergency procedures and policy.
- c. Accept responsibility for personal well-being and practice and follow safety guidelines.
- d. Acquaint self with material safety data sheets and chemicals used in shop.

Performance Standards

You will demonstrate your competence:

- by completing safety assignment and written exam at a satisfactory level

Your performance will be successful when:

- learner observes and practices safety procedures

2. Perform general power train system diagnosis using a strategy-based process. (NATEF VIII A)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause of poor vehicle performance related to mechanical engine components.
- b. Determine root cause of cranks but will not start engine condition related to a mechanical, electronic engine controls, or ignition fault. (NATEF VIII A 10)

Performance Standards

You will demonstrate your competence:

- by completing NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- by performing the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Your performance will be successful when:

- learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- learner actively participates in the NATEF task requirements listed in the related learning plan
- learner attends required class and lab sessions and shows up on time

3. Diagnose and repair vehicle “hard code” and “no code” intermittent performance concerns on vehicles with computerized controls using a strategy-based process. (NATEF VIII B & D)

Learning objectives

What you will learn as you master the competency:

- a. Determine causes of hard fault conditions related to computerized power train controls and make needed repair. (NATEF VIII B 3)
- b. Determine causes of intermittent (no code) performance concern and make needed repair.

(NATEF VIII B 4)

- c. Determine root cause of engine performance problems related to hot or cold no-start, hard start, incorrect idle, poor idle, flooding, hesitation, surging, misfire, power-loss, poor mileage, dieseling and emission failures on fuel injection-type of fuel systems. (NATEF VIII D 2).

Performance Standards

You will demonstrate your competence:

- o by completing NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o by performing the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan
- o learner attends required class and lab sessions and shows up on time

4. Diagnose and repair various ignition system engine performance concerns using a strategy-based process. (NATEF VIII C)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause of engine performance problems related to no-starting, performance and emission concerns on vehicles with (EI/DIS) distributorless ignition systems. (NATEF VIII C 1)
- b. Determine root cause of engine performance problems related to no-starting, performance and emission concerns on vehicle with distributor (DI) ignition systems. (NATEF VIII C 2)
- c. Determine root cause of mechanical, electronic engine controls, or ignition concerns using an engine analyzer/oscilloscope. (NATEF VIII A 10)

Performance Standards

You will demonstrate your competence:

- o by completing NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o by performing the priority NATEF tasks

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan
- o learner attends required class and lab sessions and shows up on time

5. Diagnose and repair excessive emission failure/concerns. (NATEF VIII A & E)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for excessive emission emitting from the exhaust and evaporative emission system.
- b. Perform and interpret four or five gas baseline tests.
- c. Identify component causing emission failure and repair or replace.

Performance Standards

You will demonstrate your competence:

- o by completing NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o by performing the priority NATEF tasks listed in the related learning plan (The tasks must be completed with limited supervision - entry level)

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning plan
- o learner attends required class and lab sessions and shows up on time
- o learner participates in all the learning activities and completes all assignments

6. Demonstrate ability to utilize various diagnostic equipment, such as: lab scope, hand-held scanners, DVOM, logic probes, sensor simulator and exhaust gas analyzer. (NATEF VI A, NATEF VII B, D, & E)

Learning objectives

What you will learn as you master the competency:

- a. Perform strategy based diagnostic process using scanner, scopes, DVOM, logic probe, sensor simulators and exhaust analyzer.

Performance Standards

You will demonstrate your competence:

- o by completing NATEF aligned assignment and job sheets listed in the related learning plan (The assignment and job sheets must be completed at a satisfactory level to the instructor)
- o by performing the priority NATEF tasks listed in the related learning plan (The task must be completed with limited supervision - entry level)

Your performance will be successful when:

- o learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan
- o learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan
- o learner actively participates in the NATEF task requirements listed in the related learning

- plan
- o learner attends required class and lab sessions and shows up on time

Types of Instruction

Classroom Presentation

Lab

Individualized/Independent Study

Simulated or Actual Work Experience

Grading Information

Grading Rationale

Course Requirements

This course requires that students attend class on time and participate. Students will not be allowed to miss more than six days or three in a row, per semester. If the student abuses this policy, he/she will be removed from the course. Tardiness to class will not be allowed and excessive tardiness (three) will count as one absent day, and the student might not be allowed to enter class after the session starts. If the student is late to class, he/she **may not be allowed to make-up missed work.**

Work will not be accepted late without a **50% penalty**. Work which was due on an excused absent day must be turned in the following class meeting. No work will be accepted for unexcused absent days.

Each instructor has the flexibility to develop evaluative procedures within the following parameters.

1. The Post Test will represent 10% of the course grade.
2. Course learning activities shall represent 90% of the course grade.

Grading Weights

Lab=45%

Class (Includes Test and Assignments and Final)=45%

Grading Methods

Class score calculation-

Quizzes, assignments and job sheet points shall be added and carry a weight equal to one test score.

All exams except the final shall have equal weight (test scores averaged) and used in class score calculations.

The final (post test) will be worth at least 10% of the overall final grade calculation.

Lab score calculation-

Instructor should evaluate each student's work habits using lab time card.

Each student should be evaluated on productivity and progress on task requirements, working in a professional manner, clean-up and safe work habits. Instructor is also required to evaluate each student's skill level in achieving the NATEF task requirement outlined in the various learning plans.

Instructors are encouraged to reward students for showing up on time and attending each class and lab session. This can be done by requiring students to make arrangements with the instructor to make-up any lost time prior to missed day. All students need to notify the instructor of sick days through voice mail, etc.

on the day of sickness. Instructors should not allow for any work to be turned in late or any test made up without some type of deduction for late assignments/test. Suggested deduction 50% of original score.

Grading Scale

A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%
F	Below 60 %

Learning Plan

Safety

Overview

In this learning plan you will develop the knowledge needed to work safely in a shop environment. You will learn safety procedures, the location of safety equipment, and the safety features of various shop equipment. The instruction will cover general shop safety processes, fire safety, battery safety, lifting procedures, and health-related hazards.

1. Apply proper safety procedures and processes.

Learning Activities

- ____1. Complete a worksheet/assignment sheet.

- ____2. Collect a current article that relates to concepts and issues about which you are studying.

- ____3. Listen and observe a lecture covering safety procedures and practices - review a safety and hazards video.

- ____4. Operate hoist, floor jack (jack stands) and any equipment needed during assigned lab activities.

- ____5. Identify location of safety equipment, first-aid kit, phone, fire blanket, fire extinguishers, exits, light switches and vents.

Assessment Activities

- ____1. Participate in safety discussion.
- ____2. Complete activities in lesson.
- ____3. Complete written safety test.

Learning Plan

General Power Train Diagnosis

Overview

To perform general vehicle power train performance diagnosis.

2. Perform general power train system diagnosis using a strategy-based process. (NATEF VIII A)

Learning Activities

- _____ 1. Isolate cause, using a strategic process, of an engine that cranks but will not. (P1 NATEF VIII 1 & 2)
- _____ 2. Verify customer concern to determine needed action. (P-1 NATEF VIII A 1)
- _____ 3. Identify unusual exhaust color, odor, and sound to determine necessary action. (P-2 NATEF VIII A 4)
- _____ 4. Test engine absolute (vacuum/boost) manifold pressure. (P-1 NATEF VIII A 5)
- _____ 5. Perform cylinder power balance test; determine necessary action. (P-1 NATEF VIII A 6)
- _____ 6. Perform cylinder compression test; determine necessary action. (P-1 NATEF VIII A 7)
- _____ 7. Perform fuel delivery system testing (fuel pressure & flow)

Assessment Activities

- _____ 1. Participate in lecture & discussion. Listen, take notes, and discuss material provided in lesson.
- _____ 2. Complete assignment and job sheets covering electrical basics, ignition basics, fuel systems basics, and compression theory basics. Complete assignment sheet ID compression systems components and tools, electrical terms, fuel system components. Complete job sheets - compression test, vacuum tests, power balance tests, cylinder leakage test, scope set-up / scope pattern assessment, gasoline testing RVP & alcohol, and perform 60,000 vehicle maintenance.
- _____ 3. Complete written tests covering basic electricity & engine analyzer (scope) set-up and usage. Complete test on analyzing the engine's ignition, fuel and compression systems.

Learning Plan

Vehicle Performance, Intermittent, Code and No Code Operational Concerns (Computerized System)

Overview

To diagnose engine performance and emission concerns.

3. Diagnose and repair vehicle “hard code” and “no code” intermittent performance concerns on vehicles with computerized engine controls using a strategy-based process. (NATEF VIII B & D)

Learning Activities

- ____ 1. Verify customer concern to determine needed action. (P-1 NATEF VIII A 1)
- ____ 2. Retrieve and record stored OBD I diagnostic trouble codes; clear codes. (P-1 NATEF VIII B 1)
- ____ 3. Retrieve and record stored OBD II diagnostic trouble codes; clear codes. (P-3 NATEF VIII B 2)
- ____ 4. Inspect and test computerized engine control system sensors, power train control module (PCM), actuators, and circuits; perform necessary action. (P-2 NATEF VIII B 5)
- ____ 5. Obtain and interpret digital multimeter (DMM) readings. (P-1 NATEF VIII B 6)
- ____ 6. Obtain and use electronic service information (ESI). (P-3 NATEF VIII B 7)
- ____ 7. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (P-1 NATEF VIII B 8)
- ____ 8. Inspect and test power and ground circuits and connections; service or replace as needed. (P-1 NATEF VIII B 9)
- ____ 9. Practice recommended precautions when handling static sensitive devices. (P-2 NATEF VIII B 10)
- ____ 10. Check for fuel contaminants and quality; determine necessary action. (P-2 NATEF VIII D 4)
- ____ 11. Inspect and test electrical fuel pumps and pump control systems. (P-2 NATEF VIII D 5)
- ____ 12. Inspect and test fuel pressure regulation system and components of injection-type fuel systems. (P-1 NATEF VIII D 7)
- ____ 13. Inspect and test cold enrichment system and components; perform necessary action. (P-3 NATEF VIII D 8)
- ____ 14. Inspect, test, and clean fuel injectors. (P-2 NATEF VIII D 10)
- ____ 15. Remove, inspect, and test vacuum and electrical circuits, components, and connections of fuel system. (P-2 NATEF VIII D 14)
- ____ 16. Inspect exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s). (P-2 NATEF VIII D 15)
- ____ 17. Perform exhaust system back-pressure test. (P-1 NATEF VIII D 16)
- ____ 18. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. (P-2 NATEF VIII E 2-4)
- ____ 19. Inspect and test components of intake air temperature control system; perform necessary action. (P-3 NATEF VIII E 4-2)
- ____ 20. Verify engine operating temperature. (P-1 NATEF VIII F 3)

Assessment Activities

- _____ 1. Participate in lecture and discussion. Listen, take notes, and discuss the information presented in lesson related mechanical and computerized engine controls.
- _____ 2. Complete assignment sheets and job sheets related performance diagnosis. Gasoline quality worksheet, AV presentation Changes in Gasoline by Downstream Alternatives, INC., AS1-L1-UVI, AS1-L2-UVI, AS2-L2-UVI, AS3-L2-UVI, Job sheets - JS-L2-UVI, JS2-L2-UVI, JS3-L2-UVI, JS1-L2-UVI, JS2-L2-UVI, JS3-L2-UVI, JS4-L2-UVI, JS5-L2-UVI, JS1-L2-UVI, JS1-L3-UIV, JS1-L1-UIV.
- _____ 3. Complete written test basic engine diagnosis (mechanical & computerized systems).

Learning Plan

Engine Performance- Ignition System Types

Overview

To perform engine performance diagnosis on various ignition system types.

4. Diagnose and repair various ignition system engine performance concerns using a strategy-based process. (NATEF VIII C)

Learning Activities

- ____1. Verify customer concern to determine needed action. (P-1 NATEF VIII A 1)
- ____2. Perform engine analysis using an engine analyzer/oscilloscope. (P-1 NATEF VIII A 9)
- ____3. Inspect and test ignition primary circuit wiring and components. (P-2 NATEF VIII C 3)
- ____4. Inspect and test distributor. (P-3 NATEF VIII C 4)
- ____5. Inspect and test ignition system secondary circuit wiring and components. (P-2 NATEF VIII C 5)
- ____6. Inspect and test ignition coil(s). (P-2 NATEF VIII C 6)
- ____7. Check and adjust (where applicable) ignition system timing and timing advance/retard. (P-1 NATEF VIII C 7)
- ____8. Inspect and test ignition system pick-up sensor or triggering devices. (P-2 NATEF VIII C 8)
- ____9. Inspect and test ignition control module. (P-2 NATEF VIII C 9)

Assessment Activities

- ____1. Participate in lecture and discussion. Listen, take notes, and discuss among class the information presented related to gasoline ignition systems.
- ____2. Complete assignment and job sheets related to ignition theory and service. AS1-L1-UI, AS1-L2-UI, watch Bergwall AV presentation (Ignition systems theory), AS1-L1-UI, AS1-L2-UI, AS1-L2-UII, AS1-L3-UII, AS1-L1-UV, AS2-L2-UV, AS3-L1-UV, AS4-L1-UV, AS5-L1-UV, AS6-L1-UV, AS1-L2-UV, AS2-L2-UV, AS3-L2-UV, AS1-L1-UIII. Job sheets replacing points & set dwell / timing, JS1-L2-UV, JS2-L2-UV, JS1-L1-UV, JS2-L1-UV, JS3-L1-UV, JS4-L1-UV, JS5-L1-UV, JS6-L1-UV, JS7-L1-UV
- ____3. Complete written tests covering point ignition & electronic ignition theory, testing and servicing.

Learning Plan

Excessive Emission Concerns

Overview

To diagnose excessive emission concerns.

5. Diagnose and repair excessive emission failures / concerns. (NATEF VIII A & E)

Learning Activities

- ____ 1. Perform strategic-based diagnostic process to determine emission failure due to air injection and/or catalytic converter system. (P2 NATEF VIII 3-1)
- ____ 2. Perform pin-point test sequence to isolate cause of an on-board vehicle emission related code and/or service light. (P-1 NATEF VIII B 6)
- ____ 3. Determine reason for emissions and vehicle problems caused by failure of the exhaust gas recirculation (EGR) system. (P-1 NATEF VIII E 2-1)
- ____ 4. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems. (P-2 NATEF VIII E 2-4)
- ____ 5. Determine reason for emissions and performance problems resulting from failure of the intake air temperature control system. (P-3 NATEF VIII E 4-1)
- ____ 6. Determine reason for emissions and performance problems resulting from failure of early fuel evaporation control system. (P-3 NATEF VIII E 5-1)
- ____ 7. Determine reason for emissions and performance problems resulting from failure of evaporative emissions control system and determine necessary action. (P-2 NATEF VIII E 6-1)
- ____ 8. Determine reason for emission and performance problems resulting from failure of air injection system and or catalytic converter. (P-1 NATEF VIII E 3-1)
- ____ 9. Perform five-gas exhaust analysis and interpret results.

Assessment Activities

- ____ 1. Participate in classroom discussion of subject matter. Listen, take notes and discuss items presented in class related to vehicle emission failures / IM 240 drive trace.
- ____ 2. Access and use repair information systems and interactive computer-based instruction dealing with excessive exhaust emissions.
- ____ 3. Complete all required activities related to emission systems. Complete assignment sheets & job sheet related to five gas analysis loaded and unloaded, assignments read five gas analysis, emission component ID and testing.
- ____ 4. Complete test related to vehicle emission ID and testing.

Learning Plan

Utilization of Diagnostic Equipment

Overview

To demonstrate ability to utilize various diagnostic equipment.

6. **Demonstrate ability to utilize various diagnostic equipment, such as, hand-held scanners, scopes, DVOM, logic probes, sensor simulator and exhaust gas analyzer. (NATEF VI A, NATEF VIII B, D, & E)**

Learning Activities

- ____ 1. Utilize Fluke and or PC-based oscilloscope to obtain various types of voltage and current signals within various computer controlled power train systems. (P-1 NATEF VIII A 10)
- ____ 2. Check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM) and determine necessary action. (P-1 NATEF VI A 3)
- ____ 3. Check current flow in electrical/electronic circuits and components using an ammeter and determine necessary action. (P-1 NATEF VI A 4)
- ____ 4. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter and determine necessary action. (P-1 NATEF VI A 5)

Assessment Activities

- ____ 1. Participate in discussion of subject matter. Participate in hands-on activities related to using hand-held testing equipment.
- ____ 2. Complete all required activities. Participate in hands-on activities related to using hand-held scan tool, lab scope, DVOM.