

EASTERN ARIZONA COLLEGE

Automotive Electrical Fundamentals

Course Design
2016-2017

Course Information

Division Industrial Technology Education
Course Number AUT 105
Title Automotive Electrical Fundamentals
Credits 2
Developed by Brian Coppola
Lecture/Lab Ratio 1 Lecture/3 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 (42 Questions/100 Points)
Semester Taught Fall
GE Category None
Separate Lab No
Awareness Course No
Intensive Writing Course No

Prerequisites

None

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 the student's ability to work with and diagnose electrical/electronic systems on modern automobiles.

Description

This course provides a study of automotive electrical and electronic fundamentals. Course has an emphasis on Ohm's Law and application of Ohm's Law in solving electrical system failures. This course provides an in-depth study on how to properly use wiring and current flow diagrams in electrical diagnosis and repair. Course includes using industry-standard diagnostic equipment and techniques. Prepares the student to take the ASE certification test on electrical/electronic systems.

Supplies

Safety glasses
Student notebook/folder

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 chemical used in the shop.

Performance Standards

You will demonstrate your competence:

- o by completing safety assignments and written exam at a satisfactory level

Your performance will be successful:

- o learner observes and practices safety procedures

2. Diagnose and repair various electrical/electronic vehicle system concerns using a strategy-based process. (NATEF VI A)

Learning objectives

What you will learn as you master the competency:

- a. Perform trouble-shooting process on electrical components and systems using industry-standard tooling, equipment and reference information.

Performance Standards

You will demonstrate your competence:

- o by completing NATEF aligned assignments 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 in 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

3. Diagnose and repair various automotive lighting system concerns using a strategy-based process. (NATEF VI E)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for various vehicle lighting system problems using vehicle reference material, test light and/or multi-meter.

Performance Standards

You will demonstrate your competence:

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

4. Diagnose and repair various automotive electrical driver information system (gauges and warning devices) concerns using a strategy-based process. (NATEF VI F)

Learning objectives

What you will learn as you master the competency:

- a. Determine root causes for various vehicle problems related to gauges and warning device, using vehicle reference material, test light and/or multi-meter.

Performance Standards

You will demonstrate your competence:

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

5. Diagnose and repair various automotive electrical accessory systems (horn, wiper, heated glass, door systems, and cruise controls) concerns using a strategy-based process. (NATEF VI G & H)

Learning objectives

What you will learn as you master the competency:

- a. Determine root cause for various vehicle problems related to horn, wiper, heated glass,

door system (electrical), cruise control, and anti-theft, using vehicle reference material, test light and/or multi-meter.

Performance Standards

Your will demonstrate your competence:

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

6. Perform industry-standard electrical repairs on various automotive electrical systems.

Learning objectives

What you will learn as you master the competency:

- a. Perform proper electrical wire and connector repair.

Performance Standards

You will demonstrate your competence:

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

Types of Instruction

Classroom Presentation

Lab

Individualized/Independent Study

Simulated or Actual Work Experience

Grading Information

Grading Rationale

Grading Weights

Lab=45%

Class (Includes Test and Assignments)=45%

Final Exam (Post Test is the Final)=10%

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%

Pass/Fail A non-major student may choose to have a grade of P or F rather than a letter grade. A grade of P will require that the student receive a percentage grade of at least 70%. A grade less than this will result in a grade of F.

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

Electrical/Electronic Vehicle Systems' Concerns

Overview

To diagnose electrical/electronic vehicle systems' concerns.

2. Diagnose and repair various electrical/electronic vehicle system concerns using a strategy-based process. (NATEF VI A)

Learning Activities

- ____ 1. Use wiring diagrams during diagnosis of electrical circuit problems. (P1 NATEF VI A 1)

- ____ 2. Check electrical circuits with a test light and determine necessary action. (P2 NATEF VI A 2)

- ____ 3. Check voltage and voltage drop in electrical/electronic circuits using a digital multi-meter (DMM). (P1 NATEF VI A 3)

- ____ 4. Check current flow in electrical/electronic circuits and components using an ammeter. (P1 NATEF VI A 4)

- ____ 5. Check electrical circuits using jumper wires. (P2 NATEF VI A 6)

- ____ 6. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits. (P1 NATEF VI A 7)

- ____ 7. Inspect and test fusible links, circuit breakers, and fuses. (P1 NATEF VI A 9)

- ____ 8. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter. (P1 NATEF VI A 5)

Assessment Activities

- ____ 1. Participate in classroom discussion of subject material. Listen, take notes, and discuss material related to general electrical system diagnosis and repair.

- _____2. Access and use repair informational resources and use interactive computer-based learning systems related to electrical theory and testing.
- _____3. Complete related assignment and job sheets provided by instructor. job sheet measuring voltage & resistance & current, complete group activity using Ford CBI and Honda CBI, watch Bergwall or Honda video dealing with electrical theory and testing.
- _____4. Complete written test electrical system theory and testing (measuring volts, resistance, and current).

Learning Plan

Automotive Lighting Systems

Overview

To diagnose automotive lighting system concerns.

3. Diagnose and repair various automotive lighting system concerns using a strategy-based process. (NATEF VI E)

Learning Activities

- ____ 1. Use wiring diagrams during diagnosis of electrical circuit problems. (P1 NATEF VI A 1)

- ____ 2. Check electrical circuits with a test light and determine necessary action. (P2 NATEF VI A 2)

- ____ 3. Check voltage and voltage drop in electrical/electronic circuits using a digital multi-meter (DMM). (P1 NATEF VI A 3)

- ____ 4. Check current flow in electrical/electronic circuits and components using an ammeter. (P1 NATEF VI A 4)

- ____ 5. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter. (P1 NATEF VI A 5)

- ____ 6. Check electrical circuits using jumper wires. (P2 NATEF VI A 6)

- ____ 7. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits. (P1 NATEF VI A 7)

- ____ 8. Inspect and test fusible links, circuit breakers, and fuses. (P1 NATEF VI A 9)

- ____ 9. Identify the cause of brighter than normal, intermittent, dim, or no light operation. (P2 NATEF VI E 1)

____10. Inspect, replace, and aim headlights and bulbs. (P2 NATEF VI E 2)

____11. Inspect and diagnose incorrect turn signal or hazard light operation. (P2 NATEF VI E 3)

Assessment Activities

____1. Participate in discussion of subject material. Listen, take note and discuss material related to diagnosis and testing automotive lighting systems.

____2. Complete assignment and job sheets related to automotive lighting systems. Trace current diagrams and wiring diagrams, ID schematic symbols, isolate electrical open, ground shorts, and Ford & Honda CBI light systems activities.

____3. Complete written test covering using electrical schematics.

Learning Plan

Gauges and Warning Devices

Overview

To diagnose automotive gauges and warning devices.

4. Diagnose and repair various automotive electrical driver information system (gauges and warning devices) concerns using a strategy-based process. (NATEF VI F)

Learning Activities

- ____ 1. Use wiring diagrams during diagnosis of electrical circuit problems. (P1 NATEF VI A 1)

- ____ 2. Check electrical circuits with a test light and determine necessary action. (P2 NATEF VI A 2)

- ____ 3. Check voltage and voltage drop in electrical/electronic circuits using a digital multi-meter (DMM). (P1 NATEF VI A 3)

- ____ 4. Check current flow in electrical/electronic circuits and components using an ammeter. (P1 NATEF VI A 4)

- ____ 5. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter. (P1 NATEF VI A 5)

- ____ 6. Check electrical circuits using jumper wires. (P2 NATEF VI A 6)

- ____ 7. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits. (P1 NATEF VI A 7)

- ____ 8. Inspect and test fusible links, circuit breakers, and fuses. (P1 NATEF VI A 9)

- ____ 9. Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings. (P2 NATEF VI F 1)

- ____ 10. Inspect and test connectors, wires, and printed circuit boards of gauge circuits. (P3 NATEF VI F 2)

- ____ 11. Identify the cause of incorrect operation of warning devices and other driver information systems and determine necessary action. (P1 NATEF VI F 3)

- ____ 12. Inspect and test sensors, connectors, and wires of electronic instrument circuits. (P3 NATEF VI F 4)

Assessment Activities

- ____ 1. Participate in discussion of subject material. Listen, take notes, and discuss material related to diagnosing and testing gauges and warning devices.

- ____ 2. Complete assignment sheets and job sheets related to diagnosis, test, and repair of electrical warning devices. Job & assignments sheets trace electrical circuit, tests circuit & repair, use test light and DVOM while testing circuit.

- ____ 3. Complete quiz covering warning devices.

Learning Plan

Automotive Electrical Accessories

Overview

To diagnose automotive electrical accessory systems concerns.

5. **Diagnose and repair various automotive electrical accessory systems (horn, wiper, heated glass, door systems, and cruise controls) concerns using a strategy-based process. (NATEF VI G & H)**

Learning Activities

- ____ 1. Use wiring diagrams during diagnosis of electrical circuit problems. (P1 NATEF VI A 1)
- ____ 2. Check electrical circuits with a test light and determine necessary action. (P2 NATEF VI A 2)
- ____ 3. Check voltage and voltage drop in electrical/electronic circuits using a digital multi-meter (DMM). (P1 NATEF VI A 3)
- ____ 4. Check current flow in electrical/electronic circuits and components using an ammeter. (P1 NATEF VI A 4)
- ____ 5. Check continuity and resistances in electrical/electronic circuits and components with an ohmmeter. (P1 NATEF VI A 5)
- ____ 6. Check electrical circuits using jumper wires. (P2 NATEF VI A 6)
- ____ 7. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits. (P1 NATEF VI A 7)
- ____ 8. Inspect and test fusible links, circuit breakers, and fuses. (P1 NATEF VI A 9)
- ____ 9. Identify the cause of incorrect horn operation. (P3 NATEF VI G 1)

- ____ 10. Identify the cause of incorrect wiper operation. (P3 NATEF VI G 2)

- ____ 11. Diagnose wiper speed control and park problems. (P3 NATEF VI G 2)

- ____ 12. Diagnose incorrect windshield washer operation. (P3 NATEF VI G 3)

- ____ 13. Identify the cause of incorrect operation of motor-driven accessory circuits. (P2 NATEF VI H 1)

- ____ 14. Identify the cause of incorrect heated glass operation and determine necessary action. (P3 NATEF VI H 2)

- ____ 15. Identify the cause of incorrect electric lock operation and anti-theft system. (P3 NATEF VI H 3)

- ____ 16. Identify the cause of incorrect operation of cruise control systems. (P3 NATEF VI H 4)

Assessment Activities

- ____ 1. Participate in discussion of subject material. Listen, take notes and discuss testing and repair of electrical accessories.

- ____ 2. Complete assignment and job sheets related to testing and repair of automotive electrical accessories. Trace electrical schematic, test blower circuit, electric windows, seats, window defroster, power locks, and radiator fan circuit. Complete Honda CBI & Ford CBI covering accessories.

- ____ 3. Complete written test covering testing and repair of electrical accessories.

Learning Plan

Electrical Repairs

Overview

To perform industry standard electrical repairs.

6. Perform industry-standard electrical repairs on various automotive electrical systems.

Learning Activities

____1. Repair wiring harnesses and connectors. (P1 NATEF VI A 11)

____2. Perform solder repair of electrical wiring. (P1 NATEF VI A 12)

Assessment Activities

____1. Participate in discussion of subject material. Describe proper techniques for proper repair of electrical wires and related components.

____2. Complete lab assignment related to wire crimping, soldering and connector replacement & repairs.