

AUTO-2505: AUTOMOTIVE ELECTRICAL DIAGNOSIS FOR GENERAL MOTORS ASEP

Cuyahoga Community College

Viewing: AUTO-2505 : Automotive Electrical Diagnosis for General Motors ASEP

Board of Trustees:

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Academic Term:

Fall 2022

Subject Code

AUTO - Automotive Technology

Course Number:

2505

Title:

Automotive Electrical Diagnosis for General Motors ASEP

Catalog Description:

Covers diagnosing electrical concerns on General Motors vehicles. Includes instructor led content along with hands-on activities. Participants will have the opportunity to learn about the different testing equipment, demonstrate how to use the equipment to run a variety of tests and learn how to develop an action plan to aid them in thorough diagnosis. Encourages problem-based learning. Upon completion, students should be able to properly use wiring diagrams, diagnose, test, and repair wiring, lighting, gauges, accessories, modules, and electronic concerns.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

3

Requisites

Prerequisite and Corequisite

AUTO-1510 Automotive Electrical Systems; or departmental approval: industry-related experience.

Outcomes

Course Outcome(s):

Perform General Electrical System Diagnosis and Identify a Logical Electrical Circuit Testing Order

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. Use a digital multimeter to diagnose starting and charging system problems.
2. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.
3. Check electrical circuits with a test light; determine necessary action.
4. Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
5. Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
6. Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action.
7. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
8. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.

9. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action.
10. Troubleshoot and perform diagnostics and repair procedures on body electrical accessory systems.
11. Identify and interpret electrical/electronic system concern; determine necessary action.
12. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
13. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).
14. Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).

Course Outcome(s):

Diagnose, repair, and maintain vehicles equipped with Advanced Battery Systems

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. Identify battery diagnostics.
2. Identify battery charging strategies.
3. Identify regulated voltage control systems.

Course Outcome(s):

Diagnose, repair, and maintain vehicles equipped with Advanced Starting Systems

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. Diagnose the cause of false, intermittent, or no operation of anti-theft systems.
2. Identify starting system characteristics.
3. Identify the characteristics, components, and operation of the content theft deterrent systems.
4. Identify diagnostic strategies and service considerations for keyless entry and security systems.

Course Outcome(s):

Diagnose, repair, and maintain vehicles equipped with Advanced Charging Systems

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. Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.
2. Identify charging system characteristics.
3. Identify charging system diagnosis.

Course Outcome(s):

Diagnose and repair vehicles equipped with Integrated Driver Information Systems

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. Identifying isolated networks on the vehicle.
 2. Identify how the Serial Data Gateway Module manages network traffic.
 3. Identify how isolated network faults are identified.
 4. Identify aspects and diagnostics of cellular and GPS technology.
 5. Describe OnStar generation 10 diagnostics and programming.
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Course Outcome(s):

Diagnose and repair automotive electronic systems using manufacturer specific service information and electronic test equipment.

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. Diagnose body electronic system circuits using a scan tool; determine necessary action.
2. Check for module communication (CAN/BUS) errors using a scan tool.
3. Diagnose and repair various types of audio system noise concerns.
4. Identify MOST® network characteristics, normal operation, and fault reporting function.
5. Identify the types and characteristics of Universal Serial Bus and recall how to diagnose its connectivity.
6. Diagnose electronic circuits by observing square wave or sine waves on an oscilloscope.
7. Perform the diagnostic process for the rear vision camera, parking assist, lane departure warning, side object detection, and enhanced electronic pedal override systems.
8. Identify common characteristics and functions of control modules.
9. Perform the diagnostic process for the Supplemental Inflatable Restraint (SIR) and seat belt system.
10. Repair and validate the connection system and harness, and repair concerns on GM vehicles.

Course Outcome(s):

Diagnose and repair integrated vehicle electronics systems components, throughout the vehicle.

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. Check electrical circuits using fused jumper wires; determine necessary action.
2. Identify, test and diagnose ground and voltage circuits.
3. Identify, test and diagnose signal and control circuits.
4. Demonstrate specific diagnostic procedures for communication networks.
5. Identify the terminology describing Bluetooth® connectivity.
6. Identify the steps to diagnose Bluetooth® connectivity concerns.
7. Identify the Active Noise Cancellation system. Features, operation and diagnosis.
8. Identify the characteristics and operation of mobile digital media system.
9. Identify characteristics and diagnosis of various electronic sensors.
10. Identify important features of communication systems.
11. Use wiring diagrams during diagnosis of electrical circuit problems.

Methods of Evaluation:

1. Participation and discussion
2. Observation
3. Written assignments
4. Exams
5. Quizzes
6. Lab tasks
7. Classroom recitations
8. On-car fault finding and diagnosis

Course Content Outline:

1. Lecture Topics: Body computer
 - a. Operation
 - i. input
 - ii. processing
 - iii. storage
 - iv. output
 - b. Actuators

- i. relay
 - ii. solenoid
 - iii. motor
- 2. Data Communications
 - a. Communication network for modules
 - b. Advantages
 - i. data information shared
 - ii. easier to add vehicle features
 - iii. fewer high current devices and switches
 - iv. diagnose from one location
 - c. Serial data
 - i. High Speed CAN
 - 1. data bus (+)
 - 2. data bus (-)
 - ii. Single wire
 - iii. network line repair
 - d. Broadcasting methods
 - i. specific requests sent to other modules
 - ii. general information sent to all modules
 - e. Message transmittal
 - i. periodically (vehicle speed)
 - ii. when an event occurs
 - iii. periodically during an event (traction control)
 - iv. during self-testing
 - f. Prioritized messages
 - i. some messages more important
 - ii. isolate trouble codes
 - 1. "U" codes
- 3. Electronic instrument circuits
 - a. Body control module (BCM) computers
 - b. Electronic displays
 - i. light emitting diode
 - ii. liquid crystal
 - iii. vacuum fluorescent
 - iv. cathode ray tube
 - c. Menu driven displays
 - d. Head up display (HUD) system
- 4. Radios and sound systems
- 5. Integrated/Networked Heating and air-conditioning controls
- 6. Power windows
- 7. Power seats
- 8. Memory seats
- 9. Power door locks
- 10. Keyless entry systems
 - a. Components
 - i. door lock motors
 - ii. control module
 - iii. key FOB
- 11. Speed control (Cruise control)
- 12. Heated side view mirrors
- 13. Power sunroof
- 14. Power convertible top
- 15. Power antenna
- 16. Power trunk latches
- 17. Power mirrors
 - a. Power side view mirror
 - b. Automatic rear view mirror
 - c. Electrochromatic mirror
- 18. Message centers

19. Trip monitors
20. Cellular/Smart phone integration
21. Illuminated entry
22. Retained accessory power
23. Automatic door lock system
24. Laboratory Topics: Diagnostic process
 - a. Verify the complaint
 - i. customer discussion
 - ii. is it a problem?
 - iii. intermittent or continuous
 - b. Determine related symptoms
 - i. entire circuit dead?
 - ii. determine what is working and what is not
 - c. Analyze the symptoms
 - i. trace circuit flow under various conditions
 - d. Isolate the trouble
 - i. substitute
 - ii. isolate circuit areas
 - e. Correct the trouble
 - f. Check for proper operation
25. Types of electrical problems
 - a. Open circuit
 - i. disconnected connectors
 - ii. bad switches
 - iii. poor terminal contacts
 - iv. cut wires
 - v. blown or defective fuses
 - b. Unwanted parasitic loads
 - i. isolate fuse
 - ii. isolate circuit
 - c. Short-to-ground
 - i. insert load for fuse (sealed beam)
 - ii. problem in load or wiring before the load
 - d. Short-to power
 - e. Feedback problems
 - i. tracing flow is important
 - ii. check fuses
 - iii. check open grounds
26. Diagnostic strategy
 - a. Symptom-to-system
 - b. System-to-component
 - c. Component-to-cause
27. Diagnostic tools
 - a. Test light
 - i. self-powered
 - ii. high impedance
 - b. Digital volt-ohmmeter
 - c. Inductive ammeter
 - d. Oscilloscope
28. Body computer
 - a. Handling precautions
 - i. pin contact
 - ii. static electricity
 - b. Testing
 - i. visual inspection
 - ii. trouble codes
 1. hard codes
 2. intermittent codes

- iii. scan tool diagnostics
 - iv. testing actuators and sensors
 - c. Multiplexing diagnostics
 - d. Testing gauges and sending units
 - i. gauge reads low
 - ii. gauge reads high
 - iii. inaccurate gauge readings
 - e. Testing warning lamps
 - f. Testing buzzers, and chimes
 - g. Testing voice warning systems
29. Electronic instrument service
30. Radio and sound systems
- a. Speed dependent volume
 - b. Radio theft systems
 - c. Sources of radiated noise
 - d. Sources of conducted noise
 - e. Checking for noise sources
31. Power windows
32. Power seats
33. Memory seats
34. Power door locks
35. Keyless entry system
- a. Testing of remote keyless entry system
 - i. feature does not work
 - ii. transmitter does not lock doors
 - iii. transmitter unlocks all doors except the driver's
 - iv. transmitter unlocks driver's door only
 - v. trunk lid does not release with keyless entry transmitter
36. Heated seats
37. Heated side view mirrors
38. Power sunroof
39. Power convertible top
40. Power antenna
41. Power trunk latches
42. Power mirrors
- a. Power side view mirrors
 - b. Automatic rear view mirror
 - c. Electrochromatic mirror
43. Message centers
44. Trip monitors
45. Headlight dimming
46. Automatic on/off headlamp delay
47. Illuminated entry
48. Retained accessory power
49. Automatic door lock system
- a. Remote keyless
 - b. Security systems
50. Heated seats
51. Warning lamp operating principles
- a. Specific instruments
 - i. charging system indicators
 - ii. oil pressure gauge or warning lamp
 - iii. coolant temperature gauge or warning lamp
 - iv. fuel level gauge or warning lamp
 - v. tachometer
 - vi. turbo boost indicator
 - vii. malfunction indicator lamp
 - viii. antilock brake system lamp

- b. Buzzers, tone generators, chimes and bells
 - i. seat belt warning
 - ii. key-in ignition reminder
 - iii. headlight on reminder

Resources

Halderman, James D. *Automotive Electricity and Electronics*. 6th ed. Hoboken, NJ: Pearson, 2021.

Duffy, James E. *Auto Electricity and Electronics*. 7th ed. Cengage, 2019.

Duffy, James E. *Auto Electricity and Electronics*. 7th ed. Goodheart-Wilcox, 2021.

Resources Other

1. GMSTC course specific training materials.

Top of page

Key: 790