**COURSE OUTLINE OF RECORD**

**Number:** AUTO G120  **TITLE:** Electrical/Electronic Systems: Introductory

**ORIGINATOR:** Eli Jaramillo  **EFF TERM:** Summer 2010

**FORMERLY KNOWN AS:**

**CROSS LISTED COURSE:**

**TOP NO:** 0948.00  **DATE OF OUTLINE/REVIEW:** 02-24-2012

**SEMESTER UNITS:** 5.0

**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 provides students with theory, knowledge, and skills necessary to understand electrical flow and electronic concepts. Instruction is given and lab experience provided which will enable students to successfully perform diagnostics and repair on vehicle electrical and electronic circuits. Information presented is based on the Automotive Service Excellence (ASE) A-6 Electrical/Electronics Tasks and Standards intended to prepare students for the ASE Certification Examination. Lecture and Lab. Advisory: Auto G101

**JUSTIFICATION FOR COURSE:**

**PREREQUISITES:**

**COREQUISITES:**

**ADVISORIES:**

- AUTO G101: Introduction To Automotive Technology

**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 [X] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]

**OPEN ENTRY/OPEN EXIT:** Yes [ ] No [X]

**TRANSFER STATUS:** CSU Transferable[X] UC/CSU Transferable[ ] Not Transferable[ ]

**BASIC SKILLS STATUS:** Yes [ ] No [X]  **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:**

**REQUIRED FOR DEGREE OR CERTIFICATE:** No [ ] Yes [X]

Chassis and Drivetrain Specialist(Certificate of Achievement)

Chassis and Drivetrain Specialist(Associate in Arts)

Engine Performance and Emission Specialist(Associate in Arts)

Engine Performance and Emission Specialist(Certificate of Achievement)

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

measure and convert assigned unit pieces to interpret the appropriate SAE and metric unit. (Celsius to f, and inches to millimeters).

identify a fault (ac no air) and will perform a (repair) to then evaluate a successful (fix) in a lab situation.

analyze and diagnose automotive engines and related components for correct system operation.

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

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

1. Demonstrate mastery of diagnostic tools and equipment used for automotive repair.
2. Compare precision electrical measurements.
3. Demonstrate an ability to self-assess progress and development in a specific area and to further design and pursue a course of action based on the self-assessment.
4. Analyze and diagnose automotive engines and related components for correct system operation.

COURSE OBJECTIVES:

1. Pass the SP-2 mechanical Safety and Mechanical Pollution Prevention Test.
2. Analyze and interpret wiring diagrams.
3. Perform systematic analysis on automotive electrical systems using industry-accepted testing procedures, and diagnostic tools and equipment such as test lights, logic probes, Digital Volt Ohm Meters (DVOM’s), Digital Storage Oscilloscopes (DSO’s), and scan tools.
4. Retrieve and interpret service and repair information.
5. Perform precision electrical measurements and compare against factory specifications.
6. Identify electrical component failures using analytical skills, processes, and industry-accepted procedures.
7. Apply industry-accepted processes and principles for circuit analysis and repairs.
8. Apply learned safety concepts when servicing hybrid electric vehicles (HEV’s), identifying the location of high voltage service disconnect switches, warning devices, and following proper safeguards, and correct set-up procedures.

COURSE CONTENT:

LECTURE CONTENT:

A. Safety Instruction and SP-2 Mechanical Safety and Mechanical Pollution Prevention Test

B. General Electrical System theory and concepts.

1. Electrical basics: Electron theory, ohm’s law, magnetic induction concepts.
2. Wiring diagrams.
3. Electrical circuits.
7. Parasitic current draw.
10. Units of measure and conversion processes used in electricity and electronics.

C. Battery theory and science

2. Battery capacity (load, high-rate discharge).
3. Electronic memory concepts.
4. Slow/ vs. fast battery charge concepts.
5. Battery cables, connectors, clamps and hold-downs.
6. Theory and accepted practices of applying auxiliary vehicle electrical power sources.

D. Starting System

2. Starter current draw and circuit voltage drop.
3. Relays, solenoids, and magnetic induction theory.

E. Charging System concepts and theory of operation.

1. Electro-mechanical theory and concepts.
2. AC / DC theory and diode rectification concepts.
3. Concepts and analysis of undercharge, no-charge or an overcharge condition.
4. Voltage regulation.

F. Lighting Systems power flow concepts

1. Headlights, taillights, and stoplights.
2. Clearance and auxiliary lighting.
3. Turn signal or hazard light operation.
4. Module control of daytime running lights.
5. Voltage drop and lighting systems functionality.

G. Driver Information Systems theory and operation

1. Concepts and causes of intermittent, high, low or no gauge readings.
2. Circuit voltage regulators (limiters).
3. Gauges and gauge sending units.
4. Printed circuit board concepts.
5. Constant, intermittent or no warning light and driver information system operation.
6. Intermittent, high, low or no readings on electronic digital instrument clusters.
7. Sensors, sending units, connectors and wires of electronic digital instrument circuits.

H. Horn and Wiper/Washer.

1. Circuitry layout and structure.
2. Electrical concepts and theories associated with these circuits.

I. Accessories analysis and diagnostics

1. Slow, intermittent or no operation of motor-driven accessory circuits.
2. Poor, intermittent or no heated glass operation.
3. Poor, intermittent or no electric door and hatch/trunk lock operation.
4. Unregulated, intermittent or no operation of cruise control systems.
5. Supplemental restraint system warning light staying on or flashing. Safety procedures to prevent accidental deployment.

J. Practice sample ASE (A6) Electrical/Electronics certification test

LABORATORY CONTENT:

After acquiring the appropriate lecture information, the successful student will demonstrate skill accomplishment by completing worksheet-driven NATEF-approved tasks. NATEF (National Automotive Technicians Education Foundation) is a non-profit agency that evaluates technician training programs against standards developed by the automotive industry. All of the current NATEF approved tasks for this class are listed below, and are also contained in a separate document that is handed out on the first day of class.

ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic systems, the following safety requirement must be strictly enforced:
Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

A. General Electrical System Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret electrical/electronic system concern; determine necessary action.
3. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
6. Use wiring diagrams during diagnosis of electrical circuit problems.
7. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow, and resistance.
8. Check electrical circuits with a test light; determine necessary action.
9. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs.
10. Check electrical circuits using fused jumper wires; determine necessary action.
11. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
12. Measure and diagnose the cause(s) of excessive parasitic draw; determine necessary action.
13. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
15. Remove and replace terminal end from connector; replace connectors and terminal ends.
16. Repair wiring harness (including CAN/BUS systems).
17. Perform solder repair of electrical wiring.
18. Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures.

B. Battery Diagnosis and Service
1. Perform battery state-of-charge test; determine necessary action.
2. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
3. Maintain or restore electronic memory functions.
4. Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs.
5. Perform battery charge.
6. Start a vehicle using jumper cables or an auxiliary power supply.
7. Identify high voltage circuits of electric or hybrid electric vehicle and related safety precautions.
8. Identify electronic modules, security systems, radios, and other accessories that require reinitialization or code entry following battery disconnect.
9. Identify hybrid vehicle auxiliary (12v) battery service, repair and test procedures.

C. Starting System Diagnosis and Repair

1. Perform starter current draw tests; determine necessary action.
2. Perform starter circuit voltage drop tests; determine necessary action.
3. Inspect and test starter relays and solenoids; determine necessary action.
4. Remove and install starter in a vehicle.
5. Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.
6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.

D. Charging System Diagnosis and Repair

1. Perform charging system output test; determine necessary action.
2. Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.
3. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.
4. Remove, inspect, and install generator (alternator).
5. Perform charging circuit voltage drop tests; determine necessary action.

E. Lighting Systems Diagnosis and Repair

1. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.
2. Inspect, replace, and aim headlights and bulbs.
3. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.
4. Identify system voltage and safety precautions associated with high intensity discharge headlights.

F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

1. Inspect and test gauges and gauge sending units for cause of abnormal gauge readings; determine necessary action.
2. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.
3. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.
4. Inspect and test sensors, connectors, and wires of electronic (digital) instrument circuits; determine necessary action.

G. Horn and Wiper/Washer Diagnosis and Repair

1. Diagnose incorrect horn operation; perform necessary action.
2. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.
3. Diagnose incorrect washer operation; perform necessary action.

H. Accessories Diagnosis and Repair

1. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.
2. Diagnose incorrect heated glass, mirror, or seat operation; determine necessary action.
3. Diagnose incorrect electric lock operation (including remote keyless entry); determine necessary action.
4. Diagnose incorrect operation of cruise control systems; determine necessary action.
5. Diagnose supplemental restraint system (SRS) concerns; determine necessary action.
6. Disarm and enable the airbag system for vehicle service.
7. Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action.
8. Remove and reinstall door panel.
9. Diagnose body electronic system circuits using a scan tool; determine necessary action.
10. Check for module communication (including CAN/BUS systems) errors using a scan tool.
11. Diagnose the cause of false, intermittent, or no operation of anti-theft systems.
12. Describe the operation of keyless entry/remote-start systems.
13. Perform software transfers, software updates, or flash reprogramming on electronic modules.

I. Practice sample ASE (A6) Electrical/Electronic Systems certification test.      B. Diagnostics task management
   c. Monitors and enabling criteria

METHODS OF INSTRUCTION:

A. Lecture:
B. Lab:
C. Audio – One Way:
D. Online:
E. Independent Study:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:

Reading Assignments

Required reading:

Websites
Web-based assignments:  Autoshop 101.c0m, CTE Online.com
Other topic-specific websites as needed

Out-of-class Assignments

Writing Assignments

1. Create vehicle repair orders, perform math exercises for flat rate labor, parts and materials totals.
2. Demonstrate an understanding of Ohm's Law by performing math exercises to validate voltage, current flow, and resistance values.
3. Use information and concepts learned in class to successfully pass a practicum or written test or assignment.
4. 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
- Essay Examinations
- Objective Examinations
- Report
- Projects (ind/group)
- Problem Solving Exercises
- Oral Presentations
- Skills Demonstration

**Demonstration of Critical Thinking:**

1. Analyze and troubleshoot electrical circuits and restore them to proper service.
2. Analyze, confirm, and diagnose electrical and electronic system faults based on symptoms indicated on repair orders.
3. Relate diagnostic test results directly to circuit or component failures based on readings or measurements.
4. Analyze wiring diagrams to determine integrity of vehicle electrical and electronic circuits.

**Required Writing, Problem Solving, Skills Demonstration:**

1. Create vehicle repair orders, perform math exercises for flat rate labor, parts and materials totals.
2. Demonstrate an understanding of Ohm's Law by performing math exercises to validate voltage, current flow, and resistance values.
3. Use information and concepts learned in class to successfully pass a practicum or written test or assignment.
4. Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during electrical diagnostic activities.

**TEXTS, READINGS, AND RESOURCES:**

**TextBooks:**


**LIBRARY:**

- Adequate library resources include:
- Comments:

**Attachments:**

- [Attached Files](#)