AUT 110 Introduction to Automotive Electronics

Course Number: 3
Course Title: 3/1

Credits: Hours: lecture/laboratory/other (specify)

Catalog description (2016-2017 Catalog):
An introduction to voltage, current, and resistance, series and parallel circuits, batteries, and electronic components. Wiring schematics, wire repair and circuit troubleshooting are also covered. For automotive technology students.

Prerequisites: None
Corequisites: MAT 033 or Equivalent Proficiency, AUT 111


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Information resources: (Describe the primary information resources that support the course, including books, videos, journals, electronic databases, websites, etc.)
Fiat/Chrysler Dealer Connect Web-site, Fiat/Chrysler Academy Training Reference Books, Service Manuals, On-line Self-Study Courses and the ALLDATA Online Service Information Database.

Other learning resources: (Describe any other student learning resources that are specific to this course, including any special tutoring or study group support, learning system software, etc.)

Course goals: [List the most important 5-8 overall student learning goals for your course. Learning goals (or competencies) are statements that describe the specific, measurable knowledge, skills, and/or values that the student is expected to demonstrate, perform or exhibit after completion of the course. Learning goals should focus on what the students will learn (rather than what the instructor will teach) and should include verbs (explain…, demonstrate…, identify…) that accurately reflect lower-order and higher-order learning goals.]

1. Using the computers in the automotive facility, the student will be able to obtain service repair information and procedures from the appropriate online service information database web-site.
2. Using the vehicle service manuals supplied by the program, the student will be able to research service procedures to repair shop vehicles.
3. Given a schematic of a series circuit consisting of known voltage and resistance values, the student will be able to calculate the circuit voltage, current and resistance of all components in the circuit.

4. Given a schematic of a parallel circuit consisting of known voltage and resistance values, the student will be able to calculate the circuit voltage, current and resistance of all components in the circuit.

5. The student will be able to demonstrate an understanding of the proper use of a digital multimeter by successfully measuring voltage, current, resistance and voltage drop on sample test circuits.

6. The student will be able to demonstrate the proper procedure for repairing a damaged wire by soldering two jumper wires that can be used for electrical troubleshooting.

7. Given a live vehicle with an electrical problem, the student will be able to successfully diagnose the problem using both electrical test devices and wiring diagram manuals.

Course-specific General Education goals and objectives. [To an extent consistent with its primary purposes, each course in every program is expected to reflect the college’s commitment to general education, as affirmed in the attached list of General Education Goals and Objectives. A General Education Course is one whose primary purposes and overall design coincide strongly with one or more of the approved general education goals and objectives. For any approved (or proposed) General Education Course, the General Education Goals and Objectives form should be completed and attached to the course outline.]

This course is not designed to be a General Education offering.

General Education Core Competencies.

1. Students will read, write and listen actively, critically and reflectively.
2. Students will write and speak clearly and effectively in formal American English.
3. Students will draw logical conclusions by applying a variety of mathematical problem-solving strategies.
4. Students will be able to communicate mathematical concepts effectively. Students will integrate scientific principles and scientific discovery, and will critically investigate the impact of science and scientific discovery on our understanding of the natural universe.
5. Students will demonstrate proficiency with electronic communications as appropriate to their program.
6. Students will demonstrate a working knowledge of a major domain of technological application.
7. Students will demonstrate the ability to use a particular technology or group of technologies to analyze or solve problems in general and within their academic discipline.

Units of study in detail. [List the units of study according to the general topics or themes by which the course is organized. Units of study are not chapter titles, but should be seen as independent of the selected textbook. For each unit, identify specific learning objectives. These unit learning objectives should stem from the overall course objectives and applicable General Education objectives. Unit learning objectives should state (in terms that can serve as the frame of reference for ongoing assessment of both student achievement and of the course’s effectiveness) what successful students will be able to demonstrate, perform or exhibit at the end of the unit.]
Unit I: INTRODUCTION

Learning Objectives
1. The student will be able to calculate the units of measure of Mega, Kilo, Milli, and Micro and convert from one to the other.
2. Using Ohm’s Law, the student will be able to explain the relationship of voltage and resistance and their effect on circuit current flow.

A. Fundamentals
   1. Current, Voltage, Resistance
   2. Conductor, Semi-conductor, Insulator

Homework Assignment: Read Chapter 3
   Pages 53-63
   Answer Review and Chapter Quiz Questions

B. Reading the Digital Multimeter
   1. Units of Measure
      a. Mega, Kilo, Milli, Micro
      b. Decimal Placement
   2. Meter Scales

Homework Assignment: Read Chapter 8
   Pages 97-117
   Answer Review and Chapter Quiz Questions

C. Interpreting Resistor Values
   1. Color Bands

D. Electron Theory of Electron Flow
   1. Ohm’s Law
   2. Relationship of Voltage, Current, and Resistance

Homework Assignment: Read Chapter 4
   Pages 64-71
   Answer Review and Chapter Quiz Questions

Unit II: SERIES CIRCUITS

Learning Objectives
1. The student will be able to apply the rules for a series circuit to explain its operation.
2. Using the proper electrical components, the student will construct a working electrical circuit to be used for class activities.
3. On a live vehicle, the student will be able to perform a Starter Motor Voltage Drop test to determine starter circuit condition.

A. Circuit Rules
   1. Voltage
   2. Current
   3. Resistance

B. Applying Ohm’s Law to Calculate Values
   1. Sample Problems
C. Using the Test Circuit Board
   1. Complete the Activity Sheet: Series Circuits

D. Completing and Testing Sample Circuits
   Homework Assignment: Read Chapter 5
   Pages 72-78
   Answer Review and Chapter Quiz Questions
   Homework Assignment: Series Circuit Worksheet
   Lab Assignment: Starter Voltage Drop Test

Unit III: PARALLEL CIRCUITS
Learning Objectives
1. The student will be able to apply the rules for a parallel circuit to explain its operation.

A. Circuit Rules
   1. Voltage
   2. Current
   3. Resistance

B. Applying Ohm’s Law to Calculate Values
   1. Sample Problems

C. Completing and Testing Sample Circuits

D. Series/Parallel Circuits
   1. Sample Problems

E. Using the Test Circuit Board
   1. Completing the Activity Sheet: Parallel Circuits

Homework Assignment: Read Chapters 6 and 7
   Pages 80-87, 89-93
   Answer Review and Chapter Quiz Questions
   Homework Assignment: Parallel Series Worksheet, Series-Parallel Worksheet

UNIT IV: COMPONENTS
Learning Objectives
1. Using a fully-charged 12 volt automotive battery, the student will be able to perform a Battery Load Test to determine battery condition.

A. 12V Automotive Battery
   1. Electro-chemical Device
   2. Battery Construction
      a. Flooded Cell
      b. Absorbed Glass Mat
   3. Operating Characteristics
      a. Discharging
      b. Charging
      c. Cold-cranking Amp Rating
      d. Reserved Capacity
   4. Testing and Diagnosis
      a. Specific Gravity
b. Load Testing
  c. Using the AVR Tester
Homework Assignment: Read Chapters 17 and 18
  Pages 235-243, 245-259
  Answer Review and Chapter Quiz Questions

LAB ASSIGNMENT: C-2- BATTERY SERVICE AND TESTING

B. Resistors
  1. Types
  2. Theories of Operation
C. Capacitors
  1. Types
  2. Theories of Operation
Homework Assignment: Read Chapter 12
  Pages 163-169
  Answer Review and Chapter Quiz Questions
D. Coils
  1. Principles of Magnetism
     a. Electrostatic Discharge
  2. Methods of Voltage Amplification
  3. Types
E. Switching Devices
  1. Solenoids
  2. Relays
  3. Types
     4. Methods of Operation
Homework Assignment: Read Chapter 13
  Pages 170-183
  Answer Review and Chapter Quiz Questions
F. Circuit Protection Devices
  1. Fuse
  2. Fusible Link
  3. Circuit Breaker
     4. Theories of Operation
G. Power Distribution Networks
H. Ground Distribution Networks
I. Semi-Conductors
  1. Diodes
     a. P-N Junction
     b. Forward Bias
     c. Applications
     d. Zener Diodes
     e. LED
     f. Diagnosis and Testing
  2. Transistors
     a. Types
     b. Theories of Operation
     c. Gain
     d. Applications
     e. Analog to Digital
     f. Diagnosis and Testing
UNIT V: WIRING DIAGRAMS AND SCHEMATICS

Learning Objectives
The student will be able to trace a wiring diagram to indicate power flow from positive to ground.

A. Automotive Wiring
1. Gauge Sizes
   a. AWG
   b. Metric
   c. Examples of Gauge Size Applications
2. Color Coding
3. Main Circuit Identification Codes
   a. Applications
4. Harness Circuit Components
   a. Terminals
   b. Connectors
   c. Splices
   d. Component Symbols
B. Using the Wiring Diagram
1. Circuit Information
   a. Circuit ID
   b. Color Code
   c. Wire Size
   d. Component #
2. Type of Wiring Diagram
   a. Conventional Layout
   b. Individual Circuit
   c. Valley Forge Style Layout
3. Tracing the Wiring Diagram for Troubleshooting
   a. Related Components
   b. Locating Components, Splices, Connectors, Grounds

Homework Assignment: Wiring Schematics Worksheet

UNIT VI: WIRE REPAIR AND CIRCUIT TROUBLESHOOTING

Learning Objectives
1. The student will be able to repair a broken wire by stripping the insulation and soldering the repair.
2. The student will be able to explain to the instructor the Chrysler Six Step Trouble Shooting Procedure and how it is used for problem diagnosis.
3. The student will be able to perform a check for Ignition Off Draw (IOD) to determine battery drain.
4. The student will be able to perform a check for a short circuit to repair an excessive current flow.
5. Given a vehicle with an electrical problem, the student will be able to successfully diagnose and repair it using the tools and procedures outlined in class.
A. Performing Wire Repairs- Copper Wire
   1. Terminal Removal from Connector
   2. Performing Repairs
      a. Stripping Wire insulation
      b. Rosin Core Solder
      c. Heat Shrink Tubing
B. Repairing Aluminum Wire
C. Repairing Twisted/Shielded Cable

LAB ASSIGNMENT: C-3 WIRE REPAIR

D. Circuit Troubleshooting
   1. Chrysler Six Step Troubleshooting Procedure
      a. Verify the Complaint
      b. Determine Related Symptoms
      c. Analyze the Symptoms
      d. Isolate the Trouble
      e. Correct the Problem
      f. Check for Proper Operation
   2. Checking for Ignition Off Draw (IOD)
   3. Checking for a Short Circuit
      a. Circuit Breaker Method
      b. Using a Short Finder
   4. Checking for an Open Circuit
      a. Continuity Check
   5. Troubleshooting with a Wiring Diagram
      a. Tracing a Circuit

LAB ASSIGNMENT: C-4 CIRCUIT TROUBLESHOOTING

UNIT VII: INTRODUCTION TO MICROPROCESSORS/VEHICLE COMMUNICATIONS

Learning Objectives
1. The student will be able to compare the three types of vehicle computer communication networks.
2. The student will be able to discuss the advantages and disadvantages of each vehicle communication network.
3. The student will be able to explain the operation of each of the three computer memories.

A. Binary Code
   1. Bit, Byte, Word
   2. Signals- Analog and Digital
B. Memories
   1. Read-Only
   2. Random Access
   3. Programmable Read-Only
C. Clock Pulses
D. Interfaces
E. Vehicle Communication- Introduction
   1. Serial Data Links
   2. Chrysler Collision Data (CCD Data Bus)
   3. Programmable Communication Interface (PCI)
4. Controller Access Network (CAN)
   F. Output Commands
      1. Analog to Digital
      2. Digital to Analog

UNIT VIII: COURSE REVIEW/ FINAL EXAM

A. Introduction/ Fundamentals
B. Series Circuits
C. Parallel Circuits
D. Components
E. Wiring Diagrams and Schematics
F. Wire Repair and Circuit Troubleshooting
G. Introduction to Microprocessors/ Vehicle Communications
H. Final Exam

Assessment of student learning:

A. Quizzes/ Tests *                                45%
B. Final Exam                                        25%
C. Lab Work/ Activity Sheets                 20%
D. Class Participation/ Homework         10%
   Total              100%

*All students are required to complete the web-based courses, Introduction to Electrical- Phase 1 and Phase 2, found in FiatChrysler Performance Institute Learning Center on DealerConnect.

Policy Statement for Missed Lab and Equipment Demonstrations:
Due to the technical nature of the Automotive Program and hazards involved with the use of specialty tools and equipment, a student that is absent from lab instruction, where demonstrations are performed by the course instructor, will not be permitted to complete the related lab work upon their return. This includes full-day absences and partial-day absences that result in missing the lab demonstration(s). Enforcement of these policies will be at the discretion of the course instructor.

Academic Integrity Statement: [Include a statement affirming the college's Academic Integrity policy and any specific implications for the course. See http://mlink.mccc.edu/omb/0403_academic_integrity_OMB210.pdf.]

A student who knowingly represents the work of others as his/her own, uses or obtains unauthorized assistance in the execution of any academic work, or gives fraudulent assistance to another student is guilty of cheating. (See Student Handbook). Any student who violates this policy is subject to receive a failing grade for the assignment and will be reported to the Office of Student Affairs for further disciplinary action. Possible dismissal from the course could result.

Reasonable Accommodations for Students with Documented Disabilities
Mercer County Community College is committed to ensuring the full participation of all students in all activities, programs and services. If you have a documented differing ability or think that you may have a differing ability that is protected under the ADA and Section 504 of the Rehabilitation Act, please contact Arlene Stinson in LB 216 stinsona@mccc.edu for information regarding support services.
If you do not have a documented differing ability, remember that other resources are available to all students on campus including academic support through our Academic Learning Center located in LB 214.