

# AT R115: AUTOMOTIVE ELECTRICAL SYSTEMS

## Originator

kevin\_corse1

## College

Oxnard College

## Discipline (CB01A)

AT - Automotive Technology

## Course Number (CB01B)

R115

## Course Title (CB02)

Automotive Electrical Systems

## Banner/Short Title

Automotive Electrical Systems

## Credit Type

Credit

## Start Term

Spring 2021

## Formerly

AT R015 - Automotive Electrical Systems  
AT R015L - Automotive Electrical Systems Lab

## Catalog Course Description

This course introduces students to automotive electrical system theory and application. Discussion and training include charging and starting, ignition, accessories, and electronics. This course will cover reading wiring diagrams and diagnostics of electrical problems. Labs will provide skills necessary to recognize electrical problems in computer controls and all systems using electricity on vehicles. This course provides vocational preparation and skills required in diagnosis, adjustment, repair and maintenance of the electrical systems of modern automotive vehicles. The course includes practice of electrical service equipment and procedures for the overhaul of electrical components and circuitry in automobiles. Preparation for the Industry ASE A-6 Certificate is included.

## Taxonomy of Programs (TOP) Code (CB03)

0948.00 - \*Automotive Technology

## Course Credit Status (CB04)

D (Credit - Degree Applicable)

## Course Transfer Status (CB05) (select one only)

B (Transferable to CSU only)

## Course Basic Skills Status (CB08)

N - The Course is Not a Basic Skills Course

## SAM Priority Code (CB09)

C - Clearly Occupational

## Course Cooperative Work Experience Education Status (CB10)

N - Is Not Part of a Cooperative Work Experience Education Program

## Course Classification Status (CB11)

Y - Credit Course

## Educational Assistance Class Instruction (Approved Special Class) (CB13)

N - The Course is Not an Approved Special Class

**Course Prior to Transfer Level (CB21)**

Y - Not Applicable

**Course Noncredit Category (CB22)**

Y - Credit Course

**Funding Agency Category (CB23)**

Y - Not Applicable (Funding Not Used)

**Course Program Status (CB24)**

1 - Program Applicable

**General Education Status (CB25)**

Y - Not Applicable

**Support Course Status (CB26)**

N - Course is not a support course

**Field trips**

May be required

**Grading method**

Letter Graded

**Alternate grading methods**

Credit by exam, license, etc.

**Does this course require an instructional materials fee?**

No

**Repeatable for Credit**

No

**Is this course part of a family?**

No

**Units and Hours**

**Carnegie Unit Override**

No

**In-Class**

**Lecture**

**Minimum Contact/In-Class Lecture Hours**

87.5

**Maximum Contact/In-Class Lecture Hours**

87.5

**Activity**

**Laboratory**

**Minimum Contact/In-Class Laboratory Hours**

52.5

**Maximum Contact/In-Class Laboratory Hours**

52.5

**Total in-Class****Total in-Class****Total Minimum Contact/In-Class Hours**

140

**Total Maximum Contact/In-Class Hours**

140

**Outside-of-Class****Internship/Cooperative Work Experience**

Paid

Unpaid

**Total Outside-of-Class****Total Outside-of-Class****Minimum Outside-of-Class Hours**

175

**Maximum Outside-of-Class Hours**

175

**Total Student Learning****Total Student Learning****Total Minimum Student Learning Hours**

315

**Total Maximum Student Learning Hours**

315

**Minimum Units (CB07)**

6

**Maximum Units (CB06)**

6

**Advisories on Recommended Preparation**

AT R110

**Student Learning Outcomes (CSLOs)****Upon satisfactory completion of the course, students will be able to:**

- |   |   |
|---|---|
| 1 | Operate graphing meters, scopes, and other related test equipment.  |
| 2 | Identify and comprehend environmental safety rules and proper procedures for handling hazardous waste. regulations, in the following areas. Shop safety, personal safety, hazardous material safety, air bag safety, power tools, and typical equipment safety. |
| 3 | Trace three wiring diagrams to mark power, ground, switched power, switched ground, and varying voltage wires. Color markers or crayons will be used.   |
| 4 | Retrieve important vehicle information from multiple subscription based databases.  |
| 5 | Build a relay circuit and test operation of relays.   |

**Course Objectives****Upon satisfactory completion of the course, students will be able to:**

- |   |  |
|---|--|
| 1 | Identify safety hazards in an automotive shop and mitigate shop accidents. |
| 2 | Describe proper customer relations and treatment of complaints.            |
| 3 | Explain and repair the lighting accessories and body electrical wiring.    |

- |    |   |
|----|---|
| 4  | Demonstrate the proper steps in calibration of shop diagnostic equipment.   |
| 5  | Describe magnetism, electromagnetism as it relates to automotive motors and switches.   |
| 6  | Explain the differences between the conventional theory and electronic theory.  |
| 7  | Explain the charging and starting electrical application used in today's vehicles.  |
| 8  | Identify electrical circuits used in automotive systems, series circuits, parallel circuits and series parallel circuits.                                   |
| 9  | Identify semiconductors and solid-state electronics in electrical circuits.   |
| 10 | Explain Ohm's Law in the calculation of electrical circuits, voltage, resistance, amperage.   |
| 11 | Demonstrate testing of electrical charging and starting systems.  |
| 12 | Use scan-tool data information to trace on-board computer trouble codes.  |
| 13 | Perform starter motor overhaul, disassembly, cleaning, inspection and testing.  |
| 14 | Perform alternator overhaul, disassembly, cleaning, inspection and testing.   |
| 15 | Demonstrate electrical circuit troubleshooting procedures in automotive electrical circuits   |
| 16 | Properly test and recharge a vehicle battery  |
| 17 | Recognize the safety aspects of hybrid vehicles and the orange wire color determining high voltage and potentially deadly results from handling improperly. |

## Course Content

### Lecture/Course Content

Textbook, related materials, worksheets, video presentations are used to present the following material.

1. Fundamentals of Electricity and Safety
  - a. Electrical safety
  - b. Magnetism
  - c. Ohm's Law
  - d. Voltage pressure
  - e. Current flow (amperage)
  - f. Resistance (Ohm's)
  - g. Circuit protection devices
  - h. Capacitors
  - i. Transistors
  - j. Semiconductors
2. Electrical Circuits
  - a. Series circuits
  - b. Parallel circuits
  - c. Series parallel circuits
  - d. Voltage pressure
  - e. Grounds (negative side)
  - f. Insulated protection
  - g. Electronic circuits
  - h. Solid state circuits
3. Battery System
  - a. Visual inspection
  - b. Battery load testing
  - c. Battery ratings
  - d. Amp hour ratings
  - e. Cold cranking ratings
  - f. Watt ratings
  - g. Parasitic loads and drains
4. Cranking Systems
  - a. Mechanical condition – sound
  - b. Types of starters
  - c. Starter construction
  - d. Starter amperage draw test
  - e. Available voltage test

- f. Resistance test
- g. Starter relays/solenoids
- 5. Charging System
  - a. Visual inspection
  - b. Alternator construction
  - c. Alternator output test
  - d. Regulator operation
  - e. External and internal regulators
  - f. Diode rectification
  - g. Charging system circuits
- 6. Accessory Systems
  - a. Heater fan motors
  - b. Heater control circuits
  - c. Lighting systems
  - d. Instrumentation
  - e. Directional signals
  - f. Hazard warning light circuits
  - g. Ignition switches and locking devices
  - h. Power window and power door locks
  - i. Wiper motor delay circuits
- 7. Engine Management Control Systems
  - a. Computer controls
  - b. Sensors and actuators
  - c. Computerized fuel injection
  - d. Distributorless ignition (DSI)
  - e. Direct ignition (DI)
  - f. OBD 1 and OBD 2 systems
  - g. Open loop and closed loop
- 8. Ignition System Application
  - a. Conventional distributor system
  - b. Electronic distributor systems
  - c. Distributorless ignition systems
  - d. Components
  - e. Primary circuit
  - f. Secondary circuit

### Laboratory or Activity Content

Lab activities are listed below. These are hands on practice and require student to complete all tasks on worksheet for credit. These ASE task sheets are required by ASE accreditation guidelines.

1. Identify/Interpret Electrical Systems Concerns
2. Diagnose Electrical/Electronic Circuits
3. Use Wiring Diagrams to Diagnose a Circuit
4. Electrical Fault Diagnosis
5. Fusible Links, Circuit Breakers, and Fuses
6. Inspect and Test the Switches and Relays
7. Wire Repair
8. Oscilloscope
9. Digital Multimeter Use for Electrical Problems
10. Test Light Usage
11. Circuit Testing Using a Fused Jumper Wire
12. Series-Parallel Circuit Task Sheet #1
13. Series-Parallel Circuit Task Sheet #2
14. Series-Parallel Circuit Task Sheet #3
15. Parallel Circuit Task Sheet #1
16. Parallel Circuit Task Sheet #2
17. Parallel Circuit Task Sheet #3
18. Material Safety Data Sheet

19. Fire Extinguisher
20. Electrical Fundamentals
21. Electrical Circuits
22. Series Circuit Task Sheet #1
23. Series Circuit Task Sheet #2 –
24. Series Circuit Task Sheet #3 –
25. Vehicle Hoisting –
26. Safety Check –
27. Work Order
28. Vehicle Service Information
29. Vehicle Service History
30. Technical Service Bulletins
31. VIN Code
32. Vehicle Safety Certification Label
33. Temporary Disabling of an Airbag
34. High-Voltage Circuits Identification
35. Hybrid High-Voltage Disconnect

## Methods of Evaluation

**Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):**

Problem solving exercises  
Skills demonstrations  
Written expression

**Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):**

Group projects  
Individual projects  
Laboratory activities  
Objective exams  
Oral presentations  
Skills demonstrations  
Skill tests

## Instructional Methodology

**Specify the methods of instruction that may be employed in this course**

Audio-visual presentations  
Computer-aided presentations  
Class activities  
Class discussions  
Case studies  
Distance Education  
Demonstrations  
Guest speakers  
Instructor-guided interpretation and analysis  
Instructor-guided use of technology  
Lecture

**Describe specific examples of the methods the instructor will use:**

Multiple presentation methods are used to engage all students. Video, worksheets, hands on demonstrations and testing using meters and equipment.

1. Reading assignments: Textbook reading assignments will be discussed in class to assist students in the understanding of electricity as used in operation of automobiles.
2. Students will prepare for and give presentations on electrical circuits and systems diagnosis. Testing procedures using circuit boards will be covered.
3. Lecture presentations pertaining to customer relations, shop safety, diagnosis and equipment utilization and operation.
4. Students will become familiar with the automotive computer information systems in the classroom, and use the computers to locate specifications on assigned vehicles.

## Representative Course Assignments

### Writing Assignments

Students are required to hand write all their labs and task sheets and making sure all the important information has been included.

1. Student will be required to answer questions at the end of each chapter; all tests will include essay type questions.

### Critical Thinking Assignments

Lab operations require use of the scientific method. Forming a hypothesis and setting a plan to prove or disprove. Most labs have a diagnostic component to them.

### Reading Assignments

Textbook chapters will be assigned and reading in those chapters will be required. In addition

1. Students will be required to do outside readings in professional journals such as Motor Age Magazine and Motor Service Journal in addition to the textbook assignments.
2. Students will be required to complete reading on the soft skills online certificate program.
3. Detailed labs require reading and understanding, students will have many labs.

### Skills Demonstrations

Hands on Labs are required and students will have the opportunity to practice using shop equipment, cleaning up and storing the equipment properly.

### Other assignments (if applicable)

1. Students will be required to visit internet websites related to automotive electrical systems such as AESWAVE.com and How things work.com.
2. Students will be required to use classroom computer programs Alldata and Mitchell to locate electrical specifications and wiring diagrams.
- 3.

## Outside Assignments

### Representative Outside Assignments

1. Students will be required to visit internet websites related to automotive electrical systems such as AESWAVE.com and How things work.com.
2. Students will be required to use classroom computer programs Alldata and Mitchell to locate electrical specifications and wiring diagrams.
3. Online certification is required to be completed by semester end. Soft skills for the automotive trade, attending a meeting, customer care and building a resume.
4. Online viewing of webcasts showing electrical tests and completing additional training online.

## **District General Education**

**A. Natural Sciences**

**B. Social and Behavioral Sciences**

**C. Humanities**

**D. Language and Rationality**

**E. Health and Physical Education/Kinesiology**

**F. Ethnic Studies/Gender Studies**

## **CSU GE-Breadth**

**Area A: English Language Communication and Critical Thinking**

**Area B: Scientific Inquiry and Quantitative Reasoning**

**Area C: Arts and Humanities**

**Area D: Social Sciences**

**Area E: Lifelong Learning and Self-Development**

**CSU Graduation Requirement in U.S. History, Constitution and American Ideals:**

## **IGETC**

**Area 1: English Communication**

**Area 2A: Mathematical Concepts & Quantitative Reasoning**

**Area 3: Arts and Humanities**

**Area 4: Social and Behavioral Sciences**

**Area 5: Physical and Biological Sciences**

**Area 6: Languages Other than English (LOTE)**

## **Textbooks and Lab Manuals**

### **Resource Type**

Textbook

### **Classic Textbook**

Yes

### **Description**

Automotive Electricity and Electronics James Halderman 2017

Book ISBN: 9780134073644

Printed Task Sheets ISBN: 9780134074764

eBook ISBN: 9780134074733

Textbook can be any type, hard copy, soft copy, electronic, rental, used.



## Distance Education Addendum

### Definitions

#### Distance Education Modalities

- Hybrid (51%–99% online)
- Hybrid (1%–50% online)
- 100% online

### Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

### Regular Effective/Substantive Contact

#### Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as “Message Students Who” and “Assignment Comments”, will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Face to Face (by student request; cannot be required)	Students will have direct face-to-face contact with instructor during weekly class meetings. This time will provide the opportunity for students to discuss and ask questions about the material to facilitate student learning objectives and course outcomes. The instructor will also hold weekly, scheduled office hours for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form “study groups” in person or online. Note: For hybrid classes, face-to-face class time will provide opportunities for students to discuss amongst themselves (in groups or pairs) and ask questions about the material to facilitate SLOs and course outcomes.
Other DE (e.g., recorded lectures)	Faculty may use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: <ul style="list-style-type: none"> <li>o Recorded Lectures, Narrated Slides, Screencasts</li> <li>o Instructor created content</li> <li>o OC Online Library Resources</li> <li>o Canvas Peer Review Tool</li> <li>o Canvas Student Groups (Assignments, Discussions)</li> <li>o 3rd Party (Publisher) Tools (MyOpenMath)</li> <li>o Websites and Blogs</li> <li>o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)</li> </ul>

Synchronous Dialog (e.g., online chat)	Instructor may provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.
<b>Hybrid (51%–99% online) Modality:</b>	
<b>Method of Instruction</b>	<b>Document typical activities or assignments for each method of instruction</b>
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as “Message Students Who” and “Assignment Comments”, will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Face to Face (by student request; cannot be required)	Students will have direct face-to-face contact with instructor during weekly class meetings. This time will provide the opportunity for students to discuss and ask questions about the material to facilitate student learning objectives and course outcomes. The instructor will also hold weekly, scheduled office hours for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form “study groups” in person or online. Note: For hybrid classes, face-to-face class time will provide opportunities for students to discuss amongst themselves (in groups or pairs) and ask questions about the material to facilitate SLOs and course outcomes.
Other DE (e.g., recorded lectures)	Faculty may use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o VC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Synchronous Dialog (e.g., online chat)	Instructor may provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.

**100% online Modality:**

<b>Method of Instruction</b>	<b>Document typical activities or assignments for each method of instruction</b>
E-mail	E-mail, class announcements and various learning management system tools such as “Message Students Who” and “Assignment Comments”, will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcome
Face to Face (by student request; cannot be required)	The instructor will hold weekly, scheduled office hours either in person or via-web conferencing, for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form “study groups” in person or online.
Video Conferencing	Faculty may use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o VC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Synchronous Dialog (e.g., online chat)	Instructor will provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Telephone	Students can request for instructor to call or vice versa in order to answer one-on-one questions about course material or student progress.

**Examinations****Hybrid (1%–50% online) Modality**

Online  
On campus

**Hybrid (51%–99% online) Modality**

Online  
On campus

**Primary Minimum Qualification**

AUTOMOTIVE TECHNOLOGY

**Review and Approval Dates****Department Chair**

12/02/2020

**Dean**

12/02/2020

**Technical Review**

12/09/2020

**Curriculum Committee**

12/09/2020

**DTRW-I**

MM/DD/YYYY

**Curriculum Committee**

MM/DD/YYYY

**Board**

MM/DD/YYYY

**CCCCO**

MM/DD/YYYY

**Control Number**

CCC000611490

**DOE/accreditation approval date**

MM/DD/YYYY