# AUME-780: AUTOMOTIVE ELECTRICAL/ELECTRONICS I

**Effective Term**
Fall 2026

**BOT Approval Date**
12/11/2025

**Discipline**
AUME - Automotive/Transportation Tech
**Course Number**
780

**Course Title**
Automotive Electrical/Electronics I

**Short Title**
Auto Elect./Electronics

**Credit Status (CB 04)**
D - Credit - Degree applicable

## Units

**Lecture Units**
3.00

**Lab Units**
1.00

**Total Units**
4.00

## Hours

**Lecture Contact Hours**
48-54
**Out of Class Hours Lecture**
96-108

**Lab Contact Hours**
48-54
**Out of Class Hours Lab**
0.00

**Total Contact Hours**
96 - 108

**Total Out of Class Hours**
96 - 108

**Total Student Learning Hours**
192 - 216

**Is this an existing Extensive Lab?**
No

**Do you want to propose this for Extensive Lab?**
Yes

**Distance Education**
No

**Catalog Description**
This course covers the basic theory of electricity, use of meters and test equipment, interpretation of wiring diagrams, and the diagnosis and repair or replacement of major electrical components of automotive and light trucks. Major areas of study include vehicle high and low-voltage batteries, starting, charging and ignition systems as well as common electrical accessories. This course is intended to assist the student in preparing to take and pass the ASE A6 exam.

## Requisites

**Recommended Preparation**

| Recommended Preparation (note that students can enroll in the class even if they haven't take the recommended course) |
| --- |
| AUME-700 |

## Codes

**TOP Code (CB 03)**
0948.00* - *Automotive Technology

**CIP Code**
47.0604 - Automobile/Automotive Mechanics Technology/Technician.

**Repeatability Code**
No

**Grading Option**
Letter grade OR P/NP

**Minimum Qualifications**

| Minimum Qualifications | And/Or |
| --- | --- |
| Automotive Technology | End |

## Learning Objectives

**Learning Objectives**

| Learning Objective |
| --- |
| 1. Measure voltage, amperage and resistance with a digital multi-meter (DMM). |
| 2. Diagnose the cause of faults in automotive electrical circuits in a bugged vehicle or trainer unit. |
| 3. Categorize the major components of automotive electrical and electronic systems. |
| 4. Predict the behavior of electrical circuits using Ohm's Law, Watt's Law and Kirchhoff's Law. |
| 5. Test the voltage, current, resistance and power values present in series-parallel circuits. |
| 6. Evaluate the condition of low-voltage automotive battery, starting and charging circuits. |
| 7. Inventory the safety precautions and Personal Protective Equipment which must be used Hybrid/Electric (HEV) vehicles. |
| 8. Analyze the ways in which the self-starter and motor-generator improved employment opportunities, particularly for African Americans who were able to escape a life of poverty in the Southern United States and enter into the middle class because of the opportunities that the growth in automobile manufacturing provided. |
| 9. Distinguish between series, parallel and series-parallel circuits using standard wiring diagrams. |

## Learning Outcome Information

### Course Learning Outcomes

| Learning Outcome |
| --- |
| 1. Students will measure source voltage, voltage drop (including grounds), current flow and resistance. |
| 2. Students will use wiring diagrams during the diagnosis of electrical/electronic circuit problems. |
| 3. Students will be able to inspect and test fusible links, circuit breakers, and fuses and determine the necessary action. |
| 4. Students will be able to evaluate the condition of the battery, starting and charging system. |
| 5. Students will evaluate how historical innovations in automotive technology expanded career pathways and continue to shape workforce diversity, equity and inclusion in today's transportation industry. |

## Content

### Course Lecture Content

1. General Electrical and Electronic Concepts
    a. Online Training
        i. Automotive Service Safety Training
        ii. Automotive Service Pollution Prevention
        iii. Ethics in the Automotive Industry
    b. Locating Service Information and Electrical Diagrams
    c. Preparing a Work Order
        i. State of California Regulatory Requirements
        ii. Required Information
            1. About the Customer
            2. About the Vehicle
            3. About the Problem or Issue
                a. Customer Complaint
                b. Cause of the Complaint
                c. Correction of the Complaint
        iii. Electrical and Electronic Units of Measurement
            1. Voltage
            2. Current (Amps)
            3. Resistance (Ohms)
        iv. Electrical and Electronic Laws of Operation
            1. Ohm's Law
            2. Kirchhoff's Law
            3. Watt's Law
        v. Electrical Circuit Types
            1. Series Circuits
            2. Parallel Circuits
            3. Series-Parallel Circuits
2. Low-Voltage (12 Volt) Batteries
    a. Low-Voltage Battery Types
        i. Low-Maintenance Batteries
        ii. Maintenance-Free Batteries
        iii. Absorbed-Glass-Matt (AGM) Batteries
        iv. Gel-Type Batteries
3. The Low-Voltage Starting System
    a. History of Self-Starters
        i. Problems Encountered With Physical Requirements of Hand-Cranking
            1. Difficulty in Operating the Crank
            2. Special Precautions Required for Hand-Cranking
            3. Dangers Associated with Hand-Cranking
        ii. Limitations of Other Early Vehicle Types

1. Steam-Powered Vehicles
   a. Time Required to Produce Steam Pressure
   b. Dangers Surrounding Pressurized Steam Boilers
2. Early Electric Vehicles
   a. Battery, Charging and Range Limitations

iii. The Invention of Practical Self-Starters (1912)
1. How Self-Starting Internal Combustion Engines Made Vehicle Operation Practical for the Many
2. The Secondary Effects of Self-Starters
   a. Improved Mobility Employment Prospects
   b. The Great Northern Migration of African Americans Looking to Escape Poverty in the Sothern United States
      i. Escape From the Threat of Violence
      ii. Greater Economic Opportunities
         1. Escape from Poverty
         2. A Path to Entry Into the Middle Class
      iii. Vast Improvement in Future Prospects
         1. In Educational Opportunities
         2. In Other Employment Opportunities

4. The Low-Voltage Charging System
   a. The Generator
   b. The Alternator
   c. The Accessory Belt Drive System (ABDS)
5. Lighting System Types
   a. Sealed-Beam Lighting
   b. Halogen Bulbs
   c. High-Intensity Discharge Bulbs
   d. Light-Emitting Diodes (LEDs)
   e. Laser Lighting
   f. Directional Signal and Clearance Lighting Types
6. Instrument Cluster and Driver Information Systems
   a. Essential Electrical Sensor (Input) Operating Characteristics
   b. The Body Control Module (BCM)
   c. Navigation System Types and Functions
7. Body Electrical System Operation
   a. Power Window System Types
   b. Power Door Lock Types
   c. Windshield Wiper System Operating Characteristics
8. High-Voltage Circuit Identification and Precautions
   a. Wiring Conduit Color Coding
   b. Personal Protective Equipment
      i. Class 0 Lineman's Gloves
      ii. Category 3 Electrical Meters
      iii. The Lock-Box
      iv. The "Hot Stick"
   c. The "Live-Dead-Live" Test Description

**Course Lab Content**

1. General Electrical and Electronic Diagnosis and Repair
   a. Electrical Diagram Usage
      i. Locating Circuit Protection Devices
      ii. Diagnose a Circuit Fault Using an Electrical Diagram
   b. Electrical Measurements Using the Digital Multi-Meter (DMM)
      i. Measure Voltage
      ii. Measure Current Flow
         1. With an Ammeter
         2. With a Current Clamp
      iii. Measure Resistance

            1. With an Ohmmeter
            2. Testing Resistance By Determining Voltage Drop
    c. Testing Electrical Circuits
        i. Test the Operation of Circuit Protection Devices
        ii. Test for Parasitic Current Draw
        iii. Testing for Short or Open Circuits
        iv. Using a Fused Jumper or Power-Probe
    d. Wiring and Circuit Repair
        i. Soldering
        ii. Splicing
2. Low-Voltage Battery Service
    a. Battery Cleaning and Refilling
    b. Servicing the Hold-Down
    c. Battery Testing
        i. Verify the Battery Type and Capacity Ratings are Correct
        ii. Conductance Meter Testing
        iii. Digital Multi-Meter Testing
            1. Battery State-of-Charge (SOC)
            2. Load Testing
            3. Voltage Drop Testing of Battery Connections
3. Low-Voltage (12 Volt) Starting System Service
    a. Testing Starting Circuit Current Draw
    b. Differentiate Between Mechanical and Electrical Faults
    c. Voltage Drop Testing of Starting Circuits
    d. Examine the Simplicity and Efficiency of the Electric Self-Starter
        i. As an Adjunct to Making Mass Production Feasible
            1. Vast Improvement in Employment Opportunities that Resulted
                a. The Groups Most Affected Were Among the Poorest, Such as African Americans who were able to escape a life of poverty in the Southern United States and enter into the middle class because of the opportunities that the growth in automobile manufacturing provided.
        ii. As a Contributor to Increased Mobility Through Ease of Operation
4. Low-Voltage Charging System Service
    a. Perform Output Testing
        i. Charging Voltage
        ii. Charging Current
        iii. Alternator Ripple Testing
    b. Perform Voltage Drop Testing of the Charging Circuit
        i. Positive (Charge) Circuit
        ii. Negative (Ground) Circuit
5. Lighting System Service
    a. Inspect Exterior Lighting
    b. Inspect Interior Lighting
    c. Perform Headlight Aiming Procedure
6. Instrument Cluster and Driver Information System Service
    a. Verify the Operation of Panel Gauges and Warning Indicators
    b. Test Sensors and Sending Units (Input Devices)
7. Body Electrical System Service
    a. Verify Anti-Theft System Operation
    b. Verify Windshield Wiper/Washer Operation
    c. Verify the Operation of Safety Circuits (Horn, Air Bags)
    d. Remove and Replace Interior Door Panels
8. High-Voltage Circuit Deactivation and Reactivation
    a. Disconnect the 12-Volt Battery
    b. Using and Testing Personal Protective Equipment
    c. Removing the High-Voltage Service Plug
    d. Performing a "Live-Dead-Live" Test to Verify Depowering
    e. Reinstallation of the Service Plug and Reactivation of the HV Circuits

9. Open Lab Time to Make-Up or Repeat Lab Assignments
    a. To Improve Skills
    b. To Ensure Grading Equity

## Methods of Instruction

**Method**

Online Activity/Discussion

**Integration**

Students will be asked to participate in a discussion board on the CMS concerning the downstream effects of the invention of the self-starter and motor-generator system for the internal combustion engine. The focus should be upon how the device made automobiles more practical and affordable for people from all walks of life. Particular attention should be paid to the way in which the innovation encouraged the Great Northern Migration, which allowed groups such as African Americans who were able to escape a life of poverty in the Southern United States and enter into the middle class because of the opportunities that the growth in automobile manufacturing industry provided, which might not have been possible otherwise.

---

**Method**

Observation and Demonstration

**Integration**

The instructor of the course will demonstrate the operation of the various procedures required to perform the tasks necessary to complete the coursework. Demonstrations will include any necessary safety precautions, diagnostic techniques and repair best practices. The demonstration should take place directly before the students are asked to perform the same procedure themselves in the automotive lab setting.

---

**Method**

Lab Activities

**Integration**

Students will participate in lab activities as a part of a team of three or four students. The lab activities will concern themselves with the procedures listed in the Course Lab Content, such as verifying the proper operation of exterior lighting circuits or performing a headlight aiming procedure. Emphasis will be placed upon adherence to safety requirements, conformity to industry-standard practices, encouraging work professionalism and proper documentation of the performance of the procedure.

---

**Method**

Role Playing/Simulation

**Integration**

Students will be asked to locate an electrical fault in a circuit on a bugged vehicle or an electrical system trainer unit that has a bug inserted into it. Unlike the usual lab activity listed elsewhere, this is intended to hone the individual student's diagnostic skills along with the student's ability to apply the various electrical concepts presented as a part of the Course Lecture Content.

---

## Methods of Evaluation

**Method**

Simulation

**Integration**

Students will be asked to perform diagnostic procedures, such as pinpointing the cause of a starting or charging system problem, on a bugged vehicle or electrical systems trainer. Evaluation will be made according to the accuracy of the student's diagnosis, the student's ability to reach a conclusion within the time allotted by industry standards, and the completeness of the documentation of the work that the student has performed.

**Method**

Quizzes

**Integration**

Quizzes will be administered periodically in order to measure the level of student understanding of the materials being presented and to give students feedback about their academic performance. In order to enhance equity, multiple attempts will be allowed for these quizzes on the Course Management System which will give students who struggle with certain learning styles to have an equitable opportunity to succeed in the course. Final evaluation will be made according to the accuracy of the student's responses after the student's best attempt has been recorded.

**Method**

Final Performance

**Integration**

Students will be given a hands-on final performance exam designed to measure the student's ability to perform a standard electrical diagnostic procedure, such as an ordinary battery, starting and charging system test that would be performed as a part of a multi-point inspection. The final performance exam is intended to level the playing field for those whose primary learning style is either Visual or Kinesthetic; evaluation will be made according to the accuracy of the testing performed and the ability of the student to perform the test within the time allotted by industry standards.
The main intention of the final performance examination is to augment the level of equity for all students; individuals who possess any of the four main learning styles will be able to take advantage of this exercise in applied science. Students who practice the Kinesthetic learning style and have difficulty with traditional written examinations, which represents a substantial cross-section of the department's student body, will benefit the most from this practice.

**Method**

Exams/Tests

**Integration**

A written final exam will be administered at the conclusion of the semester. In this case, the primary purpose of this exam will be to provide an equitable opportunity to succeed in the course for students whose predominant learning style is through reading and writing. Since one of the most important functions of this course is to prepare the student to take and pass the official ASE A6 Electrical and Electronics Specialist Certification Exam, the test should mimic the official test as much as possible; that is, it should be a Computer-Based Test (CBT) consisting of questions written in the ASE style. Evaluation will be made according to the accuracy of the student's responses and the ability of the student to complete the test within the amount of time generally allotted by this type of testing, which allows approximately one and one-half minutes for each question. The ASE Student Certification Proctored Online Test would be ideal for this purpose.

## Assignments

**Assignment Type**

Reading

**In-class and/or outside of class**

Outside of class

**Formative or Summative**

Formative

**Assignment**

Read the information presented in the textbook concerning Watt's Law of Electricity. Describe how you would approach a hypothetical situation in which you are going to install a set of fog lamps; search the information presented to determine how large a fuse or other circuit protection device would need to be used in order to protect a circuit that powers two 75-Watt fog lamps and what diameter wire would need to be used if the circuit is 8 feet in length.

---

**Assignment Type**

Writing

**In-class and/or outside of class**

In-class

**Formative or Summative**

Formative

**Assignment**

Prepare documentation describing how you used the information on a wiring diagram to perform a diagnostic process on a bugged vehicle or trainer unit. Please note that the trainer units represent electrical circuits based on an actual vehicle. which will be described to you. The documentation must include the type and location of the relevant circuit protection devices, the size or diameter of the wiring used to connect the circuit, the location(s) of the electrical load devices themselves and the electrical ground location(s) on the vehicle for the circuit you are diagnosing.

---

**Assignment Type**

Other

**In-class and/or outside of class**

In-class

**Formative or Summative**

Summative

**Assignment**

Perform a battery, starting and charging system inspection on a bugged vehicle. The inspection would normally be a part of a multi-point inspection, but in this case, it is intended to function as a "hands-on" final exam. Please note that part of the intention for this assignment is to provide an opportunity for the Visual or Kinesthetic learner to display the skills that they have learned throughout the course.

---

**Assignment Type**

Other

**In-class and/or outside of class**

In-class

**Formative or Summative**

Formative

**Assignment**

Assess and test the operation of a control module in one of the computer networks on a bugged late-model vehicle. This will consist of attempting to communicate with the control module with a diagnostic scan tool and then checking the power, ground and wake-up circuits supplying that control module if communication with the scan tool is not possible. It will be necessary to document the process you used to determine the cause of the circuit fault.

---

## Course Materials

### Textbooks

James E. Duffy and Dr. Chris McNally (2026) Auto Electricity and Electronics, 8th Edition. Goodheart and Willcox Publisher ISBN: 979-8-88817-208-7

### Other Resources

ALLDATA Online Repair Information
Mitchell ProDemand Online Repair Information

## Class Size Information

### Class Size

24

### Class Size Category

J - Specialty lab

## Diversity and Inclusion

Course Design and Materials: Course will incorporate diverse perspectives, authors, and examples that reflect a variety of cultures, identities, and lived experiences. Instructional materials will be reviewed regularly to ensure representation, inclusivity, and alignment with equity-minded practices across disciplines.

Inclusive Learning Environment: Instructors will establish classroom norms and policies that promote respect, civil discourse, and belonging in both online and face-to-face classes. Clear expectations for communication and engagement will support a learning space where all students feel valued and heard.

Accessible Instruction: Course content will be delivered using accessible design. Materials will follow accessibility guidelines within the CMS, including captioned media, readable document formats, and multiple means of engagement to support diverse learning.

Equitable Teaching Practices: Instructors will use transparent and grading criteria, varied assessment methods, and timely feedback to promote fairness and student success. Opportunities for revision, reflection, and multiple demonstrations of learning may be incorporated when appropriate to the discipline.

Culturally Responsive Pedagogies: Instructional strategies will encourage critical thinking about diverse perspectives and systems of power relevant to the course content. Faculty will foster opportunities for students to connect course material to real-world contexts.

Ongoing Reflection and Improvement: Faculty will engage in continuous professional development related to IDEAA principles and reflect on course practices using metacognition to identify opportunities for increased equity, inclusion, and accessibility.

**Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.**

This course showcases the advances made in automotive technology in its early days; in particular, the development of the electric self-starter and motor-generator unit, both of which made automobiles a viable alternative to other forms of transportation. This development provided lucrative employment opportunities to those attempting to escape from economic oppression, such as the African Americans in the Southern United States. The rapid development of the automotive manufacturing industry provided this group with a way to escape the poverty that they had known in the South, and ushered the same group into the middle class in and around Detroit. This course attempts, at least in part, to remind our students of that story.

**Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.**

The Automotive Department has traditionally provided an opportunity for those who come to our institution poorly prepared for success with traditional college coursework. Because of the nature of the subject matter, much of which is often presented visually and is then supported by actual hands-on experimentation, the curriculum in this course is intended to be as accessible as possible to as wide an audience as possible. As a result, students who practice any of the major learning styles, whether Kinesthetic, Visual, Auditory or Reading and Writing will have an equitable chance to succeed in this course.
Students will also enjoy the support of other students and faculty members in the lab setting, in the course of which students complete the tasks required by the course as part of a team of three or four individuals. The intention here is both to familiarize our students with the necessity of functioning as part of a team in order to accomplish their work and to inculcate the importance of mutual support.

In addition, students are given the opportunity to repeat the quizzes and the lab exercises so that they can hone their skills and improve their grades. Finally, a "final performance" evaluation in the form of a hands-on portion of the final exam will be administered so that students who possess Visual or Kinesthetic learning styles will be evaluated in an equitable fashion.

## Interactions

**Explain how the course will incorporate student-to-student interaction.**

The students who enroll in this course will need to perform their lab exercises by working in teams of three or four students each; successful and timely completion of the assigned tasks will require a considerable amount of interaction. There is a fair amount of research, documentation, preparation and actual work performance required by most of the tasks related to the course, so students will in essence be largely dependent on one another for success in the course. This process will naturally incorporate a considerable amount of student-to-student interaction.

**Explain how the course will incorporate instructor-to-student interaction.**

Many of the tasks required by this course will make it necessary for the instructor to demonstrate the operation of various procedures before the students perform those lab exercises themselves. In addition, some of the jobs will present the students with certain safety hazards and will require fairly close personal supervision by the instructor while the exercise is proceeding; the instructor will also provide some amount of coaching to the students about how they might perform their tasks in a safer fashion or with a greater degree of efficiency. A high degree of instructor-to-student interaction must naturally result from these processes.

**Explain how the course will incorporate student-to-content interaction.**

Because automotive technology is an applied science, students enrolled in this course will need to actively apply the concepts presented in the classroom setting to actual situations in the lab setting. This will require close attention to detail and a direct, physical application of the required content in order for the student to master it, which will provide the setting necessary to ensure that adequate student-to-content interaction takes place.

**Explain how the course will incorporate student-to-self interaction (metacognitive).**

This course necessarily involves a great deal of diagnostic ability and requires that the individual student continually check the accuracy of the work that they are required to perform. For example, often the student is asked to identify an active fault on a bugged vehicle; either the student will be able to do that successfully, or not. In addition, the automotive industry is heavily orientated toward the completion of tasks within a prescribed period of time; thus, the student will need to ask themselves, not only whether they performed a particular task correctly, but also whether they might have performed it more efficiently. This environment will lead naturally to a more than sufficient amount of student-to-self interaction.

Key: 395