

Automotive Technician 3 - EV and Hybrid

COURSE OUTLINE - UC

DESCRIPTION:

Automotive Technician 3 builds on Automotive Technician 2 by equipping students with foundational knowledge and experience in automotive technology, specifically focusing on electric vehicles (EVs). In addition, students will learn hybrid technology electric vehicles, the principles of vehicle electrification, systems integration, diagnostics, repair, and safety practices essential for the growing automotive industry. The course will combine classroom instruction with practical lab sessions, offering students exposure to both conventional automotive technology and cutting-edge electric vehicle systems. Successful demonstration of Automotive Technician 1, 2 and 3 competencies will assist students in preparing for the National Automotive Technicians Education Foundation (NATEF) certification. Activities in this course may include work-based learning that connects students to industry and the local community.

INFORMATION:

PRE-REQUISITE:	Automotive Technician 2
LENGTH:	One Year
SECTOR:	Transportation
PATHWAY:	System Diagnostic and Service
ARTICULATED:	No
UC A-G APPROVAL:	Yes – College-Preparatory Elective (G) / Interdisciplinary

O*NET SOC CODES:

41-2022.00	Specialists Parts Salesperson
49-3023.00	Automotive Service Technicians and Mechanics
49-3031.00	Bus and Truck Mechanics and Diesel Engine Specialists
53-6031.00	Automotive and Watercraft Service Attendants

Orientation
<ul style="list-style-type: none"> A. Introduce the course and facilities. B. Discuss the syllabus and major objectives. C. Explain applicable classroom management procedures, and any operational guidelines. D. Review instructor/student expectations. E. Explain attendance requirements and procedures. F. Review grading and student evaluation procedures. G. Discuss the work-based learning aspect of the program, if applicable. H. Discuss the “next steps” related to additional education, training, and employment. I. Review classroom safety, emergency and disaster procedures.
1. Communication Skills
<ul style="list-style-type: none"> A. Demonstrate positive verbal communication skills using appropriate vocabulary, demeanor, and vocal tone in the classroom and/or worksite. B. Read and interpret written information and directions. C. Practice various forms of written communication appropriate to the occupation. D. Practice positive body language skills. E. Practice professional verbal skills for resolving a conflict. F. Demonstrate active listening skills including techniques for checking for understanding, and for obtaining clarification of directions.
2. Interpersonal Skills
<ul style="list-style-type: none"> A. Demonstrate positive teamwork skills by contributing to a group effort. B. Practice the importance of diversity awareness and sensitivity in the workplace. C. Define sexual harassment in the workplace and identify the employee’s role and responsibility. D. Practice participation skills. E. Identify different personality types and demonstrate flexibility and adaptability working with diverse individuals. F. Practice business and social etiquette skills appropriate to the occupation. G. Evaluate and discuss the role of business and personal ethics in decision making based on various job-related scenarios. H. Demonstrate the use of time management skills.
3. Employability Skills
<ul style="list-style-type: none"> A. Demonstrate appropriate attendance and punctuality practices for the classroom (and worksite, if applicable).

- B. Prepare a resume, cover letter, and job application.
- C. Demonstrate interviewing techniques in seeking employment, using appropriate tone, body language and professional dress and grooming standards.
- D. Identify strategies for employment retention.
- E. Identify and analyze sources of job information, including electronic sources and the impact of social networking on employability.
- F. Identify the need for continuing education, professional development, and professional growth in chosen field.
- G. Identify appropriate procedures for leaving a job.
- H. Review company policies and current trends in employee compatibility screening, drug screening, and background checks.

4. Leadership

- A. Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- B. Work with peers to promote divergent and creative perspectives.
- C. Demonstrate how to organize and structure work, individually and in teams, for effective performance and the attainment of goals.
- D. Explain multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
- E. Employ ethical behaviors and actions that positively influence others.
- F. Analyze the short-term and long-term effects a leader's actions and attitudes can have on productivity, morale, and organizational culture.

5. Personal and Occupational Safety

- A. Demonstrate procedures to be followed in case of emergencies.
- B. Describe and discuss the procedure for reporting a work-related hazard or injury (worker's comp), including ways to report a potential safety hazard to a supervisor.
- C. Identify and discuss cyber ethics, cyber safety, and cyber security.
- D. Apply personal safety practices to and from the job.
- E. Recognize the effects of substance abuse in the workplace.
- F. Explain the importance of CAL-OSHA in the industry.
- G. Recognize good housekeeping as a safety issue.
- H. Identify safety hazards commonly found in the workplace environment.
- I. Identify the electrical hazards of working with electronic equipment.
- J. Explain the importance and role of the Environmental Protection Agency (EPA).

6. Shop Safety

- A. Locate and demonstrate knowledge of material safety data sheets (MSDS).
- B. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
- C. Apply general shop safety rules and procedures including proper ventilation procedures in lab/shop area.

- D. Utilize safe procedures for handling of tools and equipment.
- E. Apply specific vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
- F. Use proper procedures for safe lift operation.
- G. Demonstrate proper handling of hazardous materials and fire safety equipment.
- H. Wear appropriate clothing, accessories and hairstyles for shop/lab activities.
- I. Demonstrate knowledge of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and high voltage circuits (including hybrid vehicles, high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).

7. Introduction to Hybrid and Electric Vehicles (HEVs and EVs)

- A. Understand the history and evolution of hybrid and electric vehicles.
- B. Differentiate between traditional internal combustion engines (ICE), hybrid vehicles, and fully electric vehicles.
- C. Explore current trends and market growth in electric mobility.
- D. Identify key components in HEVs and EVs (e.g., battery packs, electric motors, regenerative braking systems).

8. Batteries and Energy Storage Systems

- A. Learn about various battery types used in hybrid and electric vehicles (lithium-ion, nickel-metal hydride, solid-state, etc.).
- B. Understand battery charging and discharging cycles, efficiency, and life span.
- C. Study the management systems for energy storage (Battery Management Systems, or BMS).
- D. Analyze the process of battery maintenance, diagnostics, and replacement.
- E. Discuss environmental concerns and recycling methods for electric vehicle batteries.

9. Safety and Environmental Considerations

- A. Learn about high-voltage safety procedures and protocols for working with hybrid and electric vehicles.
- B. Understand the risks of working with electric propulsion systems, including electric shock, fire hazards, and thermal runaway in batteries.
- C. Study the proper use of personal protective equipment (PPE) and tools to prevent accidents.
- D. Explore environmental regulations related to EV battery disposal, recycling, and emissions standards.
- E. Conduct safety audits and emergency response drills for high-voltage systems.
- F. Identify marked safety areas and the location of the posted evacuation routes.

10. Hybrid and Electric Drivetrain Systems

- A. Understand the mechanics of hybrid and electric drivetrains, including electric motors, transmissions, and driveline components.
- B. Study regenerative braking systems and their role in energy recovery.
- C. Analyze how hybrid powertrains combine internal combustion engines with electric propulsion to optimize fuel efficiency.
- D. Perform diagnostics and repair procedures on hybrid and electric drivetrains.

- E. Identify key differences in drivetrain layouts for different HEV and EV configurations (series, parallel, series-parallel).

11. Charging Infrastructure and Vehicle-to-Grid (V2G) Technologies

- A. Understand the different types of EV charging stations (Level 1, Level 2, DC fast charging) and how they relate to various vehicle models.
- B. Study the electric grid's interaction with electric vehicle charging (smart charging, demand-response systems).
- C. Learn about Vehicle-to-Grid (V2G) technology and how EVs can interact with and support the electrical grid.
- D. Explore safety protocols for charging and maintaining charging stations.
- E. Diagnose issues related to charging systems and infrastructure.

12. Diagnostics, Repair, and Service Procedures for HEVs and EVs

- A. Learn diagnostic procedures specific to hybrid and electric vehicles, including onboard diagnostics (OBD-II), specialized EV scanning tools, and software.
- B. Study troubleshooting methods for common issues in HEV and EV systems, such as battery performance issues, charging faults, and motor problems.
- C. Gain hands-on experience in disassembling and repairing hybrid and electric vehicle components, including electric motors, inverters, and cooling systems.
- D. Use multimeters, diagnostic scanners, and other tools to perform troubleshooting and repair on hybrid and electric vehicle systems.

13. Advanced Hybrid and Electric Vehicle Technologies

- A. Investigate emerging technologies in hybrid and electric vehicles, such as wireless charging, autonomous driving, and advanced driver-assistance systems (ADAS).
- B. Study advancements in battery technology, such as solid-state and hydrogen fuel cell systems.
- C. Explore software updates and over-the-air (OTA) technology in EVs.
- D. Perform diagnostics on emerging technologies, focusing on their integration with traditional vehicle systems.

14. Customer Service and Communication in the Automotive Industry

- A. Understand the importance of clear communication with customers regarding vehicle performance, maintenance, and repair costs.
- B. Develop professional customer service skills in dealing with hybrid and electric vehicle owners.
- C. Learn about estimating repair costs, providing estimates, and maintaining proper service documentation.
- D. Explore marketing and communication trends related to hybrid and electric vehicle technology.

15. Portfolio Design

- A. Develop personal marketing and computer skills by refining your digital portfolio for post-secondary and employment acceptance.

- B. Compile best samples of original works (in photographs and video) and documents for a variety of purposes, which shows a progression in the acquisition of knowledge and/or skills.
- C. Demonstrate knowledge of competencies through journaling or summary of selected works or documents.
- D. Revise professional resume and cover letter to align with skills and objective statements of the relevant industry.
- E. Dress professionally and practice interviewing techniques using portfolio materials.
- F. Assemble industry and employability documents (resume, cover letter, certifications, recommendation letters, etc.).
- G. Create a "leave behind" book or folder.
- H. Display portfolio materials during a fair, community event, competition, or professional panel review.
- I. Evaluate and utilize feedback to improve portfolio.

Key Assignments

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
1. Students will participate in mock interviews that represent current industry practices (e.g., skills demonstrations, resumes, applications, portfolios, personal websites, etc.).	1A, B, D 2D, E, F, H 3B, C, D, I, J 15A-I	1 2 3 9 10 11	2 3 4 7 8 10		LS 11-12.6 SLS 11-12.2 WS 11-12.4
2. In teams, students will research and write an automotive shop manual on the key safety risks and necessary procedures involved in working with Supplemental Restraint Systems (SRS) and high-voltage systems in electric vehicles (EVs). Each team will present and discuss this manual with the rest of the class to serve as an educational and reference tool. <i>(UC/A-G Key Assignment: Students will discuss the required personal protective equipment (PPE) for a given lab activity (e.g., tire repair, brake service) and explain why each item is essential. Each student will present the findings in class and demonstrate the correct use of PPE.)</i>	1A - F 2A, D 3A, D 4A-E 5B, G 6A-I 7B, D 9A-F	1 2 4 5 6 8 9 10 11 12	2 4 5 6 9 10	C1.0 C3.0 C2.0 C7.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 A-CED 4 CC 2 PS 3.A PS 4.C SEP 4, 8
3. In teams, students will identify and label key components of a hybrid or electric vehicle (battery packs, electric motors, regenerative braking systems), then create a short video or photo essay of the components, explaining and demonstrating their functions. <i>(UC/A-G Key Assignment: Students will write a two-page essay discussing the impact of electric vehicles on the future of the automotive industry, integrating data and sources from industry reports.)</i>	1A - F 2A, D 3A, D 4A-E 5B, G 6A-I 7D 8A-E 9A, B	1 2 4 5 9 10 11	2 4 5 6 10	C1.0 C2.0 C3.0 C6.0 C7.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 CC 2 PS 4.C SEP 4, 8

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<p>4. Students will research and identify different types of batteries used in EVs (e.g., lithium-ion, nickel-metal hydride). Report in class comparing the advantages, disadvantages, efficiency, and typical applications in hybrid and electric vehicles.</p> <p><i>(UC/A-G Key Assignment: Students will write an analytical two page report on battery life cycles, discussing key factors that impact the lifespan and efficiency of EV batteries, using data from auto research articles.)</i></p>	1A - F 2A, D, I, J 3A, D 4A-E 5B, G 6A-I 7D 8A-E 9A-F 13A-D	1 2 4 5 6 9 11 12	2 4 5 6 7 9 10	C1.0 C3.0 C2.0 C6.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 PS 3.B
<p>5. Students will conduct diagnostics on a hybrid or electric drivetrain (involving motor or inverter issues) using a multimeter or OBD-II scanner. Record the findings and suggest possible repairs.</p> <p><i>(UC/A-G Key Assignment: Students will analyze and write about a real-world incident involving electric vehicle safety, focusing on risks and how they were addressed.)</i></p>	1A - F 2A, D 3A, D 5B, G 6A-I 7D 9A-F 10A-E 14A-D	1 3 4 5 6 8 10 11 12	2 4 5 6 7 8 10	C1.0 C2.0 C3.0 C4.0 C7.0 C8.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 SLS 11-12.2 A-CED 4 CC 2 ETS 1.B PS 3.B PS 4.C SEP 4, 8
<p>6. Students will diagnose, troubleshoot and service a non-functional regenerative braking system, or a charging issue in an EV.</p> <p><i>(UC/A-G Key Assignment: After diagnosing drivetrain issues, students will write a detailed one-page report explaining the diagnostic process, trouble codes and tools in order to identify the problem and possible repair solutions. Communicate the action taken to clients, i.e. classmates and teacher. Use written and oral communication skills, analytical, attention to detail, problem</i></p>	1A - F 2A, D 3A, D 5B, G 6A-I 7D 8A-E 9A-F	1 3 4 5 6 8 11 12	2 4 5 6 7 10	C1.0 C2.0 C3.0 C4.0 C5.0 C7.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 RLST 11-12.3 RLST 11-12.10 A-CED 4 CC 2

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<i>solving and application of industry knowledge skills.).</i>	11A-E 13A-D 14A-D				ETS 1.B PS 4.C SEP 4, 8
7. Students will accurately use an OBD-II scanner to diagnose an issue in a hybrid or electric vehicle. Report and explain the trouble codes, possible causes, and steps to resolve the issue, in addition to computer and software maintenance. (UC/A-G Key Assignment: In teams, students will write a one-page case study on diagnosing and repairing a hybrid or electric vehicle issue, including an in class discussion of the tools and methodologies used, as well as the challenges encountered.)	1A - F 2A, D 3A, D 5B, G 6A-I 7D 9A-F	1 2 3 4 5 6 8 11 12	2 4 5 8 10	C1.0 C2.0 C3.0 C4.0 C5.0 C7.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 SLS 11-12.1d A-CED 4 CC 2 ETS 1.B PS 4.C SEP 4, 8
8. Students will collaborate on a capstone project involving diagnostics, repair, or innovation of a hybrid or electric vehicle system. Using written and oral communication skills, students will create a detailed mock service estimate for an EV battery replacement, including parts, labor, and warranty. Present the written estimate to a "customer" and explain the details in an accessible way.	1A - F 2A, D 3A, D 4A-E 5B, G 6A-I 7D 8A-E 9A-F 11A-E 12A-D 13A-D 14A-D	1 2 4 5 6 7 8 9 10 11 12	2 5 6 7 8 9 10	C1.0 C2.0 C4.0 C5.0 C7.0 C8.0	WS 11-12.4 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 RLST 11-12.3 RLST 11-12.10 SLS 11-12.1d A-CED 4 CC 2 ETS 1.B PS 4.C SEP 4, 8
9. Students will diagnose and troubleshoot a non-functional charging station. Accurately utilize diagnostic tools to identify the problem and propose solutions.	1A - F 2A, D 3A, D	1 3 4	2 4 5	C1.0 C2.0 C3.0	LS 11-12.6 WS 11-12.6 WS 11-12.7

Assignment	Competencies	Career Ready Practices	Anchor Standards	Pathway Standards	CCSS
<p><i>(UC/A-G Key Assignment: Students will write an analysis of the different types of EV charging infrastructure and their impact on the future of electric vehicle adoption. Include analytical information and application of industry knowledge on the integration of V2G technology and its implications for the electrical grid.)</i></p>	5B, G 6A-I 7D 8A-E 9A-F 11A-E	5 6 8 11 12	6 7 10	C4.0 C5.0 C7.0	RSTS 11-12.4 RLST 11-12.3 RLST 11-12.10 A-CED 4 CC 2 ETS 1.B PS 4.C SEP 4, 8
<p>10. Students will work in teams building a functional electric vehicle using a kit or modified base vehicle (e.g., go-kart, small electric car chassis). This project will integrate industry knowledge of EV systems, battery management, drivetrain systems, charging infrastructure, diagnostics, braking, steering system, safety restraints, lighting, alignment, wheel suspension, software integration and on-board computer programming. Students will identify and document each phase of the vehicle's development including technical research, planning and component selection, design choices, assembly, testing, and troubleshooting.</p>	1A - F 2A, D 3A, D 4A-E 5B, G 6A-I 7D 8A-E 9A-F 10A-E 11A-E 12A-D 13A-D	1 2 3 4 5 6 8 9 10 11 12	2 4 5 6 7 8 9 10	C1.0 C2.0 C3.0 C4.0 C6.0 C7.0 C8.0	LS 11-12.6 WS 11-12.6 WS 11-12.7 RSTS 11-12.4 RLST 11-12.3 RLST 11-12.10 A-CED 4 CC 2 ETS 1.B PS 4.C SEP 4, 8

Standards Assessed in this Program

Career Ready Practices

1. Apply appropriate technical skills and academic knowledge.
2. Communicate clearly, effectively, and with reason.
3. Develop an education and career plan aligned to personal goals.
4. Apply technology to enhance productivity.
5. Utilize critical thinking to make sense of problems and persevere in solving them.
6. Practice personal health and understand financial well-being.
7. Act as a responsible citizen in the workplace and the community.
8. Model integrity, ethical leadership, and effective management.
9. Work productively in teams while integrating cultural/global competence.
10. Demonstrate creativity and innovation.
11. Employ valid and reliable research strategies.
12. Understand the environmental, social, and economic impacts of decisions.

Anchor Standards

2.0 Communications

- Acquire and use accurately sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management

- Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology

- Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the sector workplace environment.

5.0 Problem Solving and Critical Thinking

- Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety

- Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the sector workplace environment.

7.0 Responsibility and Flexibility

- Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities

- Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork

- Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.

10.0 Technical Knowledge and Skills

- Apply essential technical knowledge and skills common to all pathways in the sector following procedures when carrying out experiments or performing technical tasks.

Pathway Standards

Transportation - Systems Diagnostics and Service Pathway

C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.

C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.

C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.

C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.

C5.0 Apply and understand appropriate business practices.

C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including, but not limited to, two- and four-stroke and supporting subsystems.

C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.

C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.

Common Core State Standards

ENGLISH LANGUAGE ARTS

Language Standards

LS 11-12.6: Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the (career and college) readiness level, demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

LS 2.D

Reading Standards for Literacy in Science and Technical Subjects

RLST 11-12.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks;

analyze the specific results based on explanations in the text.

RLST 11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.

RLST 11-12.10: By the end of grade 12 read and comprehend science/technical texts in the grades 11-12 text complexity band independently and proficiently.

Speaking and Listening Standards

SLS 11-12.2: Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions, and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

SLS 11-12.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others ideas and expressing their own clearly and persuasively.

SLS 11-12.1d: Respond thoughtfully to diverse perspectives, synthesize comments, claims and evidence made on all sides of an issue, resolve contradictions when possible, and determine what additional information or research is required to deepen the investigation or complete the work.

Writing Standards

WS 11-12.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WS 11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback including new arguments and information.

WS 11-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

MATHEMATICS

Algebra- Creating Equations

A-CED 4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R .

SCIENCE

Crosscutting Concept

CC 2: Cause and effect: Mechanism and explanation

Engineering, Technology, and the Applications of Science

ETS 1.B: Developing Possible Solutions

Physical Sciences

PS 3.A: Definitions of Energy

PS 3.B: Conservation of Energy and Energy Transfer
PS 4.C: Information Technologies and Instrumentation

Scientific and Engineering Practices

SEP 4: Analyzing and interpreting data
SEP 8: Obtaining, evaluating, and communicating information