

AT-35 Intro to HEV/EV Syllabus

Course Information

Semester & Year: Fall 2024

Course ID and Section number: AT-35-E7423

Instructor's name: Anibal Florez

Day and time of required meetings: Mondays and Wednesdays from 5:45pm to 8:55pm

Location: Lecture in AT-128 followed by lab in AT-129

Number of proctored exams: 5 plus the final exam

Course units: 3

Instructor Contact Information

Office location: AT-141

Office hours: By appointment or stop by anytime

Phone number: 707-476-4373

Email address: Anibal-Florez@redwoods.edu

Communication notes: If I don't reply or call you back within 48 hours (about 2 days) please try again.

Catalog Description

This course explores the use of Hybrid and Electric battery power for vehicle propulsion. Topics will include safety when working around high voltage, maintenance, drivability, inverter/converter, power transfer, and battery technology. Battery storage, hybrid re-generation systems, electric vehicle applications and their integrated systems from various manufacturers will be discussed. This course may be used as preparation for the student to successfully complete the L3 ASE certification exam. The Light Duty Hybrid/Electric Vehicle Specialist (L3) is a new, advanced level certification geared toward technicians who perform diagnoses and repairs on hybrid/electric vehicles. Students are advised that the Automobile Electrical/Electronic Systems (A6) and Engine Performance (A8) certifications are required to register for the (L3) certification.

Textbook information

Title & Edition: Hybrid, Electric & Fuel-Cell Vehicles, 3rd Ed.

Author: Jack Erjavec, Nathan Smith, Michael Godson

ISBN-13: 978-1-305-95257-7

Course Student Learning Outcomes

1. Demonstrate safety while performing tasks on hybrid and electric vehicles.
2. Diagnose high voltage battery failures.
3. Diagnose hybrid and electric vehicle drivetrain and controls.

Required Materials

ANSI Z87.1 approved safety glasses and closed toed shoes.

Prerequisites/corequisites/ recommended preparation

AT16 - Automotive Electrical Systems

A course covering theory and principles of automotive electrical systems. The course includes basic electrical theory, Ohm's Law, series and parallel circuits, electrical symbols and schematics, automotive batteries, charging systems, voltage regulation, starting systems, lighting systems, and various accessories. The laboratory portion of the course will place emphasis on diagnosis and testing techniques required to effectively determine the necessary action in an electrical system failure. The use of schematics, technical specifications, voltmeters, ohmmeters, ammeters, and circuit testers will be required.

Educational Accessibility & Support

College of the Redwoods is committed to providing reasonable accommodations for qualified students who could benefit from additional educational support and services. You may qualify if you have a physical, mental, sensory, or intellectual condition which causes you to struggle academically, including but not limited to:

- Mental health conditions such as depression, anxiety, PTSD, bipolar disorder, and ADHD
- Common ailments such as arthritis, asthma, diabetes, autoimmune disorders, and diseases
- Temporary impairments such as a broken bone, recovery from significant surgery, or a pregnancy-related disability
- A learning disability (such as dyslexia, reading comprehension), intellectual disability, autism, or acquired brain injury
- Vision, hearing, or mobility challenges

Available services include extended test time, quiet testing environments, tutoring, counseling and advising, alternate formats of materials (such as audio books or E-texts), assistive technology, on-campus transportation, and more. If you believe you might benefit from disability- or health-related services and accommodations, please contact [Disability Services and Programs for Students \(DSPS\)](#). If you are unsure whether you qualify, please contact DSPS for a consultation: dsps@redwoods.edu.

DSPS office locations and phone numbers

Eureka campus

- Phone: 707-476-4280
- Location: Student Services Building, first floor

Del Norte campus

- Phone: 707-465-2324
- Location: Main Building, next to the library

Klamath-Trinity campus

- Phone: 707-476-4280

Student Support Services

Good information and clear communication about your needs will help you be successful. Please let your instructor know

about any specific challenges or technology limitations that might affect your participation in class. College of the Redwoods wants every student to be successful.

The following online resources are available to support your success as a student:

[CR Online Learning Support](#)

Tech support, laptop loans, guides to using Canvas, installing Office 365 for free, and more.

[Library Articles & Databases](#)

Find the best library databases for your research.

[Online Tutoring Resources](#)

Participate in tutoring over Zoom.

To learn more about the resources available to you, click on a title bar below, or click the down arrow to expand them all.

Klamath-Trinity students can contact the CR Klamath-Trinity Office for specific information about student support services at 530-625-4821.

Community College Student Health and Wellness

[National Suicide Prevention Lifeline](#)

If you are in distress or are with someone at risk right now, call or text the National Suicide Prevention Lifeline.

Call the National Suicide Prevention Lifeline
1-800-273-TALK (8255)

Text the National Suicide Prevention Lifeline
741-741

[Timely Care](#)

When you're not feeling well physically or distressed mentally, Timely Care can offer the help you're looking for in just a few quick taps. Students can schedule an appointment anytime via phone, video, and chat. [Log in or set up an account with Timely Care.](#)

[Mental Health Counseling](#)

Students should text, email, or fax Shawna Bell directly for scheduling and/or services.

- Text: 707-496-2856
- Email: shawnabmft@gmail.com
- Fax and voicemail: 707-237-2318

Wellness Central

Resources, tools, and trainings regarding health, mental health, wellness, basic needs and more designed for California community college students, faculty and staff are available on the California Community Colleges [Wellness Central](#).

Counseling

[Counseling and Advising](#) can assist students in need of academic advising and professional counseling services. Call, email or stop by one of our offices to make an appointment!

Counseling and Advising office locations and contact info

Eureka campus

- Phone: 707-476-4150
- Location: Student Services Building, first floor
- Email: counseling@redwood.edu
- Hours: Monday through Friday, 9am to 4pm. Summer hours may vary

Del Norte campus

- Phone: 707-476-2300
- Location: Main Building, next to the library
- Hours: Summer hours may vary

Klamath-Trinity campus

- Phone: 530-625-4821
- Email: KT-staff@redwoods.edu
- Hours: Summer hours may vary

Basic Needs Center

[The Basic Needs Center](#) provides for the health and safety of students by providing access to healthy food, financial resources, and referrals to safe and secure housing. [Submit a request for services and information](#).

Basic Needs Center contact info

- Phone: 707-476-4153
- Email: the-grove@redwoods.edu

Learning Resource Center

The Learning Resource Center includes the following resources for students:

Library Services

[Library Services](#) promotes information literacy and provides organized information resources.

Multicultural and Equity Center (MCE)

The [Multicultural and Equity Center](#) is a dynamic and inclusive place that supports all students in their academic and

personal journeys at the college. We do this by creating community, home away from home, and a safe place for cultural expression, cross-cultural learning, access to college and dignity resources, and social justice work opportunities. The MEC is committed to retention and student success by offering activities related to leadership development, student connectedness and student equity. We are a student-centered program that fosters respect for all people.

Academic Support Center

The [Academic Support Center](#) offers tutoring and test proctoring for CR students.

Student Tech Help

[Student Tech Help](#) provides students with assistance around a variety of tech problems.

Extended Opportunity Programs and Services (EOPS)

[Extended Opportunity Programs and Services](#) (EOPS) provides services to eligible income disadvantaged students including: textbook awards, grants, career academic and personal counseling, transportation assistance, tutoring, laptop, calculator and textbook loans, priority registration, graduation cap and gown, workshops, and more!

TRiO Student Success Program

The TRiO Student Support Services Program provides eligible students with a variety of services including academic advising, career assessments, assistance with transfer, and peer mentoring. Students can apply for the program with the [Eureka TRiO office](#) or the [Del Norte TRiO office](#).

Veterans Resource Center

The [Veteran’s Resource Center](#) supports and facilitates academic success for Active Duty Military, Veterans and Dependents attending CR through relational advising, mentorship, transitional assistance, and coordination of military and Veteran-specific resources.

CalWORKS

California Work Opportunity & Responsibility to Kids ([CalWORKs](#)) provides supportive services to student parents with children under the age of 18, who are receiving cash assistance (TANF benefits), to become self-sufficient. Services include: transportation assistance, basic student supplies, tutoring, priority registration, laptop and calculator loans, career, academic, and personal counseling, and more!

Fall 2024 Dates to remember

Date	To Remember
August 23	Last day to register for classes (day before the first class meeting)
August 24	Classes begin
August 30	Last day to add a class

Date	To Remember
September 2	Labor Day Holiday (district wide closure)
September 6	Last Day to Drop & Receive a Refund
September 8	Last Day to Drop w/out a "W"
September 9	Census Date (20% of class)
October 31	Last Day to Petition to Graduate & Petition for Certificate
November 1	Last Day for Student/Faculty Withdrawal
November 11	Veteran's Day Holiday (District Wide Closure)
November 25-26	Fall Break (No Classes)
November 27-29	Thanksgiving Holiday (District Wide Closure)
December 14-20	Final Examinations
December 20	Last Day to File P/NP Option
December 20	Semester Ends
December 27	Grades Due
January 3	Grades Available for Transcript Release

Academic dishonesty

In the academic community, the high value placed on truth implies a corresponding intolerance of scholastic dishonesty. In cases involving academic dishonesty, determination of the grade and of the student's status in the course is left primarily to the discretion of the faculty member. In such cases, where the instructor determines that a student has demonstrated academic dishonesty, the student may receive a failing grade for the assignment and/or exam and may be reported to the Chief Student Services Officer or designee. The Student Code of Conduct ([AP 5500](#)) is available on the College of the Redwoods website. Additional information about the rights and responsibilities of students, Board policies, and administrative procedures is located in the [2023-2024 College Catalog](#) and [CR Board and Administrative Policies](#).

Disruptive Behavior

Student behavior or speech that disrupts the instructional setting will not be tolerated. Disruptive conduct may include, but is not limited to: unwarranted interruptions; failure to adhere to instructor's directions; vulgar or obscene language; slurs or other forms of intimidation; and physically or verbally abusive behavior. In such cases where the instructor determines that a student has disrupted the educational process, a disruptive student may be temporarily removed from class. In addition, the student may be reported to the Chief Student Services Officer or designee. Additional information

about the rights and responsibilities of students, Board policies, and administrative procedures is located in the [2023-2024 College Catalog](#) and [CR Board and Administrative Policies](#).

Inclusive Language in the Classroom

College of the Redwoods aspires to create a learning environment in which all people feel comfortable in contributing their perspectives to classroom discussions. It therefore encourages instructors and students to use language that is inclusive and respectful.

Canvas Information

- Log into Canvas at [My CR Portal](#)
- For help logging in to Canvas and general tech help, visit [Student Technical Support](#)
- Once you're logged in to Canvas, you click on the Help icon on the left menu
- Canvas online orientation workshop: [Canvas Student Orientation Course](#)

Setting Your Preferred Name and Pronouns in Canvas

Students have the ability to display personal pronouns and an alternate first name in Canvas. Students may change their pronouns on their own in Canvas (Account :: Settings :: Edit Settings). To request a change to your preferred list name, contact [Admissions & Records](#). Your Preferred Name will only be listed in Canvas; this does not change your legal name in our records. See the [Student Information Update Form \(pdf\)](#).

Emergency Procedures / Everbridge

College of the Redwoods has implemented an emergency alert system called Everbridge. In the event of an emergency on campus you will receive an alert through your personal email and/or phones. Registration is not necessary in order to receive emergency alerts. Check to make sure your contact information is up-to-date by logging into [WebAdvisor](#) and selecting 'Students' then 'Academic Profile' then 'Current Information Update.'

Please contact Public Safety at 707-476-4112 or security@redwoods.edu if you have any questions. For more information visit [Redwoods Public Safety](#).

In an emergency that requires an evacuation of the building anywhere in the District:

- Be aware of all marked exits from your area and building
- Once outside, move to the nearest evacuation point outside your building
- Keep streets and walkways clear for emergency vehicles and personnel

Do not leave campus, unless it has been deemed safe by the campus authorities.

Evaluation & Grading Policy

Your performance objectives, exams, and laboratory activities will be translated to points and points to grades. There are 1000 possible points and the following distribution will guarantee the following:

1000 - 900 = A-, A
899 - 800 = B-, B, B+
799 - 700 = C, C+
699 - 600 = D
599 - 500 = F

Course Schedule

This course is scheduled to meet Monday and Wednesday evenings at 5:45pm and will conclude at 8:55pm. During our allotted time we will go over assigned textbook material, work through classroom review exercises and finally discuss shop activities and conclude with hands-on application in the shop.

Attendance

The college assumes that students will attend every session of a class for which they are registered. If, however, attendance is irregular, students may be dropped from a class. Excessive absence is defined as a total of absences which equal two weeks in a 16 week semester, for a class meeting twice per week that would equate to 4 absences. For attendance purpose, the college regards a laboratory session as the equivalent of one class meeting. If you're not present for lecture you are absent, even if you make it to lab!

Veterans and financial aid recipients should remember that should they drop below the number of units required of them by the Veterans Administration or financial aid office for any reason during the semester, including being dropped from a class for excessive absences, they will lose part of the government assistance allowances and may be required to repay funds already disbursed.

In any event if an attendance problem does develop, work with the instructor to resolve it. The purpose here is to see what we can do together to keep you in the class in order to help you master the course content.

Course Attendance Policy

Attendance will be taken at the start of each class session. **Students who accumulate 4 absences during the first 10 weeks of class will be dropped from this class by the instructor.**

Punctuality is essential in the workplace and is considered respectful of fellow students and instructors. Excessive tardiness can affect your score as well. Less time present means you have less time to complete tasks.

Students who have experienced extenuating circumstances can complete & submit the Excused Withdrawal Petition to request an Excused Withdrawal (EW) grade instead of the current Withdrawal (W) or non-passing (D, F & NP) grades. The EW Petition is available from the Admissions and Records Forms Webpage. Supporting documentation is required.

Tips for Students

ASE-Certified Master Technicians were surveyed for their advice to students who want to become automotive service professional. Although the survey was especially for students, the tips that were suggested are applicable to all automotive technicians, from the newest to the most experienced. The following is a compilation of the responses:

- 1 Education, Education, Education – Continue your education and develop strong math, reading, study skills and computer skills. **A strong background in electronics is essential.**
- 2 Take advantage of on-the-job training, apprenticeship opportunities – Get all the training you can and start in

a work environment that caters to service and excellence.

- 3 Keep abreast of new technology – Make a commitment to life-long learning. There is a constant change in technology so take advantage of additional training whenever it is available.
- 4 Learn a systems approach – Vehicles today are complex, so it is necessary to understand the interaction of electrical and mechanical components within the total system. Learn how to understand the whole system and you can apply this knowledge across the spectrum of vehicles.
- 5 Develop good communication skills – learn not only the professional and technical skills but also communication and people skills. Your credibility is linked to your perceived competence.
- 6 Keep a positive attitude – Develop a positive outlook so that you perform proper repairs. Apply yourself – you get exactly as much out of your job as you put into it.
- 7 Take pride in your work – Work on every car as if it were your own. Whatever you do – do it well, it's your signature.
- 8 Be honest and ethical – Stay focused on what is most important, practice good work ethics, be dependable and honest, and try to fix it right the first time.
- 9 Cultivate professionalism in yourself and others – Act professionally, take pride in your appearance as well as in the shop area. Be a positive role model for others. **Show up for work every day and always be on time. 15 minutes early is on time.**
- 10 Become ASE certified – Certification gives you an edge when you are seeking employment. Your confidence, sense of self-worth, and ability to get a job almost anywhere are improved once you become certified. ASE certification shows your employer that you have proven your technical expertise and that you are among the group of the very best technicians.

Learning Outcomes

The college strives for continual improvement in instruction through assessment of learning outcomes. These outcomes are assessed in various ways throughout the course and upon completion of the program. Please participate to the fullest of your ability in this effort to make this course and this program successful.

Program Learning Outcomes

1. Perform common service and repair tasks identified by the National Automotive Technicians Education Foundation (NATEF)/ Automotive Service Excellence (ASE).
2. Locate industry-standard diagnostic information to localize complex automotive problems.
3. Successfully perform the entry level skills and tasks required for service and repair of automotive systems.

Course Objectives

Upon successful completion of this course the student should be able to perform the following tasks:

A. High Voltage Safety

- A.1 Perform high voltage disconnect procedure; reconnect/enable high voltage system.
- A.2 Select, test and use proper safety gloves.
- A.3 Select, qualify and use proper electrical testing equipment and leads.
- A.4 Diagnose, locate and safely disable/enable safety interlocks.
- A.5 Test, diagnose and repair high voltage leaks/loss of isolation.

B. High Voltage Support Systems

- B.1 Retrieve and diagnose DTCs; determine needed repairs.
- B.2 Determine if the internal combustion engine (ICE) is in CRANK mode or RUN mode.
- B.3 Differentiate between drivability problems caused by the internal combustion engine and/or hybrid drive

system.

B.4 Identify procedures necessary to establish the proper vehicle operational power mode during service (OFF, ACCESSORY, POWER ON, and READY TO DRIVE).

B.5 Diagnose the cause of a hybrid system warning displayed on the instrument panel and/or a drivability complaint.

B.6 Diagnose AC/DC inverter overheating; determine needed repair.

B.7 Diagnose/Replace AC/DC inverter cooling pump.

B.8 Service liquid cooling system(s).

B.9 Observe and interpret driver indicators, power flow display and energy monitor; determine necessary action.

C. HEV/EV Air Conditioning

C.1 Test and diagnose high voltage air conditioning compressor malfunctions; diagnose system problems; determine needed repairs.

C.2 Diagnose cabin heating system performance problems; determine needed repairs.

D. HEV/EV Transaxles/Drivetrain

D.1 Identify transmission fluid and coolant fluid requirements; verify fluid levels.

D.2 Remove and install rotor from stator.

E. HEV/EV Braking systems

E.1 Deactivate brake system self-test prior to service.

E.2 Diagnose brake system performance problems; differentiate between braking problems caused by hydraulic system and regenerative system malfunctions; determine needed repairs.

F. High Voltage Battery Systems

F.1 Diagnose problems caused by damaged or failed harnesses, connectors, terminals and fuses.

F.2 Diagnose high voltage (HV) battery pack malfunctions.

F.3 Remove and install high voltage battery pack.

F.4 Test, diagnose and repair high voltage battery pack heating and cooling systems.

F.5 Test, diagnose, repair or replace high voltage battery pack internal components.

F.6 Perform 12-volt battery testing.

F.7 Diagnose system main relay (SMR)/contactor malfunctions; determine needed repairs.

Evaluation & Grading Policy

Test I	High Voltage Safety	60 points
Test II	Maintenance Items & Procedures	60 points
Test III	Common Components & Systems	60 points
Test IV	Battery Electronics & Thermal Management	60 points
Test V	HEV/EV Operation & Diagnosis	60 points
Quizzes & Assignments		100 points
Final Exam Comprehensive		<u>100 points</u>
Total Lecture Points		500 points

Extra Credit

Each student may arrange with instructor to read and report on a topic related to AT 35 HEVs & EVs from a source other than the course text or the internet i.e. trade publications, library reference material, magazines, newspaper articles, etc... The report must be no less than one page typed and no longer than three pages. You

must properly cite your references on a separate page. You may earn up to **50 points per report** and you may turn in a maximum of 1 report per semester. Please inform the instructor and agree on a topic prior to doing this assignment.

Additional Extra Credit Option

We have access to Ford training modules. Completing the listed learning modules below will give you extra credit points towards your overall grade. You must turn in the certificates of completion for each of the modules for credit. Each certificate is worth 4 points. **24 points** for all.

F414101203-01, F414101203-02, F414101203-03, F414101203-04, F414101203-05, F401001003-02

Subaru University also offers appropriate options for extra credit work. Please inform your instructor if you wish to create a Subaru-U profile.

Laboratory Portion

Module 1 – High Voltage Safety	50 points
Module 2 – Maintenance Items & Procedures	100 points
Module 3 – Common Components & Systems	100 points
Module 4 – Battery Electronics & Thermal Management	150 points
Module 5 – HEV/EV Operation & Diagnosis	<u>100 points</u>
Total Laboratory Points	500 points

Course Calendar for AT-35

Date	Theory in Class	Shop Focus	Ch. To Read
8-26	HEV/EVs	HEV/EVs	Ch. 1
8-28	HEV/EVs Safety	HEV/EVs Safety	Ch. 2
9-2	Holiday		
9-4	Elec. recap	Elec. recap	Ch. 3
9-9	Uscope DSO	Pico DSO	Ch. 3
9-11	Test 1 on Ch. 1-3 & DSO		
9-16	HEV/EV Maintenance	HEV/EV Maintenance	Ch. 4
9-18	HEV/EV Maintenance	HEV/EV Maintenance	Ch. 4
9-23	HEV/EV Maintenance	HEV/EV Maintenance	Ch. 4
9-25	HEV/EV Maintenance	HEV/EV Maintenance	Ch. 4
9-30	HEV/EV Maintenance	HEV/EV Maintenance	Ch. 4
10-2	Test 2 on Maintenance		
10-7	Common Comp. & Syst.	Common Comp. & Syst.	Ch. 6, 7
10-9	Common Comp. & Syst.	Common Comp. & Syst.	Ch. 6, 7
10-14	Common Comp. & Syst.	Common Comp. & Syst.	Ch. 6, 7
10-16	Common Comp. & Syst.	Common Comp. & Syst.	Ch. 6, 7
10-21	Test 3 on Common Components		
10-23	HV Batt. & Thermal Mgt.	HV Batt. & Thermal Mgt.	Ch. 5, 8
10-28	HV Batt. & Thermal Mgt.	HV Batt. & Thermal Mgt.	Ch. 5, 8
10-30	HV Batt. & Thermal Mgt.	HV Batt. & Thermal Mgt.	Ch. 5, 8
11-4	HV Batt. & Thermal Mgt.	HV Batt. & Thermal Mgt.	Ch. 5, 8
11-6	HV Batt. & Thermal Mgt.	HV Batt. & Thermal Mgt.	Ch. 5, 8
11-11	Holiday		
11-13	Test 4 on HV Batt. & Thermal Mgt.		
11-18	HEV/EV Ops & Diag.	HEV/EV Ops & Diag.	Ch. 9, 10, 11
11-20	HEV/EV Ops & Diag.	HEV/EV Ops & Diag.	Ch. 9, 10, 11
11-25	Fall Break		
11-27	Fall Break		
12-2	HEV/EV Ops & Diag.	HEV/EV Ops & Diag.	Ch. 9, 10, 11
12-4	HEV/EV Ops & Diag.	HEV/EV Ops & Diag.	Ch. 9, 10, 11
12-9	HEV/EV Ops & Diag.	HEV/EV Ops & Diag.	Ch. 9, 10, 11
12-11	Test 5 on HEV/EV Ops & Diag.		
12-18	Final Exam @ 5:30pm		