FLORIDA POLYTECHNIC UNIVERSITY

EEL 4312 Electric and Hybrid Vehicles

Course Information

- **Course Number and Title**: EEL 4312 – Electric and Hybrid Vehicles
- **Credit Hours:** 3 credits
- **Academic Term:** Spring 2026

Instructor Information

- **Instructor: Dr. Rawa Adla**
- **Office Location: IST- 2091**
- **Office Hours**: Tuesday, Thursday: 11:00 AM- 12:00 PM or by appointment
- **Email address**: radla@floridapoly.edu

Course Description

- **Official Catalog Course Description**: This course introduces general aspects of Hybrid Electric Vehicles (HEVs), including architecture, sub-system design, sizing, modeling, and energy management strategies. Also. it covers vehicle dynamics along with energy storage types, and power electronics utilized in HEVs. The design and operation of HEVs will be demonstrated using simulation software (e.g. MATLAB/Simulink). Moreover, the environmental and economic impacts and current limitations of mass deploying of EVs will be discussed extensively.
    - **Course Pre and/or Co-Requisites**: PHY 2048, EEL 3112C - Circuits 2 or EEL 3110 Principles of Electrical Engineering, MAC 2313 Analytic Geometry and Calculus 3
- **Required Texts and Materials:**
    - **Required Text:** Husain Iqbal, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 3rd edition, 2021. ISBN-13: 978-1138590588.
      Instructional Materials: Textbook, power point slides, lectures and references.
    - **References:**
        - Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press, 3rd edition, 2018. ISBN-13: 978-1498761772.
        - James Larminie, Electric Vehicle Technology Explained, Wiley India Pvt.Ltd, 2nd edtion 2015. ISBN-13: 978-8126557608)
    - **Materials**: Matlab/Simulink

Course Objectives:

- Provide an overview of Hybrid and Electric Vehicles (HEVs) including the fundamentals, vehicle dynamics, and architectures.
- Simulate and analyze the performance of EVs;
- Cover energy storage types used within EVs and their power management systems;
- Use MATLAB/Simulink software to demonstrate the understanding of EVs and their operation

Course Learning Outcomes (CLOs)

- Describe the basic concept of EVs and HEVs structure and operation.
- Analyze the battery and battery management system of HEVs and EVs
- Model and interpret the basic components of an EV powertrain
- Evaluate the performance of the developed models using simulation studies.
- Apply MATLAB/Simulink software tools to simulate the operation of the used models.

Alignment with Program Outcomes (ABET)

After successfully completing the course with a grade of C (2.0/4.0) or better, the student should be able to do the following:

Course Learning Outcomes (CLOs):	#	After successfully completing the course with a grade of C (2.0/4.0) or better, the student should be able to do the following:	Learning Level	ABET Outcomes
	1.	Describe the basic concept of EVs and HEVs structure and operation.	2	1-L
	2.	Analyze the battery and battery management system of HEVs and EVs	4	1-D
	3.	Model and interpret the basic components of an EV powertrain	4	1-D
	4.	Evaluate the performance of the developed models using simulation studies.	5	1-D
	5.	Apply MATLAB/Simulink software tools to simulate the operation of the used models.	3	2-D

Course Policies

Attendance Students in face-to-face (this includes labs and C-courses) courses are expected "to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor" (University Policy, FPU-5.0010AP). Attendance is mandatory. [Exceptions to any attendance requirements may be made on a case-by-case basis.]

Attendance

- Students in face-to-face (this includes labs and C-courses) courses are expected "to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor" (University Policy, FPU-5.0010AP).

Participation

Students are expected to participate in the classroom experience. The use of earbuds/headphones during class is specifically not allowed and students who engage in this behavior may be asked to leave the class for the day (noting exceptions for authorized accommodations). In addition, students who routinely do not bring materials to class that are required for participation, will not be given credit for class attendance, and if this becomes a pattern of behavior, may be asked to leave the class for the day. Persistent problems with participation may result in a code of conduct referral.

Late Work/Make-up work

No makeup tests or quizzes, except in case of emergency, e.g. illness and accident. For makeup tests, a medical certificate is required, and the instructor MUST be notified in advance of the test.

Grading Scale

Grade	Percentage
A	100 - 93
A-	92 – 90
B+	89 – 86
B	85 – 83
B-	82 – 80
C+	79 – 76
C	75 – 70
D	69 – 60
F	59 – 0

Percentages that fall between grades will be rounded up.
Grades will be posted to Canvas for reference only, and students should make sure they are recorded correctly. Grades for each assignment will be posted to Canvas, and students should make sure they are recorded correctly. However, there is no guarantee that the percentages or projected grades provided are correct. The instructor will calculate final percentages and will determine final grades regardless of Canvas calculations.

Assignment/Evaluation Methods

Assignment/Evaluation Methods:	Grade items: projects, assignments, and Final Exam throughout the semester after the completion of a specific topic area – see the schedule for more details.	Points
	Attendance	5
	Assignments and Projects	30
	Midterm Exams	30
	Final Project	15
	Final Exam	20

Special Notes and instructions:

• All assignments must be turned in on time. Late assignments/reports will NOT be accepted.
• All Assignment solutions/reports must the submitted in PDF files at the CANVAS site unless otherwise stated. No resolution images of assignments.
• DO NOT send assignments by email. The CANVAS drop box is the only place to submit your assignments
• Students are expected to spend at least two hours completing "out of class student work" for each hour in class. Some or all out of class work will be graded and will comprise the percentage of the final course grade. Last but not least, when you email the instructor, you must mention the course number in your note.

Changes in syllabus and assignment sheet:

Changes in syllabus and assignment sheets may be modified as deemed appropriate. All changes will be announced in class and in Canvas Announcements.

Naming Files: Name the file as the Assignment, Report or Exam by following this format: Last name _ Assignment (Lab or Exam) #. For example: Smith_Assignment1.pdf, Smith_Exam1.pdf

Course Schedule

- Tentative Schedule (Subject to change)
- Changes in syllabus and assignments may be modified as deemed appropriate. All changes will be announced in class.
- Important Dates: https://floridapoly.edu/academics/academic-calendar/index.php

Week	Date Range	Topics	Classes
1-2	Jan 12 – 23	Introduction to Alternative Vehicles	4
3	Jan 26 - 30	Vehicle Mechanics – Roadway Fundamentals to Vehicle Kinetics	2
4	Feb 02 – 06	Vehicle Mechanics – Vehicle Kinetics to Propulsion Power	2
5-6	Feb 09 – 20	Vehicle Mechanics – Propulsion Power, Velocity and Acceleration	4
7-8	Feb 23 – Mar 06	Vehicle Mechanics – Introduction to Braking Exam 1	4
9	Mar 09 – 13	Architecture of EVs and HEVs	2
10	Mar 16 - 20	Spring Break	
11- 13	Mar 23 – April 03	Battery Basics an Parameters Exam 2	6
14	April 06 - 17	Powertrain of EVs - Configuration	2
15	April 20 – April 24	Powertrain of EVs - Traction and Vehicle Performance. Final Project	2
16	April 25 – April 28	Review	1
17	May 04 – May 08	Final Exam week	0

Note: This is a tentative schedule. Changes may occur as the semester progresses. WITHDRAWAL DATE WITHOUT ACADEMIC PENALTY DEADLINE (W ASSIGNED): **April 17, 2026**

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the University website and Canvas, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Tutoring and Learning Center (TLC)**: : The Tutoring and Learning Center (The TLC) provides tutoring to all Florida Poly students who may need additional academic support. The TLC is staffed by students who have excelled in the courses they tutor. They offer support by reviewing concepts and materials from class, clarifying points of confusion and providing assistance with learning strategies. While the focus of TLC is to

provide support to students in freshman-level courses, upper-level courses are also tutored at the Center. The TLC is located in the IST Commons (second floor).

- **Knack Tutoring:** Students looking for additional assistance outside of the classroom are advised to consider working with a peer tutor through Knack. Florida Polytechnic University has partnered with Knack to provide students with access to verified peer tutors who have previously aced this course. To view available tutors, visit floridapoly.joinknack.com and sign in with your student account.
- **Academic Success Coaches**: All students at Florida Poly are assigned an Academic Success Coach. Your Academic Success Coach can assist you with academic success strategies. Please visit the Student Success Center on the second floor of the IST building to meet with an Academic Success Coach.
- **Writing Center**: Located on the second floor of the IST (2059/2061), the Writing Center helps students to develop their writing and presentation skills. Consultations are available in person and virtually. For more detail, visit https://floridapoly.edu/writingcenter.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. The Office of Disability Services (ODS), facilitates reasonable accommodations for students with disabilities and documented eligibility. It is the student's responsibility to self-identify as a student with disabilities and register with ODS to request accommodations. If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course through the ODS student portal, and communicate with your instructor about your approved accommodations as soon as possible. Arrangements for testing accommodations must be made in advance. Accommodations are not retroactive. If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible: DisabilityServices@floridapoly.edu; (863) 874-8770; www.floridapoly.edy/disability.

Accommodations for Religious Observances, Practices and Beliefs

The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work assignments. (See University Policy.)

Title IX

Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. Resources are available if you or someone you know needs assistance. Any faculty or staff member you speak to is required to report the incident to the Title IX Coordinator. Please know, however, that your information will be kept private to the greatest extent possible. You will not be required to share your experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University Ombuds Office, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment. The Title IX Coordinator is available for any questions to discuss resources and options available.

Academic Integrity

Violations of academic integrity regulation include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to use of Artificial Intelligence tools), illegal use of intellectual property, and inappropriately aiding other students. Such actions undermine the central mission of the university and negatively impact the value of your Florida Poly degree. Suspected violations will be fully investigated, possibly resulting in sanctions up to and including expulsion from the university.

Any “special” instructions that are appropriate for academic integrity and the course should go here.

(It is essential that a heading and a statement on what constitutes, includes, academic integrity be included in the syllabus, and that the students be made aware of academic integrity at the beginning of a course.)

Recording Lectures

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. Recordings may not be used as a substitute for class participation or class attendance. Recordings may not be published or shared in any way, either intentionally or accidentally, without the written consent of the faculty member. Failure to adhere to these requirements is a violation of state law (subject to civil penalty) and the student code of conduct (subject to disciplinary action). Recording class activities including, but not limited to, lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers is prohibited.

Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers is ***prohibited****.*

Civility and Collegiality (optional statement)

Faculty and students come to the university for the same reason, which is to participate in a highly professional educational environment. To that end, both students and faculty are expected to treat each other with mutual regard and civility. Communication, written, oral and behavioral, between faculty and students must remain respectful. Within and outside of the classroom, students must refrain from derogatory comments toward the faculty member and their fellow students, and faculty as well must refrain from derogatory comments toward their students. Faculty and students should address each other with respect, in accordance with the wishes of the faculty and the students: for example, no one should be addressed by their last name alone.

Faculty from the outset of a course can and should specify what constitutes activities and behavior that take away from, that diminish, the educational environment. An individual student’s distracting behavior impedes the education of fellow students, which itself is a form of disrespect. Civility and collegiality also include respecting each other’s time: for example, neither students nor faculty should arrive late to class (unless unforeseen, pressing circumstances prevail); faculty should be present at the posted office hours; and students and faculty should be punctual when meeting times are scheduled. In more general terms, collegiality means respecting the right of both faculty and students to participate fully and fairly in the educational enterprise.