

**ME 497B**  
**HYBRID-ELECTRIC VEHICLE LAB I**  
Fall 2008

Project Management Site: <https://student.hev.psu.edu>

Meeting Times	Thursday 8:00 AM – 9:15 AM, 251 Willard Monday 6:30 PM – 7:45 PM, 114 Research Building B	
Instructor	Gary Neal 301 Applied Science Building 863-5468      863-6185 FAX <a href="mailto:gln103@psu.edu">gln103@psu.edu</a>	
Office Hours	By appointment	
Text	There is no required textbook. See page 4 for recommendations.	
Grading	Attendance	10%
	Written reports	30%
	Oral presentations	20%
	Ecocar X events	15%
	Quizzes	10%
	Peer and customer evaluation	15%
Background	The Hybrid-Electric Vehicle (HEV) Lab is designed around Penn State's Advanced Vehicle Technology Competition (AVTC) team: Ecocar. The Lab was created to encourage student participation in the AVTC by providing academic credit for completing an AVTC-related project. Two semesters of HEV Lab (ME497B and ME497A - 3 credits total) can fulfill the normal three-credit writing-intensive senior design requirement for Mechanical Engineering students (ME440W or ME441W).	
Course Objectives	The objectives are identical to those of the writing-intensive Mechanical Engineering senior design courses (ME440W/ME441W):  A. Apply academic training and education to provide a professional engineering solution to a real-life problem  B. Implement the design process to a professional engineering problem  C. Work effectively in a team that includes coworkers, customers and vendors  D. Communicate well using verbal, written and electronic methods	

## Course Outcomes

The expected outcomes are essentially the same as those of the writing-intensive Mechanical Engineering senior design courses (ME440W/ME441W). The mapping of course outcomes to course objectives is indicated in brackets below. Upon completing this course, the student should be able to:

1. Identify and utilize appropriate engineering analysis software during the execution of the project (e.g., Matlab, Mathcad, FLUENT, SolidWorks etc.) [A]
2. Learn to use new evolving engineering tools for analysis, fabrication and management [A]
3. Develop the ability and confidence to make technical decisions based on analysis and research [A]
4. Apply creative ability; i.e. learn to generate ideas focused on solving the identified project technical tasks [B]
5. Conceptualize devices and systems to satisfy design criteria [B]
6. Analyze technical and economic merits of design alternatives [B]
7. Select the most suitable solution that is both useful and feasible by using engineering analysis, modeling and simulation, while keeping in mind any side or long-term environmental and societal effects [B]
8. Learn to use information gained from the first solution to iterate and improve or refine and improve the design and/or solution [B]
9. Face the necessity to wrap up a job or task completely and be able to defend technically each step from broad concept to detailed design [B]
10. Clearly define the project needs and then develop an action plan to organize, schedule and execute the project deliverables in a timely fashion and within budget [C]
11. Cooperate as a group to accomplish a technical task, requiring division of effort and coordination of separate contributions [C]
12. Use resources such as library, patent literature, source people, hardware vendors and support personnel [C]
13. Interact with a customer (boss, coworker, client) to formulate equitable design criteria (time, cost, quality) for a meaningful engineering project [C]
14. Use skills in engineering communications, engineering drawings, graphics, written and oral reports, and shop work [D]
15. Interact with industrial sponsors and produce a working product or a model that satisfies the project needs [D]
16. Demonstrate professionalism in interactions with colleagues, faculty, and staff [D]

## Requirements

HEV Lab participants take on a challenging design project that is supervised by the AVTC team student and faculty leadership (the “customer”). 2008-2009 is the first year of the three-year Ecocar project. In year one, modeling and simulation are emphasized. In year two, the team will build a “mule” vehicle and compete in the June 2010 competition. In year three, the team will refine the powertrain and controls with an emphasis on further vehicle hardware and software refinements, consumer acceptability, and robustness for this “production” vehicle that competed in the June 2010 competition. This emphasis will be reflected in the course assignments and evaluation. Each Lab student is required to participate in broader aspects of Ecocar (e.g., planning, outreach and public relations, fundraising, report preparation, garage infrastructure, etc.).

To participate in the project, each student is required to complete and submit the following forms: a Skills Survey, a Student Contract and Emergency form, a HEV Garage Key Clearance Form, their 3-year driving record from the DMV, and two Release of Liability forms (one for GM, one for PSU). Each student is expected to read and to abide by the safety policies enumerated in the handout “Student Policies for PTI Facilities Usage.” Students working in the garage are required to receive safety training and machining training through the Learning Factory, and chemical and hazardous waste handling training through Environmental Health and Safety. Students are also required to enroll in the Ecocar Listserve and apply for an Ecocar Sharepoint File Server account. If for any reason a student feels that they will be unable to comply with these requirements, they should discuss the issue with the instructor immediately (that is, very *early* in the semester).

Students are expected to monitor regularly (e.g., daily) the Ecocar Project Management website (<https://student.hev.psu.edu>): in particular, the *Calendar*, the *Forums*, the *Files*, and the *Finance* tabs. Students are responsible for any assignments and/or events posted in these areas. Students are expected to actively participate in the Forum discussions, to document their activities, and to archive all relevant documentation. Students also are expected to sign up for the Ecocar listserv administered by Argonne National Labs.

Grading is based on timely and effective written and oral communication; on design, build, integration, and test of the team’s subsystem or project as part of the overall AVTC effort; and on active participation in the broader aspects of Ecocar. The course schedule is linked to the Ecocar competition schedule, and assignments are tied to Ecocar deliverables.

## Attendance

Regular attendance is expected and attendance will be taken. Keep in mind that your grade includes peer evaluations by your fellow ME497B students (“coworkers”) and by Ecocar team leaders (“customers”).

- Academic Integrity      In this course, you are expected to work in teams. A major component of this course is technical writing and communication. In preparing written or oral reports, keep in mind that taking information (e.g., figures, tables, text) from published sources without proper acknowledgement is inappropriate: in fact, it is plagiarism. The commission of any deliberately dishonest act may result in failure of the course with no late drop permitted. Examples of dishonest acts include plagiarism, or signing the attendance sheet for another student. For further information, see [http://www.engr.psu.edu/www/ug/acad\\_int/students/default.htm](http://www.engr.psu.edu/www/ug/acad_int/students/default.htm).
- Some Websites            <http://www.ecocarchallenge.org> - Argonne National Laboratory's Ecocar competition site; userid and password required for Student Login
- <http://www.hev.psu.edu> - Penn State AVTC team
- <http://www.sae.org> - SAE International
- <http://www2.mne.psu.edu/sae/fsae> - Penn State Formula SAE competition team
- <http://www.pti.psu.edu> - Penn State Pennsylvania Transportation Institute
- <http://www.lf.psu.edu> - Penn State College of Engineering Learning Factory
- <http://www.ehs.psu.edu/> - Penn State Environmental Health and Safety
- Some Books                R. Stone and J.K. Ball, *Automotive Engineering Fundamentals*, SAE (2004). ISBN 0-7680-0987-1
- J.M. Miller, *Propulsion Systems for Hybrid Vehicles*, IEE (2003). ISBN 0-86341-336-6
- J.M. German, *Hybrid Powered Vehicles*, SAE (2003). ISBN 0-7680-1310-0
- M. Westbrook, *The Electric and Hybrid Electric Car*, SAE (2001). ISBN 0-7680-0897-2
- L.S. Litowitz and R.A. Brown, *Energy, Power, and Transportation Technology*, Goodheart-Wilcox (2007). ISBN 1-59070-221-2
- K. Ulrich and S. Eppinger, *Product Design and Development*, 4th edition, McGraw-Hill/Irwin (2007). ISBN 10:0073101427; 13:978-0073101422