**Course Prefix, Number, Title, and Credit Hours**

ECE 5791, Vehicle Power Management, 3 Credits

Prof. Xi Zhang and Prof. Chris Mi

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Office Hours: Tuesday 11am-2:00pm

Dearborn Discovery Core Category or Categories:

Course Meeting Times and Format(s): Tuesdays 2:00-5:00pm, Lectures

**Course Description**:

This course gives graduate students a clear understanding of the latest vehicle power management technologies especially for alternative fuel vehicles. The course will cover topics such as electrified powertrain configurations, vehicle power management basic concepts, vehicle propulsion system modeling, vehicle power management approaches (analytical approach, wavelet transform technology, DP&QP, intelligent system methods), ESS (especially battery) management, power electronics in HESS and motor drive, HEV component optimization, HIL and SIL, vehicle power management future trends, and so on.

**Program Goals**

<http://www.engin.umd.umich.edu/ECE/grad_prog/general.php>

**Course Objectives**

* Understand various powertrain configurations in alternative fuel vehicles
* Understand basic concepts of vehicle power management
* Grasp the major vehicle power management strategies for fuel economy improvement and/or component lifetime extension
* Complete a simulation project to implement one vehicle power management strategy

**University Attendance Policy**

A student is expected to attend every class and laboratory for which he or she has registered. Each instructor may make known to the student his or her policy with respect to absences in the course. It is the student’s responsibility to be aware of this policy. The instructor makes the final decision to excuse or not to excuse an absence. An instructor is entitled to give a failing grade (E) for excessive absences or an Unofficial Drop (UE) for a student who stops attending class at some point during the semester.

**Academic Integrity**

The University of Michigan-Dearborn values academic honesty and integrity. Each student has a responsibility to understand, accept, and comply with the University’s standards of academic conduct as set forth by the Code of Academic Conduct (http://www.umd.umich.edu/policies\_st-rights/), as well as policies established by each college. Cheating, collusion, misconduct, fabrication, and plagiarism are considered serious offenses, and may be monitored using tools including but not limited to TurnItIn. Violations can result in penalties up to and including expulsion from the University. At the instructor’s discretion, the penalty may be a grade of zero on the assignment up to and including recommending that the student be expelled from the University. It is the sole responsibility of the student to understand and follow academic guidelines regarding plagiarism. The University of Michigan–Dearborn has an online academic integrity tutorial that can be accessed at <http://webapps.umd.umich.edu/aim>.

**Disability Statement**

The University will make reasonable accommodations for persons with documented disabilities. Students need to register with Disability Resource Services (DRS) every semester they are enrolled for classes. DRS is located in Counseling & Support Services, 2157 UC.  To be assured of having services when they are needed, students should register no later than the end of the add/drop deadline of each term. Visit the DRS website at: http://www.umd.umich.edu/cs\_disability/. If you have a disability that necessitates an accommodation or adjustment to the academic requirements stated in this syllabus, you must register with DRS as described above and notify your professor. Upon receipt of your written notification, we will make accommodations as directed by DRS.

**Safety**

All students are strongly encouraged to register in the campus Emergency Alert System, used to communicate with the campus community during an emergency. More information on the system and how it works, along with enrollment information can be found at: <http://umemergencyalert.umd.umich.edu/> Please note that the system will only communicate through UM-Dearborn email accounts, so if you primarily use a non-university account you should forward your UM-Dearborn email to your primary account.

All students are also encouraged to program 911 and UM-Dearborn’s Public Safety phone number (313) 593-5333 into personal cell phones. In case of emergency, first dial 911 and then if the situation allows call UM-Dearborn Public Safety.

Students are encouraged to identify two ways out of the building as well as to locate the building’s designated assembly area where students are expected to go in the event of an evacuation: <http://www.umd.umich.edu/fileadmin/env-health-safety/public/files/Site_Assm_Areas_2011.pdf>. For those students requiring assistance in an evacuation, please visit the following site to identify the nearest “Area of Rescue Assistance”: <http://www.umd.umich.edu/fileadmin/env-health-safety/public/files/Handicap_Accessible_Locations.pdf> Please also familiarize yourself with the locations in this building identified as shelter areas in the event of severe weather. Specific shelter locations for severe weather incidents can be located at: <http://www.umd.umich.edu/691921/>

In the case of an active shooter we will shelter in place. If this becomes a necessity please:

* Contact 911 immediately to report an emergency.
* Find a safe area such as small rooms, under furniture, or other safe areas.
* Lock or block doors in rooms where you and others are located.
* For interior rooms, close blinds, shut off lights. Rooms facing outside - have blinds open!
* Get down—preferably under tables, furniture or equipment. Stay away from the door.
* Remain silent (silence all personal communication devices) and stay in place.
* If you are grouped in an area with other people, quietly select a leader.
* The leader should call 911 to report information such as number of people and location.
* Attempt to maintain a calm quiet atmosphere.
* Stay sheltered until you receive an “all clear” message from law enforcement.
* Follow law enforcement direction.

**Required Materials and/or Technology:**

REQUIRED: Zhang, X., Mi, C. (2011). Vehicle Power Management: Modeling, Control and Optimization. London, UK: Springer-London. ISBN-13: 978085729736

**Assignment and Grading Distribution:**

 1 Project 250

2 Writing Assignments (100 points each) 200

Homework and Attendance 50

**Grading Scale:**

 94%- 100% A 77%-79% C+

 90%- 93% A- 74%-76% C

 87%- 89% B+ 70%-73% C-

 84%- 86% B 67%-69% D+

 80%- 83% B- 64%-66% D

 60%-63% D-

 0%-59% E

**Course Outline (Including Major Due Dates and appropriate detail):**

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| **Date** | **Activity and Content** |
| Week 1 1/6 | Introduction and Syllabus  |
| Week 2 1/13 | Electrified Powertrain Configurations |
| Week 3 1/20 | Vehicle Power Management Basic Concepts |
| Week 4 1/27 | Modeling of Traditional Vehicle Components |
| Week 5 2/3 | Modeling of Electric Drive Components |
| Week 6 2/10 | Analytical Approach for Blended Mode PHEV Wavelet Technology Applied to Vehicle Power Management |
| Week 7 2/17 | Wavelet Technology Applied to Vehicle Power Management |
| Spring Break |  |
| Week 9 3/3 | DP and QP for Vehicle Power Management |
| Week 10 3/10 | Intelligent System Approaches for Vehicle Power Management |
| Week 11 3/17 | Energy Storage System (ESS) Management |
| Week 12 3/24 | Power Electronic Circuits in HESS and Motor drive |
| Week 13 3/31 | HEV Component Design and Optimization for Fuel Economy |
| Week 14 4/7 | Hardware-in-the-loop and Software-in-the-loop Testing |
| Week 15 4/14, Last Class | Future Technology Trends in Vehicle Power Management |