

## **Electrical Engineering 452**

### **Electric Machines and Power Electronic Drives**

### **(Spring 2012)**

<b>Instructor</b>	Dr. Dionysios Aliprantis, Assistant Professor, ECpE
<b>Contact</b>	1124 Coover Hall, 294-7387, <a href="mailto:dali@iastate.edu">dali@iastate.edu</a>
<b>Office hours</b>	Monday & Wednesday 9:00–10:00 am
<b>Classroom</b>	Coover 1012 Tuesday & Thursday 11:00–11:50 am
<b>Laboratory</b>	Coover 1102 Section A: Tuesday 4:10–7:00 pm Section B: Wednesday 12:10–3:00 pm Section C: Wednesday 3:10–6:00 pm
<b>Web page</b>	N/A; all material will be posted on Blackboard Learn
<b>TA #1 (labs)</b>	Nicholas David
<b>Contact</b>	<a href="mailto:ndavid@iastate.edu">ndavid@iastate.edu</a>
<b>Office hours</b>	TBA
<b>TA #2 (grader)</b>	Yuanzhen Xu
<b>Contact</b>	<a href="mailto:yxu@iastate.edu">yxu@iastate.edu</a>
<b>Office hours</b>	TBA
<b>Textbook #1</b>	A. M. Trzynadlowski, “Introduction to Modern Power Electronics,” 2 <sup>nd</sup> edition, Wiley, 2010, ISBN 978-0-470-40103-3
<b>Textbook #2</b>	P. C. Krause and O. Wasynczuk, “Electromechanical Motion Devices,” Wiley

**Learning Goals:**

1. Fundamentals of power electronic circuits
2. Fundamentals of rotating electric machines and motor drives (electromechanical energy conversion)
3. Applications of power electronics and motor drives, especially in renewable energy and electric vehicles
4. Computer simulation of power electronics and motor drives
5. Microprocessor-based control of power electronics and motor drives

**Course Prerequisites:**

E E 303; E E 330 or E E 332; credit or registration in E E 324.  
Familiarity with Matlab/Simulink is useful.

**Tests:**

There will be two or three announced midterms, and a final exam. You are expected to take all tests unless you become injured or very ill or experience a death in your family (in such cases, please contact me as early as possible).

**Homework Assignments and Lab Exercises:**

Besides the tests there will be homework assignments. For each assignment, it will be your responsibility to complete and hand in on time.

Lab exercises are to be delivered at the end of each lab session.

**Class/Lab Attendance:**

You are strongly encouraged to attend class, but roll will not be called. You are responsible for all information presented in class. The Web site, instructor, and TAs, although freely available to you, are not responsible for providing you with in-class information if you choose not to attend class.

Attending the laboratory sessions is mandatory, and it will be monitored closely.

**Class/Lab Preparation:**

Reading the appropriate material in the text before the class or laboratory session is essential.

**Course Grading Policy:**

Homework	20%
Laboratory exercises	40%
Midterm exams	20%
Final exam	20%

**Letter grades will be determined by the following guidelines:**

≥85%	A
≥80%	A-
≥75%	B+
≥70%	B
≥65%	B-
≥60%	C+
≥55%	C
≥50%	C-
<50%	F

**Communication:**

Feel free to communicate with me in any way that is convenient to you (after class, during office hours, phone, e-mail), for questions about the course material or assignments. Inquiries regarding recordings of your grades should be directed to

the grader. All other inquiries, including questions on the grading of assignments or in-class material, special situations, etc., should be directed to the instructor.

**Special Needs:**

Please address any special needs or special accommodations with me at the beginning of the semester or as soon as you become aware of your needs. Those seeking accommodations based on disabilities should obtain a Student Academic Accommodation Request (SAAR) form from the Disability Resources (DR) office (515-294-7220 or TTY 515-294-6635). DR is located on the main floor of the Student Services Building, Room 1076.

**Academic Misconduct:**

Academic Misconduct in any form is in violation of Iowa State University Student Disciplinary Regulations and will not be tolerated. This includes, but is not limited to: copying or sharing answers on tests or assignments, plagiarism, and having someone else do your academic work. Depending on the act, a student could receive an F grade on the test/assignment, F grade for the course, and could be suspended or expelled from the University. See the Conduct Code at <http://www.dso.iastate.edu/ja> for more details and a full explanation of the Academic Misconduct policies.

**Tentative Lab Schedule**

LAB #	TOPIC	STUDY MATERIAL
1	Introduction to simulation of power electronics circuits with Simulink/ASMG	Simulink/Getting Started ( <a href="#">PDF</a> ) TRZ 1.1-1.2, 1.6.1-1.6.2
2	Introduction to the TI F28035 development board	F28035 Piccolo controlCARD ( <a href="#">web</a> )
3	Voltage and current sensing with the TI F28035 board	
4	Figures of merit	TRZ 1.3 & App. B
5	Buck converter with RL load (simulation)	TRZ 6.2-6.2.1
6	Buck converter with RL load (hardware)	TRZ 2
7	Boost converter with RL load (simulation)	TRZ 6.3
8	Boost converter with RL load (hardware)	
9	Four-quadrant chopper with RL load (simulation)	TRZ 6.2.5
10	Single-phase inverter with RL load and sine-triangle modulation (hardware)	TRZ 1.5, 7.1.1
11	Squirrel-cage induction motor (classical tests)	KR 1, 2, 4, 5, 6.1-6.10
12	Introduction to induction motor with position encoder	KR 6.11
13	Vector control of induction motor (simulation)	KR 6.11
14	Vector control of induction motor (hardware)	
15	Brushless DC motor or Permanent-magnet synchronous motor	KR 8