ECE 2795 – Advanced Electric Machines and Drives
Graduate Credit Syllabus

Description:
Electric machines and drives play a crucial role in modern economies, with recent advances achieving unprecedented levels of performance, flexibility and efficiency. This is a course in electric machine and drive analysis and modeling, along with their control systems. We will cover the dq0 transformation, reference frame theory, saturation, unbalanced operation and dynamics in electric machines. We will then cover the converter topologies typically used in machine drives, power electronic device characteristics, pulse-width modulation techniques, current regulation, torque and speed control, and space vector control. Students will be able to analyze and specify electric machines and controls as a system-of-systems.

Class Meeting Schedule:
Wednesday from 6:00 to 8:30 pm
Benedum Hall room TBD

Pre-requisites
An undergraduate course in electric machinery.

Instructor:
Robert Kerestes, PhD
Office: 1224 Benedum Hall
Office Phone: 412-383-5251
Email: rjk39@pitt.edu
Office hours: TBD

Learning Outcomes:
By the end of this course, graduate students will be able to:

1. Apply Maxwell's equations to the analysis and design of electric machinery.
2. Apply Park's transformations and other useful transformations to the analysis and design of electric machinery
3. Model synchronous and induction machines using CAD tools.
4. Explain the benefits of using electric drive systems.
5. Analyze and design some of the common electric drive topologies.

Required text(s) and suggested readings:
Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Analysis of Electric Machine and Drive Systems, ISBN-10: 047114326X | ISBN-13: 978- 0471143260

Instructional Delivery:
This course will be 75% lecture, 25% in-class group work.

Course Requirements:

Homework (10% of grade). There will be five homework assignments, each of equal weight. These homework assignments will be worked on in groups of three.

Project (30% of grade). There will be one project which will consist of a research paper and presentation on relevant course material.

Midterm (30% of grade). Midterm exam will cover the first half of the material.

Final Exam (30% of grade). The final exam will cover the second half of the material.

Grading Scheme: The following scale shows the minimum grade that will be awarded for a given percentage.

A+ = ≥ 97%	C = 73-77%
A = 93-97%	C- = 70-73%
A- = 90-93%	D+ = 67-70%
B+ = 87-90%	D = 63-67%
B = 83-87%	D- = 60-63%
B- = 80-83%	F = < 60%
C+ = 77-80%	

Tentative Topical Outline

Please recognize that this is a "best guess" of our progress through content. Revisions may be required as the semester yields weather constraints and/or for other unforeseen issues. Every effort will be made to keep all informed of any changes that occur.

Week 1 Theory of electromechanical energy conversion

Week 2 Distributed windings in AC machinery; Homework 1 Due

Week 3 Reference frame theory

Week 4 Permanent magnet AC machines

Week 5 Synchronous machines; Homework 2 Due

Week 6 Symmetrical induction machines

Week 7 Midterm Exam

Week 8 Machine equations in operational impedances with time constants; Homework 3 Due

Week 9 Alternative forms of machine equations

Week 10 Unbalanced operation and single-phase induction machines

Week 11 DC machines and drives; Homework 4 Due

Week 12 Semi-controlled bridge inverters

Week 13 Fully controlled three-phase bridge inverters; Homework 5 Due

Week 14 Induction motor drives

Week 15 Final exam

Academic Integrity
Groups must do their own work. Plagiarism of another group or another author's work is a serious offense, and can result in dismissal from the University of Pittsburgh. Groups may consult each other with regard to the homework problems, but must not turn in identical assignments.

Attendance Policy
This is a graduate level course where participation is expected. Hence, absence in excess of 10% of class meetings will result in the lowering of the earned total by one letter grade for each absence in excess of 10%.

Disability Services
If you have a disability for which you may be requesting accommodation, please contact Prof. Kerestes and the Office of Disability Resources and Services {216 WPU and 412-648-7890} as soon as possible. www.drs.pitt.edu

Submission of Assignments
Assignments will be submitted at the beginning of class. Distance students should upload the assignment to Blackboard.

Distance learning related components
All learning outcomes in this Distributed Learning course are equivalent to face-to-face (F2F) version of this course.

This course is an asynchronous online course. Students will work at different times from different locations and will not be required to attend any face-to-face (F2F) or synchronous meetings at the same time.

Online lectures will be provided through Adobe Connect Professional. Therefore, students must has access to the Internet to view/hear lectures. No special software is required. Students will also submit all assignments and take all quizzes/tests through Blackboard.

Minimal technical skills are needed in this online course. All work in this course must be completed and submitted online. Therefore, students MUST have consistent and reliable access to a computer and the Internet. Before starting this course, students must feel comfortable doing the following. The minimal technical skills students should have include the ability to:

- organize and save electronic files,
- use email and attached files,
- check email and Blackboard daily, and
- download and upload documents.