ECE 5041: Electric Machines

Course Description

Principles of electromechanical energy conversion; basic structures of electric machines; steady state models and performance analysis; advanced topics on AC machine control.

Prior Course Number: ECE 643 and ECE 743
Transcript Abbreviation: Electric Machines
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 3020 (323) and 3040 (341), or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.
Exclusions: Not open to students with credit for 743.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Master analyzing the stated-state and dynamic performance of different kinds of machines including: synchronous, induction and dc machines.
Be competent with using phasor analysis to analyze the steady-state performance of ac circuits and devices.
Be competent with the magnetic material properties.
Be competent with device modeling with windings associated with magnetic coupling.

Be competent understanding the relationship and interactions between electric equivalent circuit model and magnetic equivalent circuit model.
Be competent with the concept of time-varying transformations in the analysis of time-varying systems.
Be competent with the field-oriented control of induction machines.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction to electromechanical energy conversion, principles of electric machines	6.0							
General structure and major components of electric machine; derivation of steady state model of electric machines and other electromechanical devices	6.0							
Steady state performance analysis of electric machine and other electromechanical devices	3.0							
Variable speed control and operation of electric machines	3.0							
Matrix representation of magnetic coupling of windings	3.0							
Dynamic modeling and simulation of AC machines	6.0							
Interface of AC machine with voltage source converters	3.0							
AC machine with power electronics control	3.0							
Torque and speed capability of AC machine drives	3.0							
Vector control of AC machines	6.0							
Special topics on permanent magnetic machines and control	3.0							

Representative Assignments

Computer simulation process and results in report
Homework

Grades

Aspect	Percent
Reports and homework	35%
Quizzes	5%
Exams	60%

Representative Textbooks and Other Course Materials

Title	Author
Electromechanical Motion Devices	PC Krause, Oleg Wasynczuk and Steve Pekark

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
**	a	An ability to apply knowledge of mathematics, science, and engineering.
***	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.
*	d	An ability to function on multi-disciplinary teams.

Course Contribution		College Outcome
**	e	An ability to identify, formulate, and solve engineering problems.
*	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
*	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Update course description, abbreviation, prereqs and exclusions to match university version.

Added textbook 9/10/12

Remove 643 from exclusions 12/5/12

update course goals 6/16/16 BLA

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