ECE 3047: Sustainable Energy and Energy Conversion Lab

Course Description

Laboratory introducing basics of energy conversion processes for electrical energy supply systems utilizing conventional rotating machines and hardware-in-the-loop simulation system for sustainable energy systems.

Prior Course Number: 447
Transcript Abbreviation: Sustain Energy Lab
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Junior, Senior
Course Offerings: Autumn, Spring, Summer
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 1.0
Repeatable: No
Time Distribution: 0.5 hr Lec, 2.5 hr Lab
Expected out-of-class hours per week: 0.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 3040 (341), and enrollment in ECE or EngPhysics major.
Exclusions: Not open to students with credit for 447.
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: Baccalaureate Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Master the basic concepts of transformers, 3-phase ac synchronous generators, 3-phase ac induction motors, and dc motors
Be competent with the data acquisition concepts related to higher voltages and currents
Be competent with operation of the ac and dc electric machinery in both generating and motoring modes
Be familiar with the computer simulation tools like MATLAB/Simulink and SimPowerSystems
Be exposed to using the real-time simulation platform

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction to electrical energy systems; laboratory data acquisition system	1.5		1.5					
Introduction of hardware-in-the-loop based real time simulations; failure modes can be simulated and utilizing D/A capability can monitor real-time v(t)s and i(t)s.	2.0		4.0					
DC machines (motor mode), including variable speed operation	1.5		4.5					
Transformers and 3-phase synchronous generators	1.0		5.0					
3-phase induction machines motor & generator action, with variable speed motor drive	1.0		5.0					
Hardware-in-the-loop - photovoltaic energy systems	1.5		4.5					
Hardware-in-the-loop - other renewable sources, such as wind	1.5		4.5					
Hardware-in-the-loop energy storage systems	0.5		2.5					

Representative Assignments

Off-line (i.e., pre-lab) calculation of operating characteristics over a range of loading for various motors given the parameters of the machines - purpose, to compare with lab obtained data.
Perform off-line (i.e., pre-lab) simulations for the various experiments related to hardware-in-the-loop simulation system -- purpose, to predict ahead of conducting the lab experiment the operating characteristics and compare results.

Grades

Aspect	Percent
Mid semester Exam	25%
Final Exam	25%
Laboratory reports including participation; also includes any pre-lab modeling/simulation assignments.	50%

Representative Textbooks and Other Course Materials

Title	Author
ECE 3047 Lab Manual	provided by department

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.
**	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.

Course Contribution		College Outcome
	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 prereqs, exclusiong, and abbreviation to match university version.

Prepared by: Betty Lise Anderson