PURDUE UNIVERSITY | Elmore Family School of Electrical and Computer Engineering

Engineering Faculty Document No. EFD 48-22
January 31, 2022

Memorandum

To: The College of Engineering Faculty

From: The Elmore Family School of Electrical and Computer Engineering

Re: Course modifications to ECE 43300 Power Electronics

The faculty of the Elmore Family School of Electrical and Computer Engineering has approved the changes to the following undergraduate course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

FROM

ECE 43300 Power Electronics, Sem. 2, Class 3, Lab 0, Cr. 3.
Prerequisites: ECE 20002

Introduction to the fundamental operating principles of power conditioning circuits that are currently being used to effect power flow from ac to dc and vice versa. Emphasis is on the relationship between form and function of these circuits. Circuits discussed will include ac/dc line-cummutated converters, dc/dc converters, dc/variable frequency converters, resonant converters, and ac/ac converters. Computer simulations will be used as a part of the course work.

Learning Outcomes: i) an understanding of the relationships between form and function and the roles played by various circuit components in ac-dc, dc-dc, and dc-ac converters. [1,2]; ii) a knowledge of the basic characteristics of switch types and classification of converters. [1]; iii) a knowledge of control and switching techniques, and operating principles of ac-dc, dc-dc, and dc-ac converters. [1]; iv) a knowledge of the methods of sizing the switching and energy storage elements in ac-dc, dc-dc, and dc-ac converters. [1,2]

TO:

ECE 31033 Power Electronics, Sem. 2, Class 3, Lab 0, Cr. 3.
Prerequisites: ECE 20002

Introduction to the fundamental operating principles of power conditioning circuits that are currently being used to effect power flow from ac to dc and vice versa. Emphasis is on the relationship between form and function of these circuits. Circuits discussed will include ac/dc line-cummutated converters, dc/dc converters, dc/variable frequency converters, resonant converters, and ac/ac converters. Computer simulations will be used as a part of the course work.

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Learning Outcomes: i) an understanding of the relationships between form and function and the roles played by various circuit components in ac-dc, dc-dc, and dc-ac converters. [1,2]; ii) a knowledge of the basic characteristics of switch types and classification of converters. [1]; iii) a knowledge of control and switching techniques, and operating principles of ac-dc, dc-dc, and dc-ac converters. [1]; iv) a knowledge of the methods of sizing the switching and energy storage elements in ac-dc, dc-dc, and dc-ac converters. [1,2]

Reason: The Power and Energy Systems revolves around three areas: rotating electric machinery, power electronics, and power systems. While these three areas mesh well together, some people stay within their area and do not venture out into the others. The proposal is to bring ECE 43300 down to a 300-level course and it will serve as an introduction to the Power Electronics pathway. In addition, this course will serve students better prior to their late junior or senior year to better prepare them for their senior design experience.

Milind Kulkarni
Associate Head of Teaching and Learning
Professor of Electrical and Computer Engineering

ECE433

Power Electronics

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TA:	Tim Donnelly, donnellt@purdue.edu
TA Office:	TBD
TA Hours:	Mon 1-3 pm, Tues 1-3 pm, Fri 9:30-11:30 am
Text:	**Power Electronics – Dan Hart**
Prerequisite:	Undergraduate electronics course
Homework:	Initially periodic homework assignments will be used to build basic concepts. Assignments will not be collected or graded but are considered important for quiz preparation. However, after evaluating the first one or two quizzes, homeworks may be assigned more often and graded to improve student performance.
Projects:	Project I: Modeling and Analysis of Dc-Dc Converters Project II: Modeling and Analysis of Inverters Project III: TBD: Design of Closed-Loop Controlled Dc-Dc Converter, Common-mode Equivalent Circuits, Thermal Analysis, or Magnetics Design
Quizzes:	Biweekly quizzes will be given on Fridays
Exams:	Exam I – February 8 (100 pts) Exam II - March 22 (100 pts) Cumulative Final Exam (~ 200 points)
Grades:	Quiz scores will be summed and the percent taken to assign a value between 0-100. Project scores will be summed and the percent taken to assign a value between 0-150. The total sum of exam scores, and the equivalent project and quiz scores will be averaged to determine an overall percentage for the class. Grades will be assigned from this percentage. If homeworks need to be collected, hw scores will be averaged and scaled to represent a weight of 50 pts.
Policies:	All projects, quizzes, and exams are to be an individual's own work. Cheating on any of these will result in an F for the course. Projects submitted past the due date will receive a deduction of 40*(day submitted – day due) points. Cases of extended illness, family crisis, etc., will be handled on an individual basis.

Approximate Syllabus

Lecture(s)	Topic	Reading
4	Background/Tools	Chapter 2 (and 1)
9	Dc-Dc Converters	Chapter 6
6	Inverters	Chapter 8 + class
8	Rectifiers	Chapters 4-5 + class notes
5	Drive Circuits, Heat Sinks	Chapter 10
6	Common Mode Modeling	Class Notes/Papers
6	Control in Converters	Chapter 7 + class notes

Course Outcomes:

A student who successfully fulfills the course requirements will have demonstrated:

i. an understanding of the relationships between form and function and the roles played by various circuit components in ac-dc, dc-dc, and dc-ac converters. [1,4;a,c,k]

ii. a knowledge of the basic characteristics of switch types, and classification of converters. [1,3;a,e,k]

iii. a knowledge of control and switching techniques, and operating principles of ac-dc, dc-dc, and dc-ac converters. [1,4;a,e,k]

iv. a knowledge of the methods of sizing the switching and energy storage elements in ac-dc, dc-dc, and dc-ac converters. [1,4;a,c,k]

To pass the course, students must demonstrate they have met these course outcomes. Demonstration that these outcomes have been met must be accomplished by completing the models and demonstrating that they work in each of the three projects.