ELEC4430 Integrated Power Electronics Spring 2024 Credits: 3

Course Description

Power computation, diodes and rectifier circuits, power factor correctors, switch mode power converters, magnetic components, switch capacitor power converters, linear regulators, and integrated circuit techniques for controller design. Prerequisite(s): ELEC 3400

List of Topics

Lecture Outline

Week 1 Introduction; Power Computation
Week 2 Linear Regulators; Shunt and Series Regulators
Week 3 Stability and Compensation Technique; Protection Circuitry
Week 4 Switching Converters; Steady State Operation
Week 5 Other Switching Converter Topologies and Their Characteristics
Week 6 Non-ideal Performance of Switching Converters; DCM Operation
Week 7 Control Methodology; Band-Band Control
Week 8 PWM Control; PFM Control
Week 9 Current-Mode Control; Peripheral Building Blocks
Week 10 SMPC Closed-Loop Response and Stability; Magnetic Materials
Week 11 Air-gap and Inductor Design
Week 12 Power Factor and Crest Factor; Diodes Circuits
Week 13 Rectifier Circuits; Voltage Doubler

Intended Learning Outcomes:

On successful completion of this course, students will be able to:

CO1 - recognize magnetic quantities such as magnetic flux, permeability and reluctance, and compute magnetic quantities relating to inductors and transformers.

CO2 - recognize and compute electrical quantities such as power and work done related to both DC and AC circuits.

CO3 - compute operating parameters and characterize the performance of power converters and regulator circuits.

CO4 - analyze and design component parameters for power converters and regulator circuits.

CO5 - apply software (CAD) tools to design, simulate and analyze power converters and regulator circuits.

Textbook(s):

Lecture notes will be available on the course webpage.

Reference Books/Materials:

1. D.W. Hart, Power Electronics, McGraw-Hill, 2011.
2. P.T. Krein, Elements of Power Electronics, Oxford, 1998.
3. R.W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, Second Edition, Kluwer Academic Publishers, 2001

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework	12%
Project One	24%
Project Two	24%
Final Examination	40%