ELEN435 16

Course Summary

Course : ELEN435 **Title :** Introduction to Power Electronics
Length of Course : 16
Prerequisites : ELEN306, ELEN325 **Credit Hours :** 4

Description

Course Description: This course takes a student with a basic understanding of circuit analysis and introduces them to the functionality, topography, and regulation of power electronic devices. Students will become skilled in power computations based on load design, conversion of DC/DC, DC/AC, AC/DC, and AC/AC circuits, rectifiers, voltage controllers, power supplies, inverters, and operations of semiconductor devices, and basic switching circuits. Students will also delve into software tools with embedded power electronic equations to simulate and investigate the behavior of power electronic circuits under various load settings and heat sync scenarios. They will also utilize software to experiment and manipulate power electronic equations and observe voltage and current waveforms. NOTE: This course requires the student to purchase additional materials that are not covered by the book grant. Please refer to the Course Materials section for additional details. Prerequisites: ELEN306 AND ELEN325

Course Scope:

This course takes a student with a basic understanding of circuit analysis and introduces them to the functionality, topography, and regulation of power electronic devices. Students will become skilled in power computations based on load design, conversion of DC/DC, DC/AC, AC/DC, and AC/AC circuits, rectifiers, voltage controllers, power supplies, inverters, and operations of semiconductor devices, and basic switching circuits. Students will also delve into software tools with embedded power electronic equations to simulate and investigate the behavior of power electronic circuits under various load settings and heat sync scenarios. They will also utilize software to experiment and manipulate power electronic equations and observe voltage and current waveforms.

Objectives

After completing the course, the student should be able to accomplish these Course Objectives (CO):

CO-1 Summarize the basic operation of various power semiconductor devices and passive components.

CO-2 Analyze the basic principle of switching circuits.

CO-3 Design an AC/DC rectifier circuit.

CO-4 Design DC/AC converter circuits.

CO-5 Design AC/DC inverter circuits.

CO-6 Design AC/AC converter circuits.

CO-7 Analyze the role power electronics play in the improvement of energy usage efficiency and the development of renewable energy technologies.

Outline

Week 1: Course Introduction

Learning Objective(s)

Summarize the basic operation of various power semiconductor devices and passive components.

Analyze the basic principle of switching circuits.

Readings

Chapter 1

Assignment(s)

Lab1 and assignment 1 due end of week

Week 2: Power Computations Part I

Learning Objective(s)

Summarize the basic operation of various power semiconductor devices and passive components.

Analyze the basic principle of switching circuits. Analyze the role power electronics play in the improvement of energy usage efficiency and the development of renewable energy technologies.

Readings

Chapter 2

Assignment(s)

Assignment 2 due end of week

Week 3: Power Computations Part II

Learning Objective(s)

Cont'd

Readings

Chapter 2

Assignment(s)

Lab 2 and assignment 3 due end of week.

Week 4: DC-DC Controllers Part I

Learning Objective(s)

Analyze the basic principle of switching circuits.

Design an AD/DC rectifier circuit

Readings

Chapter 6

Assignment(s)

Assignment 4 due end of week.

Week 5: DC-DC Controllers Part II

Learning Objective(s)

Cont'd

Readings

Chapter 6

Assignment(s)

Assignment 5 due end of week

Week 6: DC-DC Controllers Part III

Learning Objective(s)

Cont'd

Readings

Chapter 6

Assignment(s)

Lab 3 and assignment 6 due end of week.

Week 7: DC Power Supplies Part I

Learning Objective(s)

Analyze the basic principle of switching circuits.

Design an AD/DC rectifier circuit.

Readings

Chapter 7

Assignment(s)

Assignment 7 due end of week

Week 8: DC Power Supplies Part II

Learning Objective(s)

Cont'd

Readings

Chapter 7

Assignment(s)

Lab 4 and assignment 8 due end of week

Week 9: Inverters: Converting DC to AC Part I

Learning Objective(s)

Analyze the basic principle of switching circuits. Design DC/AC converter circuits

Readings

Chapter 8

Assignment(s)

Lab 5 and assignment 9 due end of week

Week 10: Inverters: Converting DC to AC Part II

Learning Objective(s)

Cont'd

Readings

Chapter 8

Assignment(s)

Lab 6 and assignment 10 due end of week. Exam 1 due end of week.

Week 11: Half- Wave Rectifiers Part I

Learning Objective(s)

Analyze the basic principle of switching circuits. Design AC/DC inverter circuits.

Readings

Chapter 3

Assignment(s)

Assignment 11 due end of week.

Week 12: Half- Wave Rectifiers Part II

Learning Objective(s)

Cont'd

Readings

Chapter 3

Assignment(s)

Lab 7 and assignment 12 due end of week. Exam 2 due end of week.

Week 13: Full Wave Rectifiers: Converting AC to DC

Learning Objective(s)

Analyze the basic principle of switching circuits. Design AC/DC inverter circuits.

Readings

Chapter 4

Assignment(s)

Lab 8 and assignment 13 due end of week

Week 14: AC Voltage Controllers: AC to AC Converters

Learning Objective(s)

Summarize the basic operation of various power semiconductor devices and passive components.

Analyze the basic principle of switching circuits. Design AC/AC converter circuits.

Readings

Chapter 5

Assignment(s)

Lab 9 and assignment 14 due end of week. Exam 3 due end of week.

Week 15: Resonant Converters

Learning Objective(s)

Summarize the basic operation of various power semiconductor devices and passive components. Design an AC/DC rectifier circuit.

Readings

Chapter 9

Assignment(s)

Assignment 15 due end of week. Exam 4 due end of week.

Week 16: Drive Circuits, Snubber Circuits and Heat Sinks

Learning Objective(s)

Summarize the basic operation of various power semiconductor devices and passive components.

Analyze the basic principle of switching circuits. Analyze the role power electronics play in the improvement of energy usage efficiency and the development of renewable energy technologies.

Readings

Chapter 10

Assignment(s)

Assignment 16 due end of week.

Evaluation

Instructor announcements: Weekly announcements will appear on Monday of each week in the online classroom. This announcement will also be e-mailed to each student. The announcement will discuss the assignments for the week along with any other pertinent information for the week.

This is an upper level course; all students' work is to be presented as such in terms of quality and content. The grading system will be based on your introduction (2%), Forums (8%), Lab assignments (25%), weekly assignments (25%), and three exams (40%).

Reading Assignments: Please refer to the Course Outline section of this syllabus for the weekly reading assignments.

Week 1 Introductions: Each student must log into the classroom and introduce yourself to the class. This assignment is worth 20 points or 2 percent of your course grade. Your response is due by Sunday of Week 1. Your response must be greater than 250 words (a requirement) and include the following information.

a. Your name
b. Your university major or program
c. Where you are in the program of study
d. Your academic goals, to include why you are taking this class
e. Information that you would like to share about yourself

Weekly Forums: The weekly discussion forum is for students to post their questions on course content for that week. This forum should not be used to discuss specific graded material questions prior to receiving feedback from the instructor (after the material is graded). If there is a question on a specific graded question, find a similar problem in the book and ask a question on that problem or concept. Asking specific questions on graded questions creates an unfair advantage and defeats the purpose of the assessment tool.

Lab Exercises: There are fifteen laboratory exercises that must be completed in order to pass the course. Despite having completed all other requirements for the course, you must complete all of the lab exercises in order to pass the course. You must demonstrate that you are competent in using the PSPICE/NI Multism unit to perform the laboratories.

Exams: There will be four exams, each worth 10% of your final grade. It is an open book, open note exam. It

will be administered without a proctor. Students must complete the numbered exam by the end of the week indicated in the schedule.

Grading:

Name	Grade %

Materials

Book Title: Power Electronics - the VitalSource e-book is provided via the APUS Bookstore

Author: Hart

Publication Info: McGraw-Hill

ISBN: 9780073380674

Book Title: Additional required items are available to order from the APUS Bookstore. If you buy these items from other vendors, you may not receive all the parts you need for your course. These items (as noted) are not covered by the APUS Book Grant.

Author: N/A

Publication Info: N/A

ISBN: N/A

Book Title: NI Student Software Suite - access instructions provided inside the classroom

Author: National Instruments

Publication Info: National Instruments

ISBN: 779252-3501

Book Title: NI myRIO Starter Accessory Kit - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 783068-01

Book Title: myParts Kit from Texas Instruments - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 783752-01

Book Title: NI myRIO Embedded Systems Accessory Kit - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 783070-01

Book Title: NI Elvis Kit - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 780381-02

Book Title: You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - http://apus.libguides.com/bookstore/undergraduate

Author: N/A

Publication Info: N/A

ISBN: N/A

Book Title: Integrator Power Electronics Lab (Integrator Power Electronics Fundamentals Board for NI ELVIS II/II+) - this item is not covered by the APUS Book Grant

Author: National Instruments

Publication Info: National Instruments

ISBN: 784722-01

Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- Tutor.com offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 15% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without

citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- “Substantive” means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says “I agree” is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

Identity Verification & Live Proctoring

- Faculty may require students to provide proof of identity when submitting assignments or completing assessments in this course. Verification may be in the form of a photograph and/or video of the student’s face together with a valid photo ID, depending on the assignment format.
- Faculty may require live proctoring when completing assessments in this course. Proctoring may include identity verification and continuous monitoring of the student by webcam and microphone during testing.

University Policies

Student Handbook

- Drop/Withdrawal policy
- Extension Requests
- Academic Probation
- Appeals
- Disability Accommodations

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation’s military and public service communities by offering respected, relevant, accessible,

affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.