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Please, click on the following link to access A&M-Commerce Covid 19 Information, https://new.tamuc.edu/coronavirus/

EE 489 Independent Study Power Electronics

3 Credit Hours

COURSE SYLLABUS: Fall 2024

INSTRUCTOR INFORMATION

Instructor: Redha M. Radaydeh, PhD
Electrical Engineering
Department of Engineering and Technology
Office Location: AGIT 208
Office Hours: Tuesday & Thursday 1:45-2:30, 4:30-5:00 pm or with appointment. Virtual meetings can be also scheduled.
Office Phone: 903-886-5471
Office Fax: 903-886-5960
University Email Address: Redha.Radaydeh@tamuc.edu
Preferred Form of Communication: email.
Communication Response Time: within 24 hours (weekdays) to email.

COURSE INFORMATION

Class Meeting Schedule: 8/26/2022 through 12/13/2022.
Class Meeting Dates: Weekly meetings for 3 hours on Tuesdays and/or Thursdays during the time frame from 9:30 am 12:30 pm.
Classroom: Lectures on topics will be given on campus. Projects will consist of software simulations and hardware in AGIT 215.
Course Format: This course contains topic lectures and mini project sessions.

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Materials – Textbooks, Readings, Supplementary Readings

Textbook Required:

- D. Hart, Introduction to Power Electronics, McGraw-Hill, 2011.

Optional References:

- N. Mohan, First course on Power Electronics, Wiley, 2012.
- M. H. Rashid, Power Electronics Circuits, Devices, and Applications, 4th Ed., Pearson, 2013.

Software Required:

- Microsoft Office - MS Word, Excel, PowerPoint
- MATLAB Simulink, Multisim, PSpice, or an equivalent power electronics circuits simulator.

Course Description

The course presents the principles of design, analysis and control of solid-state power electronics devices. The covered topics include power computations, RLC transients, power semiconductor devices and switches. The course also addresses DC-DC converter topologies, buck converters, boost and buck/boost converters, and feedback control of DC-DC Converters. Moreover, it discusses voltage mode and current mode control, AC voltage controllers, DC power supplies, AC-DC rectification, PWM rectifiers, fly-back converters, DC-AC single phase inversion, and 3-phase inverters. The material is supported by experiments work using of simulation software (e.g. MATLAB/Simulink, PSpice).

Prerequisites: EE 321 with a minimum grade of C.

Student Learning Outcomes:

1. Analyze transient circuits using differential calculus.
2. Acquire knowledge on power semiconductor devices and switches.
3. Practice the conversion of non-linear power electronics operation into piecewise linear state.
4. Model and analyze solid-state converters using mathematical and engineering concepts.
5. Identify electrical and electronic components for use in converters and inverters.
6. Identify design and operation trade-offs related to efficiency, capacity and filtering requirements.
7. Design and test various buck, boost, and buck-boost converter configurations.
8. Design and simulate fly-back converters and DC-AC inverters.
9. Recognize the current and future applications of solid-state power electronics in electronic devices and electric services.

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COURSE REQUIREMENTS

Minimal Technical Skills Needed

- Microsoft Office - MS Word, Excel, PowerPoint
- Multisim (electronic circuits simulation program) and/or Spice (simulation program for integrated circuits emphasis).

Instructional Methods

The instructional methods will include lectures, class discussion, assignments, problem solving, mini projects reports and exercises, and simulations using software. Course materials, announcements, and lecture notes will be posted on the course website.

Student Responsibilities or Tips for Success in the Course

Student must attend classes, participate in class work and discussions, and perform required course assessments supporting the anticipated learning objectives, such as projects experimentations. Students are expected to regularly log into the course website to downloads course material, submit their course works as instructed, and follow up on new announcements. This course covers a more advanced content that requires at least 6 hours of extensive study per week.

" *Texas A&M University-Commerce acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.*

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors 'guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources.

13.99.99.R0.03 Undergraduate Academic Dishonesty

13.99.99.R0.10 Graduate Student Academic Dishonesty "

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Lab Safety Training
Students registered for this course must complete required Lab safety training prior to entering the Lab and undertaking any activities. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in Lab activities and assessments.

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GRADING

Final grades in this course will be based on the following scale:

A = 90%-100%
B = 80%-89%
C = 70%-79%
D = 60%-69%
F = 59% or Below

Weights of the assessments in the calculation of the final letter grade.

Two Mini Projects on AC-DC rectifiers	30%
One Mini Project on AC-AC controllers	15%
Two Mini Projects on DC-DC converters	30%
One Mini Project of DC power supplies	15%
One Mini Project on DC-AC inverters	10%
TOTAL	100%

Assessments

The following assessments will be performed during this course to assess individual progress towards learning outcomes:

Assessment	Weight	Due time
Mini Projects (hardware and software)	100%	Weeks 3, 5, 7, 9, 11, 13, 15

Relationship between Assessments and Course/Student Learning Outcomes

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Learning Outcomes of Instruction	Assessment
1. Analyze transient RLC circuits using differential calculus.	Lectures
2. Acquire knowledge on power semiconductor devices and switches.	Lectures and projects
3. Practice the conversion of non-linear power electronics operation into piecewise linear state.	projects
4. Model and analyze solid-state converters using mathematical and engineering concepts.	Lectures and projects
5. Identify electrical and electronic components for use in converters and inverters.	Lectures
6. Identify design and operation trade-offs related to efficiency, capacity and filtering requirements.	Lectures and projects
7. Design and test various buck, boost, and buck-boost converter configurations.	Projects
8. Design and simulate fly-back converters and DC-AC inverters.	Projects
9. Recognize the current and future applications of solid-state power electronics in electronic devices and electric services.	Lectures Projects

Mini Projects

Students will perform simulations and experiments of power electronic circuits to study the main characteristics and practical applications of power semiconductors and electronics converters. The topics include power computations, dc-dc converters: Buck, Boost, Buck-Boost, transformers models, flyback converters, inverters: square-wave inverter, and multilevel inverters. The work will be supported by software simulation using Multisim and/or PSpice. There will be projects assignments distributed over the semester. Students will work in teams.

Additional guidelines for projects work:

- Perform extensive project experiments, where each of which will require 2 weeks of work to be performed in each project. Experiments are listed in course outline below.
- Students are required to perform extensive simulations for each project.
- Students will perform hardware work in projects.

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- Each group will need to submit full report for each mini project.

A Formal project report should enable someone else to duplicate your work and obtain the same results without reference to any other documents. This does not mean that you should append data sheets to your report but that the schematics and parts layout should be clear and accurate.

Submit the files containing the circuit simulation, a schematic, and data which explain the project results you obtained. Graphics must be created using a graphics program. Acceptable programs are Multisim, Visio, or similar graphics programs. Graphics in your project reports may not be hand-drawn.

Project reports are due before project time one week after the project was performed. 10% per day will be deducted from the final project grade for each 24 hours or portion thereof that a project is late. Hardcopy of project reports are to be submitted to the instructor.

TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by Texas A&M University-Commerce have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements

LMS Requirements:
https://community.brightspace.com/s/article/Brightspace-Platform-Requirements

LMS Browser Support:
https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm

YouSeeU Virtual Classroom Requirements:
https://support.youseeu.com/hc/en-us/articles/115007031107-Basic-System-Requirements

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu**.**

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Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

COMMUNICATION AND SUPPORT

If you have any questions or are having difficulties with the course material, please contact your Instructor.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:

https://community.brightspace.com/support/s/contactsupport

Interaction with Instructor Statement

Students are highly encouraged to participate in class activities, ask questions, and solve technical problems in class. They are also highly encouraged to work in groups during the Lab sessions, prepare full documentations of their Lab work, gain experience on software simulations and hardware work, and gain experience on team work, communication skills, and technical writing.

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures/Policies

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

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University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.
http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum:
https://www.britannica.com/topic/netiquette

TAMUC Attendance

For more information about the attendance policy please visit the Attendance webpage and Procedure 13.99.99.R0.01.
http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty 13.99.99.R0.03
Undergraduate Student Academic Dishonesty Form

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/documents/13.99.99.R0.03UndergraduateStudentAcademicDishonestyForm.pdf

Graduate Student Academic Dishonesty Form

http://www.tamuc.edu/academics/graduateschool/faculty/GraduateStudentAcademicDishonestyFormold.pdf

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf

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Students with Disabilities-- ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services
Texas A&M University-Commerce
Velma K. Waters Library Rm 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@tamuc.edu
Website: Office of Student Disability Resources and Services
http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the Carrying Concealed Handguns On Campus document and/or consult your event organizer.

Web url:
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf

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Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

A&M-Commerce Supports Students' Mental Health

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Department or Accrediting Agency Required Content

The Electrical Engineering program is in the process to obtain ABET accreditation. The course material, its expected deliverables, grading policy, organization, and expected learning outcomes are designed to meet the ABET requirements.

COURSE OUTLINE / CALENDAR

The instructor reserves the right to adjust the schedule to serve the needs of the class and any changes will be communicated in a timely manner.

Course schedule: The sequence of chapters follows the textbook.

Week	Topic	Chapter
1	Introduction, power semiconductors, applications of power electronics converters	1
2-3	Power computations: Sinusoidal and non-sinusoidal waveforms	2
3-7	Full-wave rectifiers: uncontrolled and controlled rectifiers, resistive load **Mini Projects 1& 2**	4
7-9	Voltage controllers **Min Project 3**	5
9-13	dc-dc converters: Buck, Boost, Buck-Boost converters **Mini Projects 4 & 5**	6
13-15	dc power supplies: Transformers models, flyback converters **Mini Project 6**	7
15-16	dc-ac inverters **Mini Project 7**	8

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