EE 4328-005: Introduction to Power Electronics
(Current Topics in Electrical Engineering)
Fall 2015

Instructor: Ali Davoudi, Ph.D., Assistant Professor, Electrical Engineering
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- **Office Hours:**
  - **Instructor:** Tuesday and Thursday, 1:00 PM –2:00 PM (By previous appointment). ELB 303.
  - **Graduate Teaching Assistant**: Tuesday and Thursday, 9:00 AM-12:00 PM. ELB 310.

Section Information: EE 4328-005 (87212).

Time and Place of Class Meetings: NH 202, Tuesday and Thursday, 2:00 PM – 3:20 PM.

Description of Course Content: The course discuses conceptualization, analysis, and design of power electronics components, circuits, and systems. It discusses different classes of switching converters (dc-dc, ac-dc, dc-ac) and elements of power electronics (magnetic design, loads, and capacitors). Applications of power electronics in renewable energy systems and vehicular electronics are discussed.

Course Schedule: The tentative course schedule is given here:

Weeks Allotted	Lecture Content
1	Fundamental concepts: 1. Introduction to power electronics 2. Review of circuit elements 3. Review of mathematical fundamentals
8	DC-DC Converter: 1. Steady-state converter analysis 2. Operational modes of converters 3. DC-DC converter topologies 4. Transformer isolation and bridge converters 5. Soft switching and resonant converters 6. Multi-port converters 7. Controller design
3	Inverters (DC-AC Converters): 1. Single-phase inverters 2. Multi-level inverters 3. Pulse Width Modulation inverters 4. Three-phase inverters
3	Rectifiers (AC-DC Converters): 1. Single-phase rectifiers 2. Full-wave rectifiers 3. Controlled rectifiers 4. Three-phase rectifiers 5. Controlled 3-phase rectifiers

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. – Ali Davoudi.

Student Learning Outcomes: Upon successful completion of this course, an student will have the ability to

- Understand the basic principles of energy conversion using switching circuits
- Size and select components, from passive elements (e.g., magnetics) to switching components
- Analyze the operation of AC-DC, DC-DC, and DC-AC converters in the steady state
- Develop computer models of power electronics circuits in Matlab/Simulink environment

Requirements: Students are expected to be familiar with Circuit Theory and Electronics. Otherwise, consent of the instructor is required.

Required Textbooks and Other Course Materials: The instructor will use following references:

- "Power Electronics" by D. W. Hart, New York: McGraw Hill, 2011.
- "Elements of Power Electronics" by Philip Krein, ISBN 0-19-511701-8.
- "Fundamentals of Power Electronics" by Robert W. Erickson and Dragan Maksimovic, ISBN: 0-7923-7270-0

Descriptions of major assignments and examinations: There will be two midterm exams and one final exam. Homework questions will be assigned biweekly, but will not be collected/graded. Instead, there could be one quiz every other week, from the same set of homework problems.

Attendance: At The University of Texas at Arlington, taking attendance is not required. Rather, each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I require all students to attend all class sessions.

Grading: Quiz constitutes 20%, midterms are 25% each, and the final exam is 30%. There will be 10 extra bonus points, based on a project using C2000 microcontrollers development tools. The letter grade distribution is shown below.

Numerical grade	Letter grade
90 - 100	A
80 - 89	B
70 – 79	C
60 - 69	D
50 – 59	F

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels; see "Student Support Services," below.

Make-up Exams: There is no make-up exam for this class.

Expectations for Out-of-Class Study: A general rule of thumb is this: for every credit hour earned, a student should spend 3 hours per week beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 3 hours per week of their own time in course-related activities, including reading materials and simulation projects. Simulation of basic as well as more real life circuits in PSPICE or Matlab/Simulink might be developed and required.

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog. For undergraduate courses, see http://catalog.uta.edu/academicregulations/grades/#undergraduatetext; for graduate courses, see http://catalog.uta.edu/academicregulations/grades/#graduatetext.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a letter certified by the **Office for Students with Disabilities (OSD).** Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:
The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364.
Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671.

Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Title IX: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos. For information regarding Title IX, visit* www.uta.edu/titleIX.

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Lab Safety Training: Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities. Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., through the following August) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after

graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest emergency exit at Nedderman hall. Emergency exit maps are available for all buildings at *https://www.uta.edu/campus-ops/ehs/fire/Evac_Maps_Buildings.php* and for this classroom at https://www.uta.edu/campus-ops/ehs/fire/Evac_Maps_All/Evac_NH/Evac_NH_229.pdf. Please follow the exit signs on the first floor of Nedderman hall. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php

The English Writing Center (411LIBR): Hours are 9 am to 8 pm Mondays-Thursdays, 9 am to 3 pm Fridays and Noon to 5 pm Saturdays and Sundays. Walk In ***Quick Hits*** sessions during all open hours Mon-Thurs. Register and make appointments online at http://uta.mywconline.com. Classroom Visits, Workshops, and advanced services for graduate students and faculty are also available. Please see www.uta.edu/owl for detailed information.

Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381