

Power Electronics Circuits

EEL 4242C Section 0001-0004

Class Periods: Tuesday Period 4: 10:40 AM - 11:30 AM;
Thursday Period 4, 5: 10:40 AM – 11:30 AM; 11:45 AM – 12: 35 PM

Location: Zoom Link in Canvas

Academic Term: Fall/2020

Instructor:

Dr. Shuo Wang

Email Address: shuo.wang@ece.ufl.edu

Office Phone Number: 352-392-4691

Office Hours: To be conducted via Zoom,

Tuesday 1:30 PM - 3:30 PM, Thursday 2:00 PM - 4:00 PM, or by appointments

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

- Andy Yang,
- Email Address: andy.yang@ufl.edu,
- Office hour: Tuesday 1:30 PM - 3:30 PM, Thursday 2:00 PM - 4:00 PM, or by appointments

Course Description

Circuit topologies, analysis, design and simulation of electronic circuits such as power supplies, and motor drives.

Course Pre-Requisites / Co-Requisites

Electronics Circuits, EEL 3308

Course Objectives

- (1) Basic power electronics circuit operation
- (2) Power converter modeling
- (3) Converter control system design
- (4) Simple power converter design
- (5) Hands on experience in power electronics hardware

Materials and Supply Fees

N/A

Professional Component (ABET):

This course prepares students to work professionally in the area of power electronics systems and control

This course consists of 3 credits of Engineering Design;

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare,	High

as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

Required Textbooks and Software

- Title: Fundamentals of Power Electronics
- Author: R. Erickson
- Springer, 2nd Ed,
- ISBN 978-0792372707

Lab source link:

<https://university.ti.com/faculty/teaching-materials-and-classroom-resources/ti-based-teaching-kits-for-analog-and-power-design/power-management-lab-kit-series>

Free student version simulation software Simplis download link will be provided in the class

Recommended Materials

N/A

Course Schedule

Week, dates	Chapter	Topics	Homework and Labs
1 9/1, 9/3,	Chapter 1	Introduction	
	Chapter 2	V-t balance, Q balance, small ripple approx.	
2 9/8, 9/10	Chapter 2	Output voltage ripple and inductor current ripple	9/8, Lab 1 assigned
	Chapter 2	Chapter 2 review and Examples	9/10, Chapter 2 homework assigned
3 9/15, 9/17	Chapter 3	Power converter DC transformer model	9/15, Lab 1 due
	Chapter 3	Power converter DC transformer model	9/17, Chapter 2 homework due
4 9/22, 9/24	Chapter 3	Equivalent circuit modeling and input port model	9/22, Lab 2 assigned
		Chapter 3 review and Examples	9/24, Chapter 3 homework assigned

5 9/29, 10/1	Chapter 5	Principle of discontinuous conduction mode (DCM) Buck converter example	9/29, Lab 2 due
	Chapter 5	Boost converter example	10/1, Chapter 3 homework due
6 10/6, 10/8	Chapter 4	Switch applications and realization	10/6, Chapter 5 homework assigned
	Chapter 4	Switch applications and realization	10/8, Lab 3 assigned
7 10/13, 10/15	Chapter 4	Switch realization examples	10/13, Chapter 5 homework due
		Chapter 4 review and Examples	10/15, Chapter 4 homework assigned
8 10/20, 10/22	Chapter 7	Average modeling	10/20, Lab 3 due
	Chapter 7	Perturbation, linearization and small signal model	10/22, Chapter 4 homework due
9 10/27, 10/29	Chapter 7	Pulse Width Modulator	10/27, Lab 4 assigned
	10/29	Midterm Exam (Chapter 2 –Chapter 5)	10:30AM-12:30PM
10 11/3, 11/5		Chapter 7 Review and Examples	11/3, Chapter 7 homework assigned
	Chapter 8	Bode plots	11/5, Project assigned
11 11/10, 11/12	Chapter 8	Analyzing converter transfer function using bode plots	11/10, Chapter 7 homework due
	Chapter 8	Graphical construction of impedances and transfer functions	11/12, Lab 4 due
12 11/17, 11/19		Chapter 8 Review and Examples	11/17, Chapter 8 homework assigned
	Chapter 9	Negative feedback's effects on transfer functions, loop gain Loop gain analysis, stability	11/19, Lab 5 assigned
13 11/24	Chapter 9	Compensator	11/24, Chapter 8 homework due
14 12/1, 12/3	Chapter 9	Compensator design to achieve stability	12/1, Lab 5 due
	Chapter 9	Compensator design examples	12/3, Chapter 9 homework assigned
15 12/8, 12/10		Chapter 9 Review and Examples	
			12/10, Chapter 9 homework due
16 12/15, 12/18			12/15, Project due
		12/18, Final Exam (Chapter 6-Chapter 9) (10:00AM-12:00PM)	

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live and for the students enrolled in EDGE sections. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Note: The recorded videos will be posted for EDGE section within 24 hours after the class.

Attendance Policy, Class Expectations, and Make-Up Policy

All students except for those enrolled in EDGE sections are required to attend the class during the scheduled lecture time.

This class will be presented online using Zoom and requires access to a working webcam and stable internet connection. I prefer that students keep their camera on during the class so that I can see you as I would during normal face-to-face classes. Studies show that if we can see each other's faces then we will have more engagement, more student success, and more faculty success. However, this is not a requirement. I understand if on certain days you can't have your camera on due to internet bandwidth limitations, other family members, health issues, or any other reasons.

Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (7)	10 each	20%
Lab	10 each	20%
Midterm Exam	100	20%
Final Exam	100	15%
Project	100	20%
Class attendance	28	5%
Total		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93 - 100	A	4.00
90.0 - 92.9	A-	3.67
87 - 89.9	B+	3.33
83 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77 - 79.9	C+	2.33
73 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67 - 69.9	D+	1.33
63 - 66.9	D	1.00

60.0 – 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](mailto:title-ix@ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.