

## ESE 451: Power Electronics

### 1. Course Staff and Office Hours

Instructor:	Fang Luo,
Email:	<a href="mailto:fang.luo@stonybrook.edu">fang.luo@stonybrook.edu</a>
Location:	Tu/Th 1-2:20 pm. Psychology A-146 (cap 28)
Office Hours:	By Appointment
TAs:	To be announced

*Office hours and locations may change. Please check Blackboard for most up-to-date information.*

### 2. Course Description

This course gives an introduction to the design and characterization of high-efficiency switch-mode power converters. Fundamental dc-dc converter topologies will be introduced and analyzed in the steady state and dynamically. The application of semiconductor devices in power applications including MOSFET, BJT, IGBT, and thyristors will be studied. Non-idealities in circuit components and the design of magnetic components will be discussed. Students will build and characterize circuits of their own design.

**Prerequisites:** ESE 272

**Credits:** 3

### 3. Textbook

Erickson & Maksimović, Fundamentals of Power Electronics, Kluwer Academic Publishers, 2nd edition, 2001.

### 4. Course Learning Objectives

- Students should understand advantages and disadvantages of switching power supplies
- Students should be able to analyze switching power circuits
- Students should be able to design switching power circuits with standard topologies
- Students should be able to characterize switching power circuits
- Students should be able to understand the use of semiconductor devices in high power applications

## 5. Student Learning Outcomes

Student Outcomes		% contribution
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	30%
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	40%
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 judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	10%
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 judgement to draw conclusions.	20%
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	

## 6. Schedule and Topics

Tentative

<i>Weeks</i>	<i>Topics</i>
1	Introduction
1-3	Steady-state Analysis and Modeling
4-6	Efficiency, Power Device and Loss Analysis
7	Thermal Design
8-10	Topologies and Operation Mode
10-13	AC Modeling and Controller design
13-15	Passive Design and “Side Effect Control”

## 7. Assignments and Projects

Homework problems and project topics will be assigned as the course material is taught. The due dates will be assigned, the day the problems are assigned. All assignments will be uploaded to Blackboard. Once the assignment time is closed, no late homework will be accepted. Unless otherwise noted, students may work together on homework, provided that they do not copy and submit another’s work.

## 8. Grading

Your grade will be based on homework assignments, one midterm exam, a design report, and one final examination.

<b>Grading:</b>	Homework:	30%	<b>Grading Scale:</b>	90-100%	A
	Projects:	30%		80-89%	B
	Experiment Report:	15%		70-79%	C
	Take-Home Exam:	15%		60-69%	D
	Final Presentation/Report:	10%		<60%	F

## 9. Academic Honesty

Any academic dishonesty on a written homework or lab will result in a zero grade for the assignment for all parties involved. All exam work must be entirely your own with no collaboration or outside materials/information. Any academic dishonesty on the midterm exams or the final exam will result in failing the course. The case will be submitted to the College of Engineering's Committee on Academic Standing and Appeals.

## 10. Electronic Communication Statement

Email and especially email sent via Blackboard (<http://blackboard.stonybrook.edu>) is one of the ways the faculty officially communicates with you for this course. It is your responsibility to make sure that you read your email in your official University email account. For most students that is Google Apps for Education (<http://www.stonybrook.edu/mycloud>), but you may verify your official Electronic Post Office (EPO) address at <http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo>.

If you choose to forward your official University email to another off-campus account, faculty are not responsible for any undeliverable messages to your alternative personal accounts. You can set up Google Mail forwarding using these DoIT-provided instructions found at <http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail>.

If you need technical assistance, please contact Client Support at (631) 632-9800 or [supportteam@stonybrook.edu](mailto:supportteam@stonybrook.edu).

## 11. Student Accessibility Support Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building,

(631) 632-6748, or at [sasc@Stonybrook.edu](mailto:sasc@Stonybrook.edu). They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

## **12. Academic Integrity Statement**

Each student must pursue their academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at

[http://www.stonybrook.edu/commcms/academic\\_integrity/index.html](http://www.stonybrook.edu/commcms/academic_integrity/index.html)

## **13. Critical Incident Management Statement**

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.