

Lecture # 1

ECEN 438/738 Power Electronics

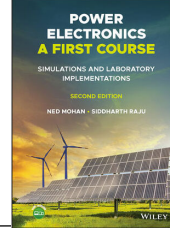
Spring 2025 Semester



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ECEN 438/738 Power Electronics



Power Electronics A First Course: 2nd Edition

Free Textbook Online Access Link: <https://go.oreilly.com/TAMU/library/view/-/9781119818564/?ar>

Chapter 1

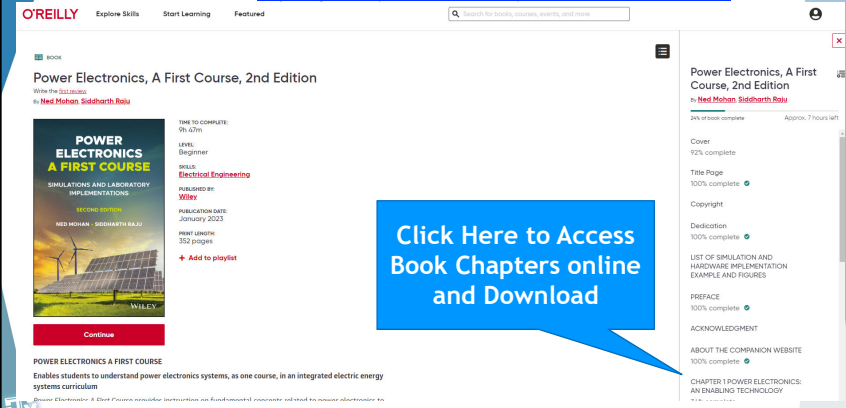
Power Electronics: An Enabling Technology

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Click Here to Access Book Chapters online and Download

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ECEN 438/738 Power Electronics

Quick POLL

- How many of you have taken ECEN 340 - Electrical Energy Conversion
- How many have taken 459 / 460
- How many have taken 441 / 442
- How many have taken 420
- NOT TAKEN 325 ?
- HOW MANY ARE TAKING 403/404 - Senior Design ?

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ECEN 438/738 Power Electronics

Spring 2025 ECEN 438/738 - Power Electronics - Sections: 501,508, T-TR 8:00 to 9:15 PM, ZACH 241; Texas A&M University Department of Electrical and Computer Engineering

Class	Sections	Topics
1 Jan 14	Chapter 1	Power Electronics - An Enabling Technology, Examples of Energy Conversion & Efficiency
2 Jan 16	Chapter 2	Design of Switching Power-Pole, Power Semiconductor devices, selection
3 Jan 21	Section 2.4 to 2.6	Switching characteristics, power loss & design considerations
4 Jan 23	Section 2.4 to 2.6	Example calculations
5 Jan 28	Chapter 3	Introduction, Section 3.5 Buck Converter Analysis
6 Jan 30	Section 3.6	Boost Converter Analysis
7 Feb 4	Section 3.7	Design Examples, Buck-Boost Converter Analysis
8 Feb 6	Section 3.11, 3.15	Interleaving, Discontinuous conduction mode
9 Feb 11	Section 3.15	Example Designs
10 Feb 13	Chapter 5	AC to DC Diode Rectifiers, Sections 5.1 to 5.3, Example
11 Feb 18	Exam # 1	In Class Chapter 1 to 3
12 Feb 20	Section 5.4 to 5.6	Diode rectifier analysis, examples
13 Feb 25	Chapter 6	Power factor correction circuits, design example
14 Feb 27	Chapter 7	Magnetic circuit concepts, Sections 7.1 to 7.4
15 Mar 4	Section 7.5	Transformers, Examples
16 Mar 6	Chapter 8	Section 8.4, Flyback Converters
17 Mar 18	Section 8.5	March 10th to 14th - Spring Break. No classes
18 Mar 20	Section 8.5	Forward Converter
19 Mar 25	Exam # 2	In Class Chapter 5 to 8
20 Mar 27	Section 8.6	Full bridge DC-DC converter
21 Apr 1	Section 8.6	Converter design examples
22 Apr 3	Chapter 12	DC to AC Inverters, Sections 12.1 to 12.4
23 Apr 8	Section 12.5	Single Phase Inverters
24 Apr 10	Section 12.5	Pulse width modulation (PWM) Schemes
25 Apr 15	Section 12.6	Three Phase Inverters
26 Apr 17	Exam # 3	In Class Chapter 12 Last Day to Q-drop is 4/14
27 Apr 22	Section 12.6	Inverters in UPS Systems and Application to Motor Drives
28 Apr 24	Section 12.7	Multilevel Inverters and Applications
May 2	Final Exam	1pm to 3pm - Final Exam - See schedule

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Note: Students registered in 738 sections will not write the final exam. Instead, they will work on a semester long project (assigned to them during the week of 3/10) and submit their written final project report due on 5/2.

3 Exams:	40%
Laboratory:	20%
Homework / Quizzes:	20%
Final Exam/Project:	20%
	100%

Lab grade is mandatory for passing the course

ECEN 438/738 Power Electronics

Date:	List of Experiments
Week of January 20 th	Lab meeting to discuss lab format, and simulation software
Week of January 27 th	Lab 1 - Linear Regulator in Open Loop DC Operation - Simulation / Experiment Pre lab 1 due before session starts
Week of February 3 rd	Lab 2 - Buck Regulator Half-Bridge PWM Operation - Simulation / Experiment Pre lab 2 due before session starts Lab Report # 1 Due before session starts
Week of February 10 th	Lab 3 - Buck Regulator LC Filter Operation - Simulation / Experiment Pre lab 3 due before session starts Lab Report # 2 Due before session starts
Week of February 17 th	Exam # 1 - No Lab
Week of February 24 th	Lab 4 - Boost Regulator in CCM Mode Operation - Simulation Pre lab 4 due before session starts Lab Report # 3 Due before session starts
Week of March 3 rd	Lab 5 - Error Amplifier Operation- Simulation / Experiment Pre lab 5 due before session starts Lab Report # 4 Due before session starts
Week of March 10 th	Spring Break - No Lab
Week of March 17 th	Lab 6 - Buck Regulator in Closed Loop Operation - Simulation / Experiment Pre lab 6 due before session starts Lab Report # 5 Due before session starts
Week of March 24 th	Lab 7 AC-DC Rectifier Operation - Simulation / Experiment Pre lab 7 due before session starts Lab Report # 6 Due before session starts
Week of March 31 st	Exam # 2 - No Lab
Week of April 7 th	Lab 8 - Flyback Isolated DC-DC Converter - Simulation Pre lab 8 due before session starts Lab Report # 7 Due before session starts
Week of April 14 th	Lab 9 - DC-AC PWM Inverter Operation - Simulation / Experiment Pre lab 9 due before session starts Lab Report # 8 Due before session starts
Week of April 21 st	Lab 10 - High-Frequency Transformer Operation - Simulation / Experiment Pre lab 10 due before session starts Lab Report # 9 Due before session starts
Week of April 28 th	No Lab - Lab Report # 10 Due

Lab attendance & grade is mandatory for passing the course

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ECEN 438/738 Power Electronics - TEAMS Page

Team - 25 SPRING ECEN 438/738 POW... ..

Home page
Class Notebook
Assignments
Grades
Reflect
Insights

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Home page
Class Notebook
Assignments
Grades
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Insights

Man Channels

General

Welcome to Spring 25 ECEN 438/738 - Power Electronics

Team - 25 SPRING ECEN 438/738 POWER ELECTRONICS Welcome to Spring 25 ECEN 438/738 - Power Electronics. Please click on "Files" on the top ribbon to access the course syllabus.

Also online access to the course textbook is available (for FREE) at https://learning.oreilly.com/library/view/power-electronics-a/9781119105647/psa-link.aspx#psa-link_from=1AMU

Power Electronics, A First Course, 2nd Edition... X
POWER ELECTRONICS A FIRST COURSE Enables students to understand power electronics systems, as one course in a...

learning.oreilly.com

Documents > General

Name	Modified	Modified By	Add column
Class Materials		Enjeti, Prasad N	
2025-SPRING-438_Syllabus_Enjeti_Howdy.pdf	5 days ago	Enjeti, Prasad N	

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ECEN 438/738 Power Electronics - CANVAS Page

ECEN-438:200,500,501,502,503,504,505,506,507,ECEN-...

CS Spring 2025

Home
Syllabus
Grades
Quizzes
Assignments
AEFIS Tools
Microsoft Teams classes
Zoom Pro 1.3
Course Evaluations
I share resources

ALL Weekly Quizzes & Exams Will Appear Here

View Course Stream
View Course Calendar
View Course Notifications

To Do
Nothing for now

Welcome!

Welcome to the course! I encourage you to read the syllabus and explore the resources in this Canvas course. Please contact me if you have any questions.

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ECEN 438/738 Power Electronics - TEAMS Page

[Team - 25 SPRING ECEN 438/738 POWER ELECTRONICS | General | Microsoft Teams](#)

Microsoft TEAMS Access

Prasad Enjeti, Stephen Darwin, Melissa Chou 92.m00e

25 SPRING ECEN 438 200: HNR-POWER ELECTRONICS

Jan 12, 2025 at 11:23am

Welcome to Spring 2025 - ECEN 438/738 (ALL Sections): You have been added to the TEAMS Page - If you DONT HAVE ACCESS TO the TEAMS Page - Please click on the link below to access the Microsoft TEAMS Page for this Course. ALL course material will be distributed via TEAMS Page.

ALL Students are expected to post questions in the discussion page regarding quizzes / exams etc. Please DO NOT send direct messages (DMs) to me unless you want to discuss your individual situation.

<https://teams.microsoft.com/l/channel/19%3Aa5-ZuMh9SFaKwnk12xkN4DIHEq4ekQ6gOmIWAQM1%40thread.tacv2/General?groupId=760805eb-f62e-40b6-b0bc-ba4dc375ee1>

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Class Attendance Log: 1/14/25



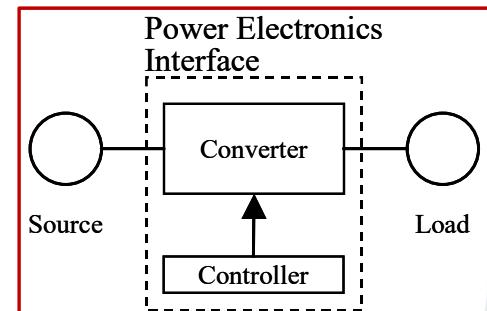
Howdy!

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Introduction to Power Electronics

Role

- Role
- Applications
- Requirements



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Applications

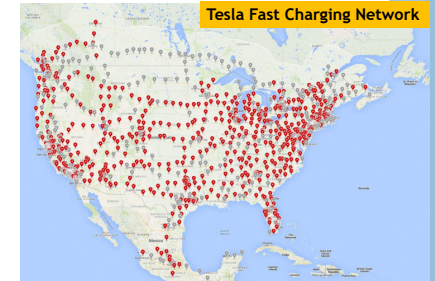
- Portable Electronics
- Consumer Electronics / Appliances
- Renewables-based Electricity Generation
- Electric/Hybrid Vehicles
- Improving Efficiency
- Utility Applications
- Information Technology

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Applications - Portable Electronics



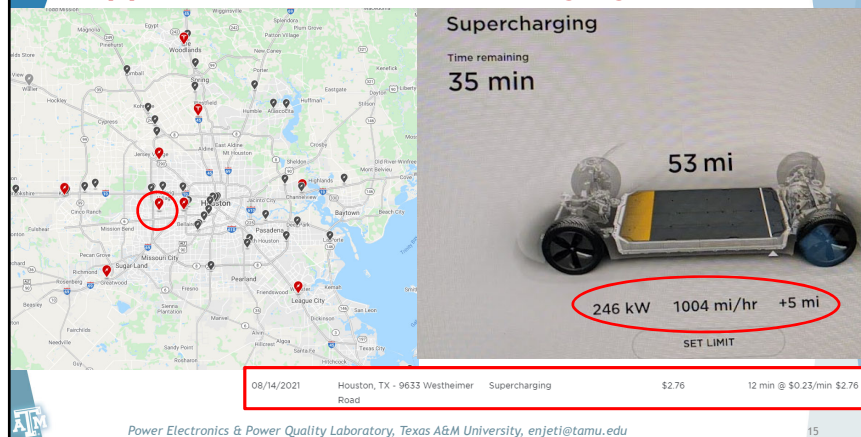
Applications - EV - Fast Charging Network



Is a DC Fast Charging Network. It is a subsidiary of [Volkswagen Group of America](#), established in late 2016 by the automaker as part of its efforts to offset [emissions](#) in the wake of the [Volkswagen emissions scandal](#)

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Applications - EV - Fast Charging Network



EV - Wireless Charging

<https://vimeo.com/337273961>

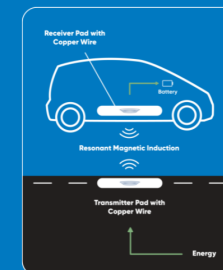
How It Works

Vehicle Subsystem

The vehicle side of the wireless charging system comprises a receiver pad and an electronics module. High frequency AC is converted to DC which directly charges the vehicle's battery.

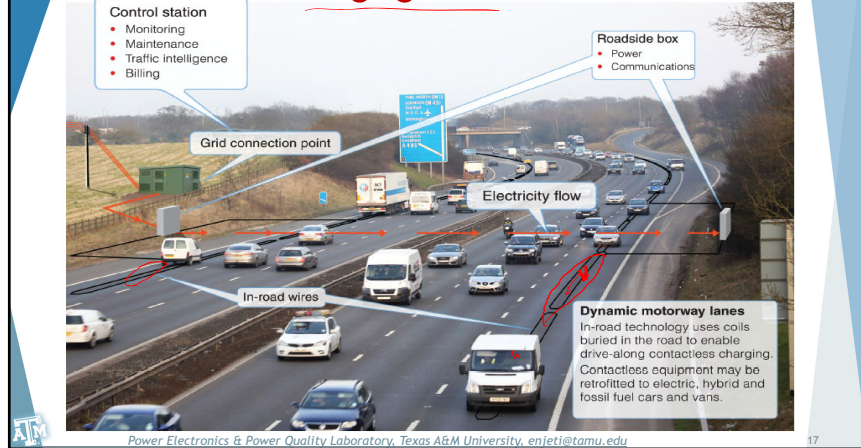
Ground Subsystem

The ground side of the Wireless Charging System consists of a charging pad installed in the pavement, which is connected to an electronics cabinet. High frequency AC power is generated by the electronics cabinet and transmitted by the charging pad to the vehicle.

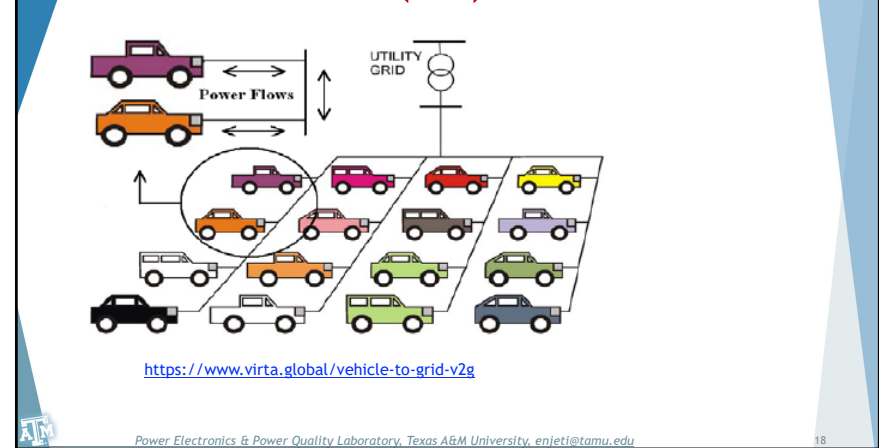


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Electric Charging Lanes - Soon to come



Vehicle to Grid (V2G) - Soon to come



The cover of IEEE Spectrum magazine features a large image of many white cars. The main headline is "What V2G Tells Us About EVs and the Grid". A sub-headline reads "Vehicle-to-grid technology adds another layer of complexity to the electric-vehicle transition". A quote from the article states: "Our grid was not designed for this." The magazine also features other articles like "The Tao of DALL-E 2" and "The Trouble With Robots in the OR".

IEEE Spectrum

What V2G Tells Us About EVs and the Grid

Vehicle-to-grid technology adds another layer of complexity to the electric-vehicle transition

How EVs Can Power the Grid

Read the Aug 2022 Article

Course Project Topic

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The advertisement shows a hand holding a Ting sensor, which is a small white device that plugs into a wall outlet. The sensor is connected to a smartphone app that displays a house diagram with various sensors. The app shows a voltage reading of 125V and a status of "No Hazards Detected".

Intelligence Smart Home Devices

Ting Sensor

Power grid faults surged right before Los Angeles wildfires began: expert

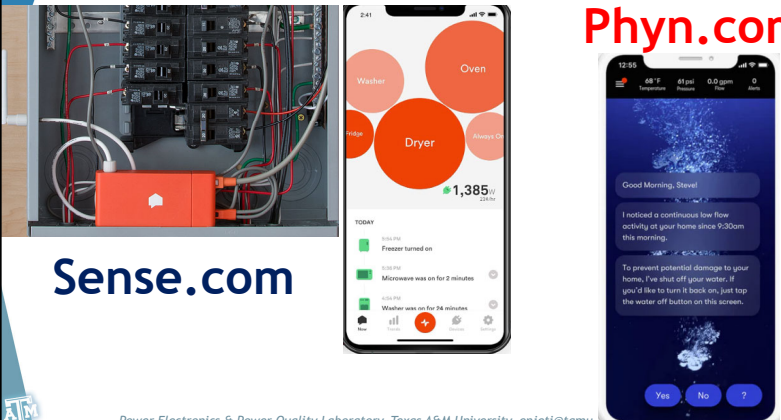
<https://www.yahoo.com/news/power-grid-faults-surged-121149045.html>

Through a simple, plug-in sensor, Ting enables detection and mitigation of electrical hazards before a fire can start. A single sensor monitors an entire home's electrical system for arcs and sparks, the precursors to imminent fires.

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Intelligence Smart Home Devices

Phyn.com

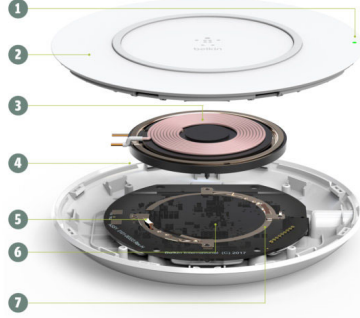


The image shows a Sense.com smart home device (a red box) connected to a wall outlet. Next to it are two smartphone screens displaying the Phyn.com app interface. The left screen shows a dashboard with circular icons for Washer, Oven, and Dryer, along with a balance of 1,385. The right screen shows a notification about a continuous low flow activity at 9:30am and a message about potential damage to the water system, with buttons for Yes, No, and ?.

Sense.com

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What's inside a WIRELESS CHARGER



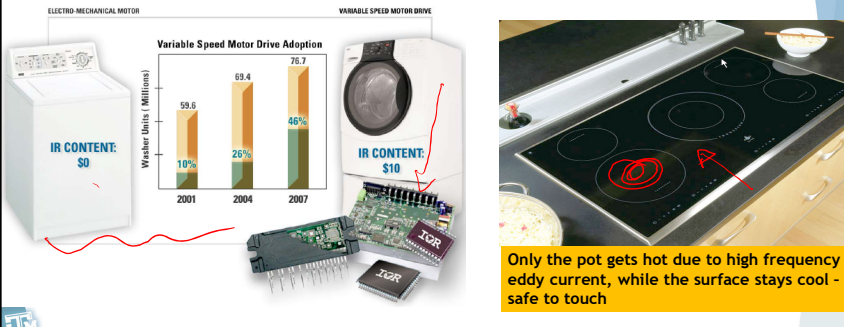
1. LED charging indicator light
2. Non-slip pad surface
3. 75W transmitter coil
4. Fanless design for quiet operation
5. Wireless charging chipset controls the flow of electricity
6. Thermal protection sensor can dial back power for safer operation
7. Foreign object detection circuit to prevent conductive materials from receiving power from the charger

SOURCE: BELKIN

Applications: Consumer Electronics / Appliances

Washer / Dryer / AC Units

Induction Cooktops



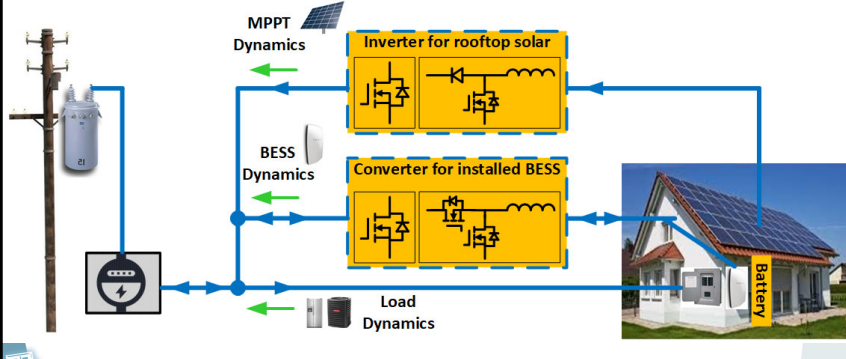
The image shows a bar chart titled "Variable Speed Motor Drive Adoption" with data for 2001, 2004, and 2007. The chart shows the adoption rate of variable speed motor drives in millions of units. The data is as follows:

Year	Washer Units (Millions)	Adoption Rate (%)
2001	59.6	10%
2004	69.4	26%
2007	76.7	46%

Below the chart is an image of an induction cooktop with a red arrow pointing to the heating element. A text box below the cooktop states: "Only the pot gets hot due to high frequency eddy current, while the surface stays cool - safe to touch".

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Applications: Renewable Energy - Rooftop Solar and Wall Battery



The diagram illustrates a renewable energy system. It shows a power line connected to a utility pole. The system includes an "Inverter for rooftop solar" and a "Converter for installed BESS" (Battery Energy Storage System). The inverter is connected to the power line and the BESS converter. The BESS converter is connected to a battery (labeled "Battery") and a load (labeled "Load Dynamics"). The diagram also shows "MPPT Dynamics" (Maximum Power Point Tracking) and "BESS Dynamics" (Battery Energy Storage System Dynamics) components.

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