Pre-Class Delivery Questions:

- Briefly describe the context of the class period and how it fits into the syllabus/goals of the course.

  Goal of the course is to introduce students to power transfer system. This class will give them a first overview on the topic.

- What are the learning objectives of the lesson for the day you are teaching?

  See lesson plan

- Briefly describe your lesson plan for the day (or include a written copy of your lesson plan) and briefly describe your rationale for the instructional methods you have chosen.

  See attached notes.

- How will you know if you accomplished your objectives for the day (assessment)?

  At the end of the class I will assign a problem to the student. I will encourage interactions with peers and with me. Their questions will make me understand how much did they learnt.

- What feedback do you want on your lesson plan and/or what questions do you have (for your peers/mentor)?

  How are my voice and body language helping to convey the concept? Is my English and hand writing intelligible? What are the students doing during the lesson and during the assessment activity?

- In terms of your development as a teacher, what are your personal goals for this lesson?

  Simplify (without making it too simple) a topic nowadays mostly explained through research papers.

Lesson Plan – Amato Oct 8

Your Name: Francesco Amato

Course Title: Antenna Engineering

Estimated # of students in course/attending your lesson: 50

Room Configuration: big room with wide tables

Course Goals:

These do not need to be properly written, include whatever is on the current syllabus for this course.

Check here if the lesson helps met this course goal. Leave empty if the lesson doesn't help meet this course goal.	List course goal in each row.
	1. Design Antenna Systems for wireless communications
	2. Radar
x	3. Power transfer systems

Please add additional rows if you need them.

Lesson Topic:

How power transfer systems work

Lesson Learning Objectives (Where are you going?):

List lesson objectives (one per row).	Domain
1. Overview of available power transfer systems and applications	cognitive
2. Terminology and circuit design of a power transfer system	cognitive
3. Knowledge Assessment	cognitive

Instructor Preparation:

What do you need to do/prepare BEFORE the lesson begins? There will likely (but not always) be long term (before you get to class to facilitate the lesson) and short- term (right before you start the lesson) items. What do students need to do ahead of time?

Long term:

pick examples and videos to facilitate discussion and spark curiosity in the students. Study research papers on the topic

Short term:

Review formulas, formulate assessment problem

Student prep:

Recall link budget equation

Agenda:

Break the lesson into component parts and include how long the part will take. Please add additional rows if you need them.

# of Minutes	Start Time:	End Time:	Name of Teaching/Learning Activity
20	1:35	1.55	Show examples of power transfer systems
20	1:55	2.15	Draw and intuitively explain how energy harvesting circuits work
10	2:15	2:25	Show results simulations on LT spice
10	2:25	2:35	How our lab contributed to this research field
20	2:35	2:55	Assessment problem + CETL form

Power transfer systems are a key application in wireless networks. Antennas are the interface between free space propagation and electronic circuit. Through the link budget equation, one can predict how much power can be wirelessly transferred from one point to another in space. After recalling the concept of wave propagation and power attenuation in free space, the lesson will be organized as follows:

I will show (or discuss about) some examples how energy harvesting circuits. Applications can be classified in Inductive, Capacitive and electromagnetics.

Starting from the half wave rectifier circuit, I will build the circuit that characterize a charge pump and define the parameters characterizing it.

Results of a charge pump circuit behavior will be shown on a simulation software (LTspice)

Discuss some contributions and works in progress made in our lab on this topic.

Introduce an assessment problem that will help them to better understand their class project assignment.

Assessment:

I will ask students to work in pairs and I will walk through the class to answer or ask questions and to facilitate discussions.

Contingencies:

20 minutes to solve the problem might be too much or too little. According to the response I get from the student during the lesson, I might decide to skip the discussions about our lab work and allot more time for the assessment problem.

Energy harvesting class 10/03/2015

Topic: Wirelss power Energy Harvesting

Tesla dream of transferring wireless power

Examples of Energy harvesting applications: Intel, STS, RFID cards, --

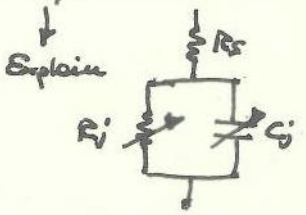
Question: what are the differences in these applications?

Inductive
Capacitive
Wireless (?) → we focus on this

Question: what types of diodes do you know?

Tunnel
pn
Shotky → draw ideal and real IV curve + equivalent circuit

Explain

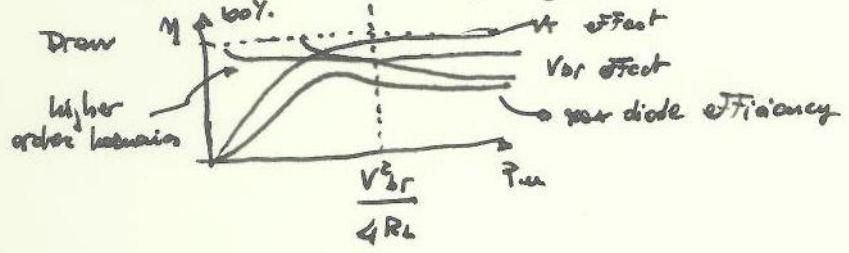


Define V_{br}, V_T, R_s, C_j

- Energy Harvesting Circuit
  - Half wave rectifier
  - Full wave rectifier
  - One stage CP
  - Dickson and > 1 stage CP

  → Show results on LT Spice
  → offer intuitive explanation of the circuit

- Define parameters: P_{out_DC}, η_{eff}, sensitivity



Question: what would be the best diode in terms of V_{br}, V_T, R_s, C_j?
($R_s \to 0$, $V_T = 0$ not included)

Examples of RF Charge Pumps

- Printed circuit CP (ORS project)
- Antenna Shootout Competition 1
- " " " 2
- Antenna Design Project (old) + new.

Recall of previous homeworks where CP appeared

Recall: link budget formula → ask as a question

$$P_r = P_T G_T G_R \left(\frac{\lambda}{4\pi r}\right)^2 \eta_p$$

Recall: voltage to power formula → ask as a question

$$V = \sqrt{8 P_r R_L}$$

Final Exercise (20 min +)

Question
Charge pump with x% efficiency
Rotor data

→ Find max achievable distance for the car