EE P 556: Wireless Power Transfer
Winter 2026

Format	10 weeks, 1-1.5 hours lecture + 2 hours lab Classroom: ECE 037 Lab: ECE 137
Prerequisite	Intro EM (Maxwell's equations & transmission lines), analog circuits, basic RF/s-parameters
Software	Ansys Electronics Desktop, MATLAB, Python
Staff	Lecturer: Kedi Yan, kedi@uw.edu Office Hours: Wednesday, 5 – 6 pm on Zoom TA: Alex Choi Office Hours: Mondays, 6 - 7 pm, In-person at ECE 137

Course Outcomes

- **Hands-on design:** You'll physically wind coils, impedance match it, measure it, and compare the results with measurements and simulations.
- **Field-to-circuit workflow:** You'll model coil geometries in Ansys HFSS/Maxwell and learn how to import into Ansys Circuit.
- **RF measurement confidence:** You'll run a Network Analyzer for 1/2-port tests.
- **Matching & validation know-how:** You'll design practical 50 Ω L-matches, measure S21 vs. coil separation, and reconcile simulation with bench results like an RF engineer.

Assessment and Grading:

- Participation: **10%**
- Weekly Labs (Best 6 of 7): **60%**
- Final Project: **30%** (4% proposal, 16% presentation, 10% written report)

Course Calendar:

Week	Date	Topics	Weekly Reading	Assignment Out	Assignment Due
1	January 7	Lecture • History of Wireless Power (far-field and near-field) • Two-coil link equivalent circuit (L, R, C, M, k, Q); • KVL and KCL • Quality factor • Resonance • Ansys Electronics Desktop – Circuit Lab • Build a 2-coil resonant link on Ansys Circuit • Sweep k & Q and plot efficiency vs. frequency File • Slide: Lecture 1.pdf • Assignment: Assignment 1.pdf • Zoom Recording	Week 1: THE HISTORY OF WIRELESS POWER TRANSMISSION.pdf	Lab 1	Assignment 0 (Due at midnight on Jan 7)
2	January 14	Lecture • Complex Power, Maximum Power and Maximum Efficiency • Inductive Link Analysis	Week 2: Analysis Experimental Results and Range Adaptation of Magnetically Coupled Resonators for	Lab 2	Lab 1 (due a day before lecture)

		• Self-inductance and Mutual-inductance Formula Lab • Wound a real coil. • Use a network analyzer, measure the single coil inductance and the two-coil mutual inductance. • Calculate the coil's inductance using Wheeler's formula, and compare it with the measured result. File • Slide: Lecture 2.pdf • Assignment: Assignment 2.pdf • Zoom Recording	Wireless Power Transfer.pdf		
3	January 21	Lecture • Transmission Line • Smith Chart • Scattering Parameters • Impedance Matching Lab • Use a Network analyzer to impedance match the coil students wound in Lab 2	Week 3: Adaptive Impedance Matching for Magnetically Coupled Resonators.pdf	Lab 3	Lab 2 (due a day before lecture)

		• Do Reactive matching • Extra credits: L network match to 50 Ohm File • Slide: Lecture 3.pdf • Assignment: Assignment 3.pdf • Zoom Recording			
4	January 28	Lecture • Guest lecture: far field wireless power transfer Lab • Impedance matches the second coil. Then measure the S21 of the two coils with various separations. File • Slide: Lecture 4.pdf • Assignment: Assignment 4.pdf • Zoom Recording	Week 4: Harvesting Watts at Ultra-High Frequencies.pdf	Lab 4	Lab 3 (due a day before lecture)
5	February 4	Lecture • FEA Modeling (Ansys ED Maxwell 3D, HFSS, and Q3D) Lab • Model the same coil (as in lab 2) in Ansys HFSS	Week 5: An Introduction to HFSS.pdf	Lab 5	Lab 4 (due a day before lecture)

		and Maxwell, and simulate their self-inductance. File • Slide: Lecture 5.pdf • Assignment: Assignment 5.pdf • Zoom Recording			
6	February 11	Lecture • Co-simulation: HFSS + Circuit, Maxwell + Simplorer Lab • Model two of the same coils and simulate in HFSS. • Import the simulated Ansys ED HFSS data into the Ansys ED Circuit, and simulate the S21 data. • Compare the simulated S21 data with the measured S21 data. File • Slide: Lecture 6.pdf • Assignment: Assignment 6.pdf • Zoom Recording	No weekly reading	Lab 6	Lab 5 (due a day before lecture)
7	February 18	Lecture	Week 7: A 6.78 MHz Multiple-	Lab 7	Lab 6 (due a day

		• System design considerations • AC-DC, DC-DC power electronics design on the receive side Lab • Design rectification and regulation. File • Slide: Lecture 7.pdf • Assignment: Assignment 7.pdf • Zoom Recording	Receiver Wireless Power Transfer System With Constant Output Voltage and Optimum Efficiency.pdf		before lecture)
8	February 25	Lecture • EMC • Safety & SAR • SAR Simulation in Ansys ED HFSS Lab • Final Project Proposal Discussion File • Slide: Lecture 8.pdf • Assignment: Final Project Proposal • Zoom Recording	Week 8: Evaluation of Wireless Resonant Power Transfer Systems With Human Electromagnetic Exposure Limits.pdf	Final Project Proposal	Lab 7 (due a day before lecture)
9	March 4	Lecture	Week 9: Analysis and Design of a Multi-hop	Final Presentation	Final Project Proposal

		• Advanced topics: Multihop wireless power transfer system • Advanced topics: Coil design Lab • Final Project File • Slide: Lecture 9.pdf • Zoom Recording	Resonant Wireless Power Transfer System Optimal Intermediate Coil Size and Location.pdf		(due before the lecture)
10	March 11	Final Presentation			
Final Weeks	March 18 (No Class)	Final Report Due			