Department of Electrical and Computer Engineering
Colorado State University

ECE 548: Microwave Theory and Component Design
Spring 2023 Syllabus (1 of 3)

Revised 1/3/23

Course Objectives:
This course is designed for seniors and graduate students. Successful students in ECE 548 will accomplish the following:

1. Model wave propagation in lossless and lossy media, reflection and transmission at boundaries and with matched layers of heterogeneous media.
2. Analyze wave propagation on transmission lines, including stripline and microstrip structures, as well as waveguides of rectangular and circular cross section.
3. Analyze the network behavior of multiport microwave systems.
4. Design impedance matching networks, including binomial and Chebyshev multi-section broadband transformers.
5. Analyze and design passive microwave components, including microwave resonators, power dividers, hybrid junctions, and microwave filters using multi-conductor lines.
6. Utilize microwave CAD software for component design
7. Demonstrate strong written communication skills through a design project report.
8. Analyze the effects of noise in microwave systems.
9. Calculate the signal and noise characteristics of microwave systems such as communication networks, radars, and radiometers, and relate this to their design.

Instructor: Prof. Steven C. Reising
Office: Engineering Bldg. B113
Phone: 970-491-2228, E-mail: Steven.Reising@ColoState.edu
Office Hours: TBD, taking into consideration students' schedules

Credits: 3 credits.

Prerequisite: ECE 342 or two semesters of EM theory at undergraduate level (or above)

Text: *Microwave Engineering*, **4th edition**, David M. Pozar, John Wiley & Sons, 2012. ISBN: 978-0-470-63155-3.

Lecture Materials: Written lecture notes and/or slides prepared by the instructor will be distributed to students through the course web site on Canvas after each lecture. *Note:* Students are responsible for all material in lecture notes, even if not covered in class.

Grading: Students will be evaluated based on homework problems, a written design project, and two exams. A final grade will be calculated based on: Homework 25%, Design Project/Report 10%, Midterm Exam 30% and Final Exam 35%. (Plus/minus grading)

ECE 548: Microwave Theory and Component Design
Spring 2023 Syllabus (2 of 3)
Revised 1/3/23

Lectures: Tuesday and Thursday, 11:00 am – 12:15 pm, Walnut 109

Midterm Exam: Thursday, March 9, 6:00 – 8:00 pm
Final Exam: Thursday, May 11, 6:20 – 8:20 pm
(Final exams are scheduled by the CSU Registrar. See http://registrar.colostate.edu/final-exams/)

Software: Microwave CAD software will be used for some of the assigned homework problems and for the Design Project. The recommended software is Ansys RF Option, which is available to students in the ENS computer labs as well as online on Virtual Lab administered by ENS. Other RF/microwave design software packages are also available.

Topics Covered:	**Pozar's 4th Edition**	**# of Lectures on each Topic**
1. Wave propagation in lossless and lossy media, reflection and transmission at boundaries and with matched layers of heterogeneous media.	1.2-1.7	2 (1 week)
2. Wave propagation on transmission lines, including stripline and microstrip structures, as well as waveguides of rectangular and circular cross section	2.1-2.8, 3.1-3.11	6 (3 weeks)
3. Network analysis of multi-port microwave systems	4.1-4.4, 4.6-4.7	3 (1.5 weeks)
4. Impedance matching techniques, including design of multi-section transformers to achieve bandwidth criteria	5.1-5.2, 5.4-5.7, 5.9	4 (2 weeks)
5. Analysis and design of microwave resonators, including resonant lines, dielectric resonators and cavities	6.1-6.5	2 (1 week)
6. Power dividers, directional couplers and hybrid junctions	7.1-7.6, 7.8	3 (1.5 weeks)
7. Microwave filters and frequency analysis of multi-conductor transmission lines	8.3-8.8	5 (2.5 weeks)
8. Noise in microwave circuits	10.1-10.4	3 (1.5 wks)
9. Applications in wireless comm. & radiometer systems	14.1-14.4	2 (1 week)

ECE 548: Microwave Theory and Component Design
Spring 2023 Syllabus (3 of 3)
Revised 1/3/23

Academic Integrity: Upholding academic integrity and abiding by ethical principles are fundamental to the practice and profession of electrical and computer engineering. In fact, the IEEE, the world's largest professional society with more than 419,000 members in 160 countries, abides by the IEEE Code of Ethics, in part: "We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree..." Please see the complete IEEE Code of Ethics online at http://www.ieee.org/about/corporate/governance/p7-8.html.

It is my belief that following ethical principles in this class is fundamental to your future contributions to society as electrical and computer engineers. In 2009, ASCSU, as well as CSU faculty and staff, adopted the CSU Student Honor Code, as follows:

"As a student at Colorado State University, I recognize my active role in building a Campus of Character. This includes my commitment to honesty, integrity, and responsibility within the campus community. As such, I will refrain from acts of academic misconduct."

This course, ECE 548, will adhere to the Academic Integrity Policy of the Colorado State University General Catalog and the Student Conduct Code. At a minimum, violations will result in a grading penalty in this course and a report to the Office of Student Resolution Center. Please make sure you are familiar with the CSU Student Conduct Code available here: https://resolutioncenter.colostate.edu/wp-content/uploads/sites/32/2018/08/Student-Conduct-Code-v2018.pdf.

Specifically in ECE 548, academic integrity will be taken very seriously, and violations will be dealt with harshly. On homeworks and design projects, you are free to discuss the work from others and learn in a group setting. *However, you are representing the work you turn in as your own. Therefore, you are required to write all homework answers and design project reports yourself.* Academic penalties are decided on a case-by-case basis, and the typical penalty for cheating on a midterm or final exam is a failing grade for the course. To promote academic integrity, you will be asked to write out the CSU Honor Pledge on the last page of your ECE 548 midterm and final exams: *"I have not given, received, or used any unauthorized assistance on this exam,"* and sign your name to give your promise of and commitment to academic integrity. The use of the CSU Honor Pledge is described on the TILT Academic Integrity web page at https://tilt.colostate.edu/Integrity/Pledge/.