Spring 2019

Microwave Engineering II

University of Massachusetts Amherst
ECE 585

Instructor	Do-Hoon Kwon
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	Department of Electrical and Computer Engineering
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Class meetings	MoWeFr 12:20–1:10PM
Room	Marston 211
Office hour	We 2:00–3:00PM and by appointment @ Marcus 215A

Course Objectives

In this course, students should acquire the following skills. He/She should be able to:

1. Understand the theoretical principles underlying microwave devices and networks
2. Design microwave components such as power dividers, hybrid junctions, microwave filters, ferrite devices, and single-stage microwave transistor amplifiers
3. Improve skills in written communication, through a project report
4. Understand and quantify the effects of noise characteristics of microwave systems
5. Quantify the signal and noise characteristics of microwave systems, and relate them to the design process

Prerequisites

ECE 584, Microwave Engineering I or equivalent

Course Website

Moodle

Textbook

D. M. Pozar, *Microwave Engineering*, 4th. ed., John Wiley and Sons, 2012.

References

R. E. Collin, *Foundations for Microwave Engineering*, 2nd. ed., McGraw-Hill, 1992.
G. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures,* Artech House, 1980.
G. Gonzalez, *Microwave Transistor Amplifiers: Analysis and Design*, 2nd. ed., Prentice Hall, 1996.

Course Requirements

Graded homeworks, one CAD filter design project, one midterm exam, and a final exam.

Grading Policy

Homework	20 %
Filter Design Project	10 %
Midterm Exam	35 %
Final Exam	35 %

Homework assignments are due at the beginning of the class period on the due date. Late homeworks will NOT be accepted.

Course Topics

1. Power dividers, directional couplers (Ch. 7) [8 lectures]
    - T-junction power divider, Wilkinson power divider
    - Waveguide couplers, quadrature hybrid, coupled line directional couplers, Lange coupler
2. Microwave filters (Ch. 8) [11 lectures]
    - Periodic structures, image parameter method, insertion loss method
    - Filter transformations, filter implementation
    - Stepped-impedance low-pass filters, coupled line filters, filters using coupled resonators
3. Ferrimagnetic components (Ch. 9) [7 lectures]
    - Basic properties, plane-wave propagation in a ferrite medium
    - Ferrite-loaded rectangular waveguide, ferrite isolators, ferrite phase shifters
4. Noise and distortion (Ch. 10) [7 lectures]
    - Noise is microwave circuits, dynamic range, intermodulation distortion
    - RF diode characteristics
5. Amplifier basics (Ch. 11) [6 lectures]
    - Two-port power gains, stability
    - Design for maximum gain, design for specified gain, low-noise amplifier design

Computer Requirements

Computer tools may be used for design problems in homework assignments. Keysight ADS or any other equivalent microwave software package may be used.

Program Outcomes

For undergraduate majors taking this course, the five objectives are related in part to ten broad capabilities (ABET Program Outcomes) that we expect for all our BS graduates in the EE and CSE programs. These are related as shown in the table below.

Program Outcomes	Course Objective				
	1	2	3	4	5
1. Well grounded in the fundamental concepts of mathematics, physics, chemistry, computer science, and engineering science	Y	N	N	N	N
2. Able to identify, formulate, and solve problems in ECE	Y	Y	Y	Y	Y
3. Able to design and conduct experiments, and to analyze and interpret measured data	N	N	N	N	N
4. Capable of designing analog and digital systems, components, and processes to meet desired needs	N	Y	N	N	Y
5. Proficient in using modern engineering techniques and computing tools for engineering practice	N	Y	N	N	N
6. Experience in engineering teamwork and in solving technically diverse problems	N	N	N	N	Y

7. Able to communicate effectively orally and in writing, and through symbolic and graphical expression	N	N	Y	N	N
8. Aware of professional and ethical responsibilities as engineers	N	N	N	N	N
9. Aware of the impact of ECE technology and decisions on society	N	N	N	N	Y
10. Motivated about the importance of lifelong learning and professional development	N	N	N	N	N

Inclusivity Statement

The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing, speak with Assistant Dean Paula Rees (rees@umass.edu, 413.545.6324, Community Equity and Inclusion (CEI) Hub Marcus 128b), or submit your concern through the College or Engineering Climate Concerns and Suggestions on-line form (tinyurl.com/UMassEngineerClimate). We are all members of an academic community where it is our shared responsibility to cultivate a climate in which all students/individuals are valued and where both they and their ideas are treated with respect.