University of Massachusetts
Department of ECE
Amherst, MA 01003

Course Instructor: **R. Janaswamy**
Date of Preparation: **01/23/2017**
Prepared by: **R. Janaswamy**

ECE 585: Microwave Engineering II (3-0), Spring 2017

I. Catalog Data

Two, Three, and Four port passive devices, power dividers, direction couplers; microwave filters and periodic structures; noise and distortion, noise temperature, cascaded systems, dynamic range and intermodulation products; microwave amplifier design, stability, single stage and broadband amplifier design; microwave oscillators, transistor and DR oscillators, phase noise, multipliers; mixers, image reject and balanced mixers, differential mixers.

II. Course Objectives

(1) To understand the theoretical principles underlying microwave devices and networks, (2) To design microwave components such as power dividers, hybrid junctions, microwave filters, single-stage microwave transistor amplifiers, microwave oscillators, and microwave mixers (3) To improve skills in written communication, through a project report, (4) To understand and quantify the effects of noise in microwave systems, and (5) To quantify the signal and noise characteristics of microwave systems such as communication networks, radars, and radiometers, and relate this to the design process.

III. Instructor

Professor Ramakrishna Janaswamy, Marcus Hall Room 215D, (413) 545-0937, janaswamy@ecs.umass.edu. Office hours: Th: 2:00-3:00 p.m., Marcus 215-F; other times by appointment

IV. Prerequisites

ECE584, Microwave Engineering I or equivalent

V. Text

D. M. Pozar, *Microwave Engineering,* 4th Ed., John Wiley & Sons, ISBN 978-0-470-63155-3, 2012.

VI. Teaching Assistant

The TA for this course will be
The TA will be grading homeworks and posting solutions.

VII. Software

AWR Design Environment of National Instruments. Free download for windows based machines at

https://awrcorp.com/register/customer.aspx?univ

VIII. Required Background Experience

1. Transmission Line Theory, Smith Chart.
2. Microwave network analysis, scattering and transmission matrices.
3. EM theory, plane waves, waveguides
4. Impedance matching and tuning
5. Microwave tuners.

IX. Detailed Description of the Course

1. Course Topics

   A. Power Dividers and Couplers, Ch. 7 — 8 lecs
   Three-port and four-port parameters, Wilkinson power divider, waveguide and coupled line directional couplers, quadrature hybrid, 180 degrees hybrid, Lange coupler.

   B. Microwave Filters: Ch. 8 — 10 lecs
   Periodic structures, image parameter method, insertion loss method, filter transformations, lowpass and bandpass filters.

   C. Noise and Distortion: Ch. 10 — 6 lecs
   Noise in microwave systems, noise figure and noise equivalent temperature, cascaded systems, dynamic range and inter-modulation distortion.

   D. Microwave Amplifier Design: Ch. 11 — 7 lecs
   Two-port power gains, stability, single-stage amplifier design, broadband transistor amplifier design, power amplifiers.

   E. Oscillators and Mixers: Ch. 13 — 8 lecs
   BJT and FET Oscillators, resonance conditions, DROs, phase noise, frequency multipliers, mixers, single ended

diode and FET mixers, balanced, image reject and differential mixers.

F. No classes (2/20, 3/13-3/17, 4/17)

TOTAL 39 lecs

2. Method of Instruction and Evaluation

A lecture mode of instruction will be used (MRST 220, MWF 12:20-1:10 pm). One midterm exam (March 10, ELAB, 6:30-8:00 pm) at 40% and a final exam (May 4, 1:00-3:00 pm, MRST 220) at 45 % are planned for the course. Finals will be comprehensive. Homeworks will be assigned periodically and graded (15%). Late homeworks will NOT be accepted.

X. Course Web Site:

www.ecs.umass.edu/ece/janaswamy/ECE585

XI. Relationship of course objectives to program outcomes:

For undergraduate majors taking this course, these five objectives are related in part to ten broad capabilities (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 Objectives				
	1	2	3	4	5
1. Well grounded in the fundamental concepts of mathematics, physics, chemistry, computer science, and engineering science.	N	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	Y	N	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

XII. Professional Component:

Engineering Science 1 cr, Engineering Design 2 cr.