

EE523 – Spring 2009

Instructor	Resources
Prof. Stephen Gedney 687C Anderson Hall 257-3926 gedney@engr.uky.edu	Text: <i>Microwave Engineering</i> , 3 rd Ed., David M. Pozar Course web page: http://www.engr.uky.edu/~gedney/courses/ee523
Office Hours: Tuesday 11 - 12, Thursday 3:30—4:30, or by appointment	

Course Syllabus

Lecture #	Topic	Section (Text)
1	Introduction	Chapter 1
2	Transmission Lines – Review	2.1-2.3
3	Standing Waves and Simple Matching	2.5-2.6, 5.2, 5.4
4,5	Smith Charts and Applications	2.4, 5.1-5.4
6	WaveGuides – Stripline, microstrip, CPW	3.1, 3.7, 3.8, notes
7	Network Theory, Z&Y Matrices,	4.1, 4.2
8	Transmission (ABCD) Matrix and Applications	4.4
9	The Scattering Matrix	4.3
10	Scattering Matrix and 2-Port Networks	4.4
11	Signal Flow Graphs	4.5, notes
12	Microwave Resonators	6.1, 6.2, 6.7
13,14	Power Dividers and Hybrids	7.1-7.3, 7.5, 7.7, 7.8
15	Coupled Line Directional Coupler	7.6
16, 17	Microwave Measurement: Network Analyzer and Calibration Techniques and microwave circuit fabrication	handout
18	Microwave Filters – Image Parameter	8.1-8.2
19, 20	Insertion Loss Method	8.3, 8.4
21	Richards Transformation and Kuroda Identities	8.5
22	Stepped Impedance Filters	8.6
23	Coupled Line Filters	8.7
24	Coupled Resonator Filters	8.8
25	Microwave Transistors	11.1
26	Gain and Stability	11.2
27	Single Stage Amplifier Design	11.3
28	Broad Band Amplifier Design	11.4
29	Detectors and Mixers	10.2

Table 1: Assignments and Exams

Requirement	% of Final Grade
Weekly Homework Assignments & short projects and labs	35 %
In class exams	40 %
Final Project	25 %

GOALS:

The objectives of this course are to provide a foundational knowledge of microwave circuit design, including:

- 1) an understanding of transmission lines, microstrip lines, and network theory,
- 2) an applied understanding of matching networks using lumped and printed circuit components,
- 3) the practical design of hybrids, couplers, and dividers
- 4) measurement of passive microwave circuit devices
- 5) fabrication of printed microwave circuits using PCB etching processes
- 6) practical design of microwave amplifiers and oscillators combined with matching networks and bias circuitry.

OUTCOMES:

The following competencies should be imparted to the students:

- 1) Understanding of transmission line analysis and network theory.
- 2) Understanding of matching network design using lumped parameters or printed microstrip or strip-lines.
- 3) Ability to design matching networks, power dividers, couplers and hybrids using printed microstrip or strip-lines.
- 4) Ability to measure microwave circuit devices using a vector network analyzer
- 5) Ability to design microwave amplifiers, matching networks, and DC-Bias networks.
- 6) Ability to design microwave amplifiers and mixers.
- 7) Ability to apply commercial microwave circuit design Computer Aided-Design tools.

Policies:

1. Assignments or short projects are due every Tuesday at the *beginning* of Lecture unless otherwise stated. 1 Late assignment, turned in by the following Thursday, will be allowed. *Subsequent late assignments will be given a zero grade.* The student will be responsible for getting each new assignment from the course web page. They will not be assigned during the class period.
2. Students are responsible for all material in the reading assignments even if not covered in Lecture. This material may be questioned on assignments or quizzes.
3. Many of the weekly homework assignments will involve computer projects using the Agilent Advanced Design System. This will be installed on the campus micro-computing systems. Students will be responsible in obtaining the necessary accounts to access the software.
4. During the semester, there will be two in-class exams. The dates of the exams will be announced at least 1 week prior to the exam.
5. There will be a laboratory component of the class which will require the students to design passive microwave circuits, simulate their performance using HPADS, create a mask, fabricate the device and measure it. The device fabrication and measurements will occur in the high-frequency laboratory (669 AH). We will have scheduled class time in the lab to overview the measurement and fabrication processes. Students will then schedule time in the lab to fabricate and measure circuits.
6. Lab policy: When working with the PCB etching chemicals, you must be wearing latex gloves, goggles and a lab coat. These are available in the laboratory.
7. Final projects will be chosen by the student with the guidance of the instructor. The final projects will have four major components: 1) the design and simulation of a microwave circuit or device, 2) the fabrication and measurement of the device, 3) a

written report summarizing the design and simulated and measured results, and 4) a class presentation during the final exam period.

8. If a student is to be absent from class for an extended period of time (two classes or more), the Instructor must be notified in advance, if possible, or by the second class of the absence. If a student is to miss an exam for any reason the Instructor must be notified *a priori*. If the absence is excusable, i.e., due to severe illness, injury or family emergency, a make up exam will be provided.
9. The final course grade will be computed according to the formula in Table 2 based on the final percentage grade evaluated from the required components of the course indicated in Table 1.

Grading Assignment

Final Grade	Letter Grade
90-100	A
80-90	B
70-80	C
60-70	D
Below 60	E