

# Course Syllabus

## EEL 4422 – RF & Microwave Circuits II

**Term & Meeting Info:** Spring Term, 2008 TR 11 - 12:15 PM in ENB 110

**Instructor Info:** Tom Weller, Office: ENB 364, Phone: 974-2440, Email: [weller@eng.usf.edu](mailto:weller@eng.usf.edu), FAX: 974-5250  
Office Hours: Tuesday 3:30-4:30, and by appointment

**Catalog Description:** Active RF & microwave circuit design. Investigate the characteristics of amplifiers and oscillators used in modern microwave systems, the tools used for analysis, and some common circuit topologies for biasing and matching. Substantial coverage of stability analysis, constant gain methods and noise figure.

**Semesters Offered:** Spring

**Prerequisites:** RF/Microwave Circuits I – EEL 4421 (Passive RF & microwave circuit design. Characteristics of transmission lines used in modern RF & microwave systems, the tools used for analysis and some common circuit topologies for matching, filtering and power distribution).

**Co-requisites:** N/A

**Courses that require this course as a direct prerequisite:** RF & Microwave Measurements - EEL 4658

**Level:** UG/Grad

**Credits:** 3

**Class Duration:** Two one hour, 15 minute sessions per week

**Text Info:** *Microwave Transistor Amplifiers* by G. Gonzalez, 2<sup>nd</sup> Edition, Prentice Hall, 1997. ISBN 0-13-254335-4

**Reference (supplemental reading):** None

### Course Outcomes: Students will learn

1. Analysis and synthesis of lumped parameter and distributed parameter matching networks
2. To analyze power gain and input/output voltage standing wave ratio of two-port networks
3. Sources of instability, principles and application of stability circle analysis of two port networks
4. Principles and application of constant gain circle two port network synthesis
5. Principles and application of constant noise figure circle two-port network synthesis
6. Low noise, broadband, high power and multistage amplifier design techniques
7. Oscillator design technique
8. To use microwave CAD/CAE tools (circuit and EM analysis)

**Test & Grading Info:** There will be homework assignments given almost every Tuesday, that are due the following Tuesday. These will be combined with five to six "laboratories" that involve the use of computer-aided engineering software (*Advanced Design System* (including *Momentum*) from Agilent Technologies). Short quizzes will be given approximately every other week. The plus/minus grading policy will not be used.

Homework - 10%; Quizzes – 15%; Project - 15%; Midterm exam - 25%; Final exam - 35%

90<x<100 = A

80<x<90 = B

70<x<80 = C

50<x<70 = D

<50 = F

**Make-up assignments** – late work will not be accepted without prior notification (at least two days before the due date) and reasonable justification; make-up exams will be allowed at the instructor's consent. Students to be absent from class due to a major religious observance must provide notice of the date(s) to the instructor, in writing, by the second class.

**TA's & Help Sessions:** TA office hours will be distributed during the first week of class.

**Course Topics and (Approx. # of Lectures):** Tentative Semester Schedule

Week	Date	Topic	Sub-Topics	Reading	HW #	Due	Assignment
1	8-Jan	Introduction to the course					
	10-Jan	Network Representations		1.1-1.9	1	1/17	Ch 1, Problems 1, 4, 7, 9, 14a
2	15-Jan	T-Lines, Smith Chart		2.1-2.2			
	17-Jan	Smith Chart, Matching Circuits		2.2-2.4	2	1/24	Ch 2, Problems 5, 7, 8, 12, 14
3	22-Jan	Matching Circuits		2.4			
	24-Jan	Matching Circuits/ Microstrip Matching		2.4	3	1/31	Ch 2, 15, 19, 21, 24, 33
4	29-Jan	Signal Flow Graphs & Power Expressions		2.5			
	31-Jan	Signal Flow Graphs & Power Expressions		2.6, 2.7	4	2/7	Ch 2: 37, Ch 3: 3,5
5	5-Feb	Power Gain Equations, Stability Circles		3.1-3.3			
	7-Feb	Power Gain Equations, Stability Circles		3.3-3.4	L1, 5	2/14	CAD LAB 1; Ch 3: 14
6	12-Feb	Constant Gain Circles		3.4, 3.5			
	14-Feb	Bilateral Matching		3.6, 3.7	L2, 6	2/21	CAD LAB 2. Ch. 3, Prob. 16,21
7	19-Feb	VSWR Circles		3.8			
	21-Feb	Transistor Characteristics; Bias networks		1.11	L3, 7	2/28	CAD Lab 3; Ch 3, Problems 26, 32. Note for 26: "design" means find gammas.
8	26-Feb	In Lab - testing matching network		1.11, 3.9			
	28-Feb	Bias Networks					
9	5-Mar	Noise, Noise Figure Circles					
	7-Mar	Mid-Term					
10	12-Mar	SPRING BREAK					
	14-Mar	SPRING BREAK					
11	19-Mar	Noise Figure		4.1-4.3			
	21-Mar	Broadband Amplifier Design, Mid-Term Review		4.4	L4, 8	3/28	CAD LAB 4, 3.38, 4.1, 4.4
12	26-Mar	Feedback Amplifier Design					
	28-Mar	CAD Project, CAD TOPICS		4.4	9	4/4	4.8, 4.11, 4.13
13	2-Apr	CAD Topics					
	4-Apr	1-port oscillators			10	4/11	4.19, 4.21
14	9-Apr	1-port oscillators		5.1-5.2			
	11-Apr	Oscillators					
15	16-Apr	Oscillators		5.3			

**Specialization:** This course is a technical elective for undergraduate students and should be taken by those interested in the general area of wireless/microwave technology, and in particular amplifier and oscillator design.

**Professional Component:** Engineering Science - 85%    Engineering Design - 15%

**Additional Course Features:**

**Computer Requirements:** Access to and experience with a PC or work-station is necessary. A PC is preferred, and it should have a 586 or higher processor, at least 512 MB RAM, Windows XP and SVGA graphics capability.

**Relation of Course to EE Dept. Program Outcomes:**

Outcome a – An ability to apply knowledge of basic math, science and engineering

Outcome c – An ability to design a systems, component, or process to meet desired needs

Outcome f – An understanding of professional and ethical responsibility

Outcome g – An ability to communicate effectively

Outcome k – An ability to use techniques, skills and modern engineering tools necessary for engineering practice

Outcome l – Knowledge of probability & statistics and advanced mathematics (e.g., calculus, DE, linear algebra, complex variables & discrete mathematics)

**Final Exam Info:** *Unless otherwise notified the final exam will be scheduled according to the Exam Matrix schedule that is distributed by the Electrical Engineering Department each semester.*

**Additional Course Info: Academic dishonesty** – it is not acceptable to copy, plagiarize or otherwise make use of the work of others in completing homework, project, exam or other course assignments. The minimum penalty for doing so is an automatic zero on the assignment. Unless specified otherwise, scholarly exchange on out-of-class assignments is encouraged. If there are any questions regarding this policy they should be asked. **Attendance policy** – you are not required to attend lectures. **Property** – you are not granted permission to sell notes or tapes of class lectures.

**Syllabus Prepared by: T. M. Weller**

**Date of Approval of Syllabus by Area Subcommittee:**