

## Course Outline, Telecommunication Circuits, ELEC 4505, Fall 2008

**Lectures:** Tue, Thur 4:00-5:30, room 3165 ME, (Term is Sept 4 – Dec 1, 2008)

**Labs:** Wed 8:30-11:30, Thur 8:30-11:30, Fri 11:30-2:30, Odd Weeks room 4135 ME

**Marks:** Lab 35%, Assignments 15%, Final 50% (must get at least 35/100 in final exam)  
(As per standard practice in Engineering, students will not be allowed to see their final exam)

Academic accommodation for any reason must be sought as soon as possible, preferably early in the term. Verification will be required.

**Course Objective:** To learn about the design of communications circuits. In other courses, the block diagrams have been seen, but here, emphasis will be on the actual circuitry which makes up these blocks. Examples of such blocks are tuned amplifiers, mixers, oscillators, phase shifters and detectors. Communications systems considered are wireless transceivers, AM, FM and TV. Use of the PLL will be discussed.

<u>Course Outline:</u>	<u>Page</u>
<b>1. Introduction to Telecommunications</b> Components of a radio systems; noise, distortion impedance matching.	<b>1</b>
<b>2. Amplifier Design</b> Tuned amplifiers, class C amplifiers, extension to frequency multipliers.	<b>17</b>
<b>3. Mixers and Modulators</b>	<b>39</b>
<b>4. Phase-Locked Loop and Applications</b> Introduction to PLLs and applications such as: synthesizers and FM demodulation.	<b>47</b>
<b>5. Oscillators</b>	<b>72</b>
<b>6. Amplitude-Modulated Radio</b>	<b>83</b>
<b>7. Frequency Modulators and Demodulators</b>	<b>89</b>
<b>8. Television Systems</b> Transmission and reception of video and audio; May also discuss high-definition TV, stereo sound.	<b>102</b>

### Labs:

Group size is 2 for all labs, one writeup per group, due one week after scheduled lab day, 4:15 PM. (Note assignments are done individually.)

- 1. Tuned Amplifiers (Simulation Lab)** (Sept. 24, 25, 26) **115**  
Design and simulation (in ADS) of a 6 MHz tuned amplifier, built with a bipolar transistor and passive components. You will learn about use of transistor parameters, tuned circuits, noise figure and impedance matching.
- 2. Mixers and Modulators (Hardware Lab)** (October 8, 9, 10 [note Oct 10 is University Day]) **127**  
Use of an analog multiplier on an IC to build frequency changers.
- 3. Phase-Locked Loops (Hardware Lab)** (October 22, 23, 24 and November 5, 6, 7) **144**  
Use of a commercially available package to build a tracking filter, a synthesizer and an FM demodulator. The IC contains a voltage-controlled oscillator and phase detectors. In this lab, the VCO and phase detectors will be characterized, then a complete phased-locked loop will be built. The main external components will consist of a simple active loop filter and a divider to realize the synthesizer.

### References:

Smith, *Modern Communication Circuits 2nd Ed.*, McGraw-Hill 1998, TK6553.S5595

Krauss, Bostonian, Raab, *Solid State Radio Engineering*, Wiley 1980, TK6553.K73

Plett, Rogers, *Radio Frequency Integrated Circuit Design*, Artech House, 2003, TK7874

Sedra, Smith, *Microelectronic Circuits*, (for intro to tuned amplifiers, oscillators)

Stremmler, *Introduction to Communication Systems*, (or other introductory communications texts)

Sigmetics, *Linear Data Manual Volume 1: Communications*, 1987 (or other data books)