

Telecommunication Circuits, 97.455, Fall 2005

- Lectures:** Tue, Thur 1:00-2:30, room 238 TB
- Labs:** Wed, Thur, Fri 8:30, Odd Weeks, Room 4135ME
- Marks:** Labs 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.)

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>
1. Introduction to Telecommunications.	1
Components of a radio systems; noise, distortion impedance matching.	
2. Amplifier Design	16
Tuned amplifiers, class C amplifiers, extension to frequency multipliers.	
3. Mixers and Modulators	38
4. Phase-Locked Loop and Applications	46
Introduction to PLLs and applications such as: synthesizers and FM demodulation.	
5. Oscillators	71
6. Amplitude-Modulated Radio	82
7. Frequency Modulators and Demodulators	87
8. Television Systems	101
Transmission and reception of video and audio; May also discuss high-definition TV, stereo sound.	

Labs

Group size: Simulation - 1, Hardware - 2, one writeup per group, due one week after scheduled lab day, 4:30 PM.

1. Tuned Amplifiers (Simulation Lab) (Sept. 28, 29, 30)	114
Use of a bipolar transistor and some passive components to build a tuned amplifier operating at 1.2 MHz. You will learn about use of transistor parameters, tuned circuits and impedance matching.	
2. Mixers and Modulators (TBD Hardware or Simulation) (October 12, 13, 14)	124
Use of an analog multiplier on an IC to build frequency changers.	
3. Phase-Locked Loops (Hardware Lab) (October 26, 27, 28 and Novemer 9, 10, 11)	138
Use of a commercially available package to build a tracking filter, a synthesizer and an FM demodulator. The IC contains a voltage-controlled oscillator a phase detector, and amplifiers. In this lab, the VCO and phase detector will be characterized, then a complete phased-lock loop will be built. The main external components will consist of a simple loop filter and a divider to realize the synthesizer.	

References

- Smith, *Modern Communication Circuits 2nd Ed.*, McGraw-Hill 1998, TK6553.S5595
- Hagen, *Radio Frequency Circuit Design*, Cambridge Press, 1997, TK
- Krauss, Bostonian, Raab, *Solid State Radio Engineering*, Wiley 1980, TK6553.K73
- Plett, Rogers, *Radio Frequency Integrated Circuit Design*, Artech House, 2003, TK7874
- Van der Puije, *Telecommunication Circuit Design*, Wiley 1992, TK5103.V
- Sedra, Smith - (for intro to tuned amplifiers, oscillators)
- Stremmer, *Introduction to Communication Systems* (or other intro texts)
- Signetics, *Linear Data Manual Volume 1: Communications* 1987