

## Course Outline, Telecommunication Circuits, ELEC 4505, Fall 2020

**Instructor:** Prof. John Rogers, **Office:** 7049MC

**Marks:** Lab 35%, Assignments 15%, Mid Term 25%, Final 25%

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

**Course Description:** Design of circuits making up the blocks in a communication system. 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.

	<b>Course Outline:</b>	<b>Page</b>
<b>1.</b>	<b>Introduction to Telecommunications</b> Components of a radio systems; noise, distortion impedance matching.	<b>1</b>
<b>2.</b>	<b>Amplifier Design</b> Tuned amplifiers, class C amplifiers, extension to frequency multipliers.	<b>17</b>
<b>3.</b>	<b>Mixers and Modulators</b>	<b>39</b>
<b>4.</b>	<b>Phase-Locked Loop and Applications</b> Introduction to PLLs and applications such as: synthesizers and FM demodulation.	<b>47</b>
<b>5.</b>	<b>Oscillators</b>	<b>72</b>
<b>6.</b>	<b>Amplitude-Modulated Radio</b>	<b>83</b>
<b>7.</b>	<b>Frequency Modulators and Demodulators</b>	<b>89</b>
<b>8.</b>	<b>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 write-up per group, labs are submitted electronically on cuLearn and are due one week after the scheduled lab day. Lab 3 has two parts, done in weeks 7 and 9, the write-up combines both parts and is due in week 10. (Note that unlike labs, assignments are done individually.)

<b>1.</b>	<b>Tuned Amplifiers</b> (Sept. 28, 29, Oct. 2) 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.	<b>115</b>
<b>2.</b>	<b>Mixers and Modulators</b> (October 12, 13, 16) Use of an analog multiplier on an IC to build frequency changers.	<b>127</b>
<b>3.</b>	<b>Phase-Locked Loops</b> (October 26, 27, 30 and November 9 10, 13) 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.	<b>144</b>

### 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)  
 Strempler, *Introduction to Communication Systems*, (or other introductory communications texts)  
 Signetics, *Linear Data Manual Volume 1: Communications*, 1987 (or other data books)