ECE 440 Lab Practical 1

Review Sheet

The following is a list of important concepts related to the first four labs. It is not necessarily an exhaustive list of everything that may be covered on the Practical Exam, but your performance on the Practical will greatly benefit from a thorough understanding of these topics.

Lab 1

Noise: Power-RMS-PSD
- Know what PSD means.
- Know how the PSD of noise is affected when the noise passes through a filter.
- Know how to convert from PSD to power to RMS voltage.

Signal-to-noise ratio (SNR)
dB unit conversions
- Know the formulas, and how to apply them.

Lab 2

LTI systems: Convolution, impulse response, frequency response, etc.
Two-tone test and inter-modulation distortion
- Know the purpose of the two-tone test.
- Derive the distortion terms arising from a two-tone test applied to a nonlinear system (Pre-Lab 2, Question 3).
- Know the in-band third-order inter-modulation terms.

Lab 3

AM (DSBLC) signals and modulation diagrams
- Know the block diagrams (how to draw them, and how to build them in lab).
- Know how the signals change during the modulation and demodulation processes.

Modulation index
- Calculate it from a time-domain waveform.
- Calculate it from a block diagram.
- Know the relationship between modulation index, message amplitude, and DC offset.

Envelope detector
- Know the circuit diagram.
- How the circuit works
- How to choose RC
- What happens if RC is too big, too small?

Frequency mixing and super-heterodyne receiver

- What is frequency mixing?
- What is the purpose of super-heterodyne receivers?
- Know the block diagram for a super-heterodyne receiver.
- How does a super-heterodyne receiver work?
- Justify (mathematically) the equations for the two choices of the local oscillator frequency.

Lab 4

DSBSC signals and modulation diagrams

- Know the block diagrams (how to draw them, and how to build them in lab).
- Know how the signals change during the modulation and demodulation processes.
- Know the differences between DSBSC and DSBLC, and the advantages and disadvantages of each.

Problems with envelope detector demodulation

- What is the result of demodulating a DSBSC signal using an envelope detector?
- How does this result compare to the original message?

Synchronous demodulation

- Why does receiver need to be at the same frequency as the incoming carrier? (Know what happens if the frequencies are different.)
- Why does receiver need to be in phase with incoming carrier? (Know what happens if the phases are different.)
- Know how to get synchronous demodulation (so that the modulating and demodulating carriers have the same phase). We've covered two methods:
    - Stealing the carrier (Know how to do this.)
    - Costas Loop (Know the block diagram, and why it works conceptually.)