ELEC 3060 – WIRELESS DESIGN LAB
(Required for WIRE)

2020 Bulletin:	**ELEC 3060 WIRELESS DESIGN LAB (1)** LAB. 3. Pr., ELEC 3400. Laboratory experiments geared towards understanding the implementation and testing of components used in wireless communication systems.
Textbook:	Communication Systems Modelling with TIMS, Emona Instruments, Sydney Australia, provided in lab
References:	T.I.M.S. System User's Guides, provided in lab
Coordinator:	Shiwen Mao, Professor of Electrical & Computer Engineering
Course Goals:	1. To understand key components of analog and digital wireless voice transmission 2. To understand key components of wireless digital data transmission 3. To be able to design key components of a wireless transceiver 4. To be able to communicate experimental results orally and in writing
Prerequisites (by topic)	1. Communications Systems 2. Electromagnetic Waves

Lab Topics (14, 170 minutes per lab):

1. Amplitude Modulation (2 class)
2. FM and Sampling (2 class)
3. Digital Communications (6 class)
4. DSSS and CDMA (1 class)
5. Final design project (2 classes)
6. Final Project Presentations (1 class)

Typical Experiments

1. AM
2. DSBSC generation
3. Sampling theorem
4. FM using VCO
5. PRBS generation
6. Eye patterns
7. The noisy channel model
8. Detection with the Decision Maker
9. Line coding
10. PCM encoding
11. Block coding and decoding

Optional experiments may replace some of the typical experiments. These optional experiments are at the discretion of the instructor. Some possible optional experiments include:

1. SSB generation
2. Frequency division multiplexing
3. Phase division multiplexing
4. Analysis of FM spectrum

5. FM and Bessel Zeros
6. FM demodulation with phase-locked loop
7. The Costas loop
8. Amplitude shift keying
9. Frequency shift keying
10. Binary phase shift keying
11. Signal constellations
12. Sample and hold
13. PCM decoding
14. Bit error rate measurement in the noisy channel
15. Bit error rate instrumentation macro model
16. Block coding and coding gain
17. QAM and 4-PSK
18. Multi-level QAM and PSK with BER
19. Spread spectrum – DSSS and CDMA

Typical method for evaluating student performance:

Prelab quizzes	5%
Lab reports	65%
Final project	30% (15% of report and 15% of presentation)

Computer usage: Students will use T.I.M.S. hardware and software to conduct experiments, capture data, and analyze outcomes. They are also encouraged to use the Tutor TIMS Telecommunications Teaching Software to prepare for the experiments and conduct experiments remotely, and to use programs such as MATLAB and Excel to solve lab related problems and prepare lab reports.

Primary student outcomes related to the course ELEC 3060:
(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Prepared by: Shiwen Mao Date: 9/24/20