THE UNIVERSITY OF UTAH

ECE 6962-002: Applications of Fading Channels, Fall 2012

Lecture:	Tuesday and Thursday, 12:25 – 1:45 pm in WEB 2460
Prerequisite:	ECE 5510, *Random Processes*, and ECE 5325, *Wireless Communications Systems*, or equivalent material, as described below.
Credit:	3 hours
Instructor:	Neal Patwari
Office:	MEB 3120
Office Hours:	Tue/Thu 1:45pm to 3:00pm and by appointment
Calendar:	`http://span.ece.utah.edu/neal-patwari`
Email:	`npatwari@ece.utah.edu`
Phone:	(801) 581-5917
Web Page:	Grades and homework/exam solutions will be posted on Canvas, and everything else will be on `http://span.ece.utah.edu/6962`.
Software:	Use of either Matlab or Python is a required part of assignments.
Textbook:	No textbook is required.
Description:	Models for the radio-frequency multipath fading channel, including time-delay, frequency-domain, angle-of-arrival and spatial; fading characteristics (and their measurement) such as narrowband fading, small-scale fading, Doppler spread, temporal fading on static links. These characteristics are useful for particular applications, and in particular, we explore (1) detection and tracking of motion in an environment: using changes in the measured received signal strength (RSS) on links in a static deployed network to estimate where people and objects are located, and their breathing rate, and (2) shared secret key establishment (SKE): signal processing methods to use measurements of a reciprocal fading channel to generate a bit stream of unpredictable, uncorrelated bits which reliably agree at two ends of the link.
Topic Schedule:	A more detailed list of topics, by class meeting date, is kept on the schedule page, `http://span.ece.utah.edu/6962-schedule`. Since this is the first time this course is being taught, it is difficult to predict in advance how fast we will progress, and we place more importance on understanding than "getting through" the material. This schedule is updated as the class progresses.
Readings:	The course covers currently developing research, and thus we will use readings from the recent research literature. Readings will be pdfs linked to from the schedule page. These are required readings, and must be read prior to the class in which they will be discussed, so that we can build our understanding of the material through in-class discussion. Short (5 minute) pop quizzes will periodically be given at the start of a class period to measure your comprehension of the assigned reading.

Grading

Course grades are recorded on Canvas. The final grade is calculated based on:

- 15% Exam 1: on Section 1, Fading Models. Covers Lectures 1-7. September 18.
- 20% Exam 2: on Section 2, Detection and Tracking of Motion from RSS. Covers Lectures 8-18. Will be a take-home exam. November 1.
- 5% Homeworks will periodically be assigned. You will always have at least one week between homework assignment and the due date.
- 10% Quizzes on Readings. See above.
- 50% Course Project.

Course Project:

You will complete, by the end of the semester, a course project, comprising of a written report and an oral presentation. You may choose one of the following.
(1) Design of a laboratory experiment: Design, test, and write up a laboratory experiment for a wireless communications system lab that teaches some concept about radio propagation or multipath fading phenomena.
(2) Fading application system design: Design, test, and write up a paper on a system that uses measurements of the multipath radio channel for some purpose, for example, localization, monitoring, secret key establishment, or some other application you wish to explore.

Collaboration Policy:

You are encouraged to work together on homework assignments. Discussing is a great way to learn. After making a genuine attempt to solve the homework problems, you are encouraged to discuss the answers with other students currently enrolled in the class to check answers and compare approaches. However, afterwards, you must complete your answers on your own, without referring to the solutions of other students, or solutions books or web sites. When working on Matlab or Python problems, you may not use or copy code written by another student, or provide your code to another student.

Grading Scale

Tests, projects, and homeworks are designed so that you can demonstrate your mastery of each of the topics within digital communications. Your grade percentage will reflect the percentage of the course topics which you have demonstrated proficiency. Competition is not necessary, since every student can get an 'A' grade. The letter grade is encoded as follows:

	A: ≥ 92	A-: ≥ 90 and < 92
B+: ≥ 88 and < 90	B: ≥ 82 and < 88	B-: ≥ 80 and < 82
C+: ≥ 78 and < 80	C: ≥ 72 and < 78	C-: ≥ 70 and < 72
D+: ≥ 68 and < 70	D: ≥ 62 and < 68	D-: ≥ 60 and < 62

Tips:

1. Read the assigned reading *before* lecture.
2. Play with the measurement hardware.
3. Start on the course project *early*.

Prereq Material: Students are expected to understand basic radio wave propagation and antennas. This material is covered in ECE 5325, but may also have been learned in other courses. Students are expected to understand how to use probability distributions, including deriving the distribution of a function of other random variables. This is material covered in depth in ECE 5510, although it is covered briefly in ECE 3530. Students are expected to use the Fourier transform, which is covered first in ECE 3500.

Disability Accommodations The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.