

## UTA EE6367 Advanced Wireless Communications — Fall 2011

**Instructor:** Qilian Liang, Ph.D  
Professor  
NH541  
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**Lecture:** TTh 11:00pm-12:20pm, NH105

**Office Hours:** TTh: 1:00pm-2:00pm

**Section Information:** EE6367-001, EE6367-002

**Course Webpage:** <http://www-ee.uta.edu/Online/liang/EE6367/>

**Description of Course Content:** Overview of the development of wireless communications, Multiple Antennas and Space-Time Communications, Convolutional Codes, Turbo Codes, Ultra Wideband (UWB) communications, Sensor Networks 7, Capacity of Wireless Channels, Other Selected Topics

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**TA Office Hours:** TTh 9:30am-11:00am and 12:30pm-2:00pm

**Pre-req:** EE5368

**Other Requirements:** Basic programming skills in MATLAB

**Grading:**  
5% Homework  
35% Midterm Exam I  
35% Midterm Exam II  
25% Final Term Paper or Project

**Exam Dates:**  
Midterm Exam I: Thursday, October 6, 2011, 11:00pm-12:20pm, NH105

Midterm Exam II: Thursday, December 1, 2011, 11:00am-12:20pm, NH105

### **Course Objective**

Students will be able to keep up-to-date with the new technology development of wireless communications: MIMO, space-time communications, turbo codes, ultra-wideband (UWB) communication, sensor networks, WiFi, WiMAX, WCDMA, CDMA2000, etc.

### **Final Project or Term Paper** (Due: December 12, 2011).

It's a team project (or term paper) for up to 3 graduate students per team (i.e., 1, 2, or 3 students per team). Each team has a choice to choose a course project or term paper. The course project will be either designing an UWB communication system (physical layer reference system) or MIMO physical layer communication system (CHOOSE ONE). Regarding the term paper, students are free to choose any topic in the areas of sensor networks, UWB communications, MIMO, FH/TH CDMA, space-time communications, turbo codes, WiFi, WiMAX, etc. More details on the project and term paper will be announced. The course project or term paper weighs 25% towards the total grade of this course.

### **Grading Policies:**

- **Final grades** will be assigned by a combination of student score distribution (histogram) and the discretion of the instructor.
- **Homework** will not be graded, but checked.
- **Late Homework** will not be accepted.
- **Make-up Exams:** No make-up exams will be given. If you can't make the above exam dates, you must drop the class.
- **Academic Integrity Policy:** As per university rules and guidelines.

### **Textbook**

No required textbook.

### **Reference Books:**

1. Hamid Jafarkhani, *Space-Time Coding: Theory and Practice*, ISBN: 0521842913, Cambridge University Press, 2005.
2. David Tse and Pramod Viswanath, *Fundamentals of Wireless Communication*, ISBN 0521845270, Cambridge University Press, 2005.
3. Andrea Goldsmith, *Wireless Communications*, ISBN: 0521837162, Cambridge University Press, 2005.
4. Di Benedetto & Giancola, *Understanding Ultra Wide Band Radio Fundamentals* (Prentice Hall Communications Engineering and Emerging Techno), ISBN: 0131480030, Prentice Hall 2004.

### **Course Material:**

1. Overview of the development of wireless communications
2. Multiple Antennas and Space-Time Communications

- Narrowband MIMO model
- Parallel decomposition of the MIMO model
- MIMO diversity gain: beamforming
- Space-time modulation and coding
- Frequency selective MIMO channel
- Smart antennas
- BLAST

### 3. Convolutional Codes

- Encoder
- Viterbi decoder
- Puncturing and Interleaver

### 4. Turbo Codes

- Soft decision decoding
- Concatenated codes
- Turbo codes

### 5. Ultra Wideband (UWB) communications

- Introduction to UWB
- DS-UWB and TH-UWB
- Channel modeling for UWB
- Transmitter and receiver system-level design for UWB radio
- Interferences and performance analysis in UWB

### 6. Sensor Networks

- Virtual MIMO-based Sensor Networks
- Fading Relay Channels in Sensor Networks
- UWB-based Sensor Networks

### 7. Capacity of Wireless Channels

- Capacity in AWGN
- Capacity of flat fading channel
- Capacity of frequency selective fading channel
- MIMO Channel capacity: static channel and fading channel
- Capacity of Wireless Networks

### 8. Other Selected Topics

- WiFi and WiMAX
- CDMA2000 and WCDMA
- Others

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period

through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/ses/fao>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Academic Integrity:** At UT Arlington, academic dishonesty is completely unacceptable and will not be tolerated in any form, including (but not limited to) "cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts" (UT System Regents' Rule 50101, §2.2). Suspected violations of academic integrity standards will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.