

UTA EE6367 Advanced Wireless Communications — Fall 2016

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Professor
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Lecture: TTh 11:00pm-12:20pm, NH106

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

Course Handouts: <http://www.uta.edu/blackboard/>

TA:

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TA Office Hours: TTh 9:30am-11:00am and 1:00pm-2:30pm

Pre-req: EE5368

Other Requirements: Basic programming skills in MATLAB

Grading (On-Campus Students, Section 001):

5% Homework
15% Quizzes
30% Midterm Exam
30% Final Exam
20% Final Project

Grading (Web Students, Section 002):

5% Homework
35% Midterm Exam
35% Final Exam
25% Final Project

Exam Dates:

Midterm Exam: Tuesday, October 11, 2015, 11:00pm-12:20pm, NH106

Final Exam: Tuesday, December 13, 2015, 11:00am-1:00pm, NH106

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, LTE, 5G, etc.

Final Project or Term Paper (Due: Monday, December 12, 2016).

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.

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. Shu Lin and Daniel Costello, *Error Control Coding*, 2nd Ed, ISBN: 0130426725, Prentice Hall, 2004.
3. David Tse and Pramod Viswanath, *Fundamentals of Wireless Communication*, ISBN 0521845270, Cambridge University Press, 2005.
4. Andrea Goldsmith, *Wireless Communications*, ISBN: 0521837162, Cambridge University Press, 2005.
5. 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

- Parallel decomposition of the MIMO model
- MIMO diversity gain and Multiplexing gain
- Space-time modulation and coding
- Space-Time Coding Design Criteria
- Space-Time Block Codes
- Space-Time Trellis Codes

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. Other Selected Topics

WiFi and WiMAX, CDMA2000 and WCDMA, LTE, 5G, 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://wweb.uta.edu/aao/fao/>).

Disability Accommodations: UT 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)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. 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 disability. Students are responsible for providing the instructor with official

notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington (“University”) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.*

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) 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. Additional information is available at <https://www.uta.edu/conduct/>.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as “lecture,” “seminar,” or “laboratory” are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback via the SFS database is aggregated with that of other students enrolled in the course. Students’ anonymity will be protected to the extent that the law allows. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, [which is located \[insert a description of the nearest exit/emergency exit\]](#). When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.