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ECE 506 PMP (4 cr)
Fundamentals of Wireless Communications (Spring 2022)
February 2022

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Professor: JA Ritcey EEB454 jar7@uw.edu
Format In-class with zoom capture
Prof Office Hours: To meet class needs, and can be virtual
TA: Yes, name not currently available
Office hours will be set based on class preferences
Course Page:
hrefhttps://canvas.uw.edu/courses/1545411Canvas
Textbooks: *See our Course Homepage.* We will use the books by Goldsmith, Anderson, and other online resources.

Prerequisites:
1. An undergrad understanding of engineering signals and systems in discrete and continuous time. The topics most important in 506 include signals, linear systems, Fourier analysis, discrete time processing. We will review this in week one.
2. Basic knowledge of probability (The UW ECE PMP core sequence is sufficient)
3. Some facility and interest in MATLAB or equivalent (Python)
4. It is *not required* that you had a previous course on digital communications or electromagnetics.
5. I understand that EE PMP come from a variety of backgrounds. You will succeed on the exams, if you are able to successfully complete the homework assignments.

Course Syllabus: Topics

1. Review of Digital Signal Processing,Signals and Systems, and Noise.
2. Telecommunications Overview. A overall look at the telecommunications sector from the point of view of spectrum (FCC regulation), standards (including 5G NR), IOT, and technology. Hot Topic: Some recent issues such as 5G C-band interference with Aircraft radar altimeters.
3. Examining the Cellular Concept and frequency reuse. Capacity. Signal-to-Noise and Signal-to-Interference. Hot Topic: Stochastic Geometry Modeling
4. The Structure of Point-to-Point Wireless Communications Systems. The role of bandwidth, power, and data rate. The concept of noise-limited vs interference limited operation. Functions of a radio receiver - detection, estimation, synchronization, and decoding.
5. Classical Modulations: PAM, QAM, MPSK, and MFSK. Spread Spectrum both for CDMA and LORA IoT approach.
6. The concept of Channel Capacity (maximum bits/sec/Hz at a given Signal-to-Noise) and transmitter-informed adaptive modulation. System Comparisons.
7. Midterm Exam Week, includes review. Midterm exam format (in-class or take-home) is not decided at this point.
8. The Wireless Channel - Fading and Multipath and Diversity. Link Budgeting.
9. Multi-Antenna Systems for Communications Beamforming and MIMO. Hot Topic: Massive MIMO
10. Modern Channel Coding Channel Coding and Information Theory. Uncoded vs Coded systems. Classical Forward Error Correction Codes. LDPC and Turbo Codes.
11. Final exam or final project depends on class interests.We will discuss at the start of the quarter

Grading: Homework assignments 30%, Midterm 30%, Final/Project 40%.

Homework (HW): HW is typically assigned weekly to the course dropbox. Delayed HW submissions may be allowed only with prior consent of the instructor and TA, and must be submitted before the HW solutions are posted. Some HW problems require MATLAB or other programming language with easy access to graphics and scientific programming.

Exams: Midterm exam is around the middle week of the quarter. The final exam is scheduled during Final's Week. It will be a takehome exam and due during the last week. it The exact format of the midterm and final has not been determined.

Religious Accommodations: Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy UW Policy Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (UW Policy

Disability Accommodations: The University of Washington is committed to providing access, and reasonable accommodation in its services, programs, activities, education and employment for individuals with disabilities. To request disability accommodation, contact Disability Resources for Students at least 10 days prior to the start of your course. You may also request accommodation in the application process by contacting Disability Services at least 10 days before you submit your application.

Course Policy on Academic Misconduct: Engineering is a profession demanding a high level of personal honesty, integrity and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the engineering profession, shall adhere to the University of Washington's Student Code of Conduct.

Cheating Policy Any student in this course suspected of academic misconduct (e.g., cheating, plagiarism, or falsification) will be reported to the College of Engineering Dean's Office and the University's Office of Community Standards and Student conduct. (See CoE website for more detailed explanation of the academic misconduct adjudication process). Any student found to have committed academic misconduct will receive a 0-grade on impacted academic work (e.g., assignments, project, or exams).