2008 EE 416 Communications I
Random Signals

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Ritcey Bio Sketch

- BSE & Math Duke University
- 5 years with GE Aerospace – military avionics
- MS Syracuse Univ at same time
- PhD Univ of Calif San Diego – CW Helstrom advisor "Computing Radar Detection Probabilities using Contour Integration"
- Professor at UW since 1985
- Currently Assoc Chair for Education – responsible for teaching schedules, & new Professional MSEE Degree (evening)
- Research: Modulation & Coding, Underwater Acoustics, Wireless Security

Ritcey Research BioSketch

- Research Areas – statistical signal processing, modulation & coding, array signal processing, underwater acoustic signal processing & comm, network security & jamming, numerical techniques
- Current Funded Projects – UWA Comm (ONR), MURI on network security (ARO)
- Most cited work – my students and I developed BICM-ID in 1997. Several papers on this each cited around 100 times
- Over 100 conference and journal publications

- I actively use Matlab for statistical computation

Course Organization

- Contact Information
- Website - linked to EE Homepages
- Course Organization & Grading
- Course Policies
- Relationships to other EE courses
- EE 416 Topics

- Please use these slides as a reference

Contact Information for EE416

- Professor Jim Ritcey Room EE1 454
- ritcey@ee.washington.edu
- Class times Mon/Wed 10:30-12:20
- Office Hours and
- Tuesday (1-2pm)
- Other times I am in my office –usually M, T, W
- TA Linda Bai lyb3@u.washington.edu
- TA Office will be in TA room in Sieg Hall 126
- TA Office hours on website
- TA priorities – office hours, Q&A , grading, class management

Important Dates for Autumn 2008

- First day Wed Sept 24 in MEB 242
- Last Class Wed Dec 3
- Quizzes can occur during on any class day
- Midterm is on Wed Oct 29

- Final Exam Monday Dec 8 8:30-10:30AM here

Course Organization & Grading

- In Class Quizzes (short exams) 20%
- 1 Midterm 20% Wednesday Oct 29 20%
- 1 Final Mon Dec 8 25%
- Weekly Homework 15%
- Group Matlab Projects (several) 20%
  - Due on Wednesdays in class or to TA by 3pm
- Some variation in final grade due to …
- Class Attendance & overall quality of work
  - important components of EE 416

Quizzes & Midterm & Final

- Closed book. No electronic equipment is permitted
- No cheating will be tolerated.

- I usually allow some limited (2-4) pages of personal notes. The midterm is 90-100minutes
- I am testing competency – I design for a high mean (70%). If you score very low (<45%), it will have a significant impact on your grade
- Many grade points are available later in the quarter – keep trying hard
- Quizzes are short tests 20-30min

EE 416 - Learning Together Policy

- Learning improved by active participation
- Problem solving is an iterative process
- Teams - important for engineering efficiency
- Many types of experts are often needed – software, hardware, reliability, finance, customer relationships, marketing, manufacturing, field service,etc

- I strongly encourage homework problem solving in small groups – so long as every member understands all aspects and contributes equally
- Projects are likely to be small teams (2-3)

EE 416 Warnings

- No electronic equipment of any kind can be used during quizzes or exams.
- Cheating on any test is a violation of UW rules and will be prosecuted
- Plagiarism-the use of ideas or material from another source without proper attribution-is a violation of UW rules.

- The EE Dept and College of Engineering are the immediate "courts of authority." Sentencing can be severe.

Communications Track in EE

- 416 Probability & random signals
- 417 Modulation for Digital Communications
- 420 Capstone design – software radio algorithms
- 461 Networking fundamentals
- 418 Crypto and network security

- Electromagnetics & Antennas
- Signal & Image Processing & Coding
- Mixed Analog & Digital Circuits & Embedded
- Sensors & Photonics

EE 416 Course Topics

- Textbook –Tummala & Therrien + Class Notes
- Matlab is critical for computation

- Probability Models -ch2
- One Random Variables–discrete, continuous-ch3,4
- Multiple Random Variables-ch5 – correlation
- Applications in Statistics-ch6 selected topics
- Random Processes-ch7 selected topics
- Applications in Communications & Networked Systems

Learning Objectives

- Probability-what are the most important random variables, how do we use them in models and analysis
- Statistics- how do we use data to make inference. Estimate parameters, make choices, design systems
- Computation-engineers make tools. For us, these are software tools. Matlab is the common toolkit for EE's in signal processing & communications
- You MUST learn how to effectively compute in Matlab – it is what makes the course relevant & fun. You need to move beyond your comfort zone

Learning Styles

- Visuals –figures & sketches- are critical for active learning & retention . You must invent them
- Draw a diagram/picture/flowchart rather than reading a description.
- Acronyms are useful – PDF, CDF, DSP,
- Equations are the building blocks of software
- Mathematical Analysis provides test cases for software
- Learning is iterative. Revisit to deepen your understanding

Maths & Stats

- Probability is basically applied math – it builds heavily upon calculus, linear algebra, and signals & systems.
- Communications draws upon both continuous & discrete math – signals & sequences, Fourier & Z
- Matrix algebra is insufficiently used in EE235, EE341. But it is the workhorse of computation and signal processing.
- Probability & Statistics is deceptively easy but …
- Much new jargon & terminology & concepts
- Need to draw on EE315 & Stat390 pre-req

Matlab & Other Software

- Matrix Laboratory – use vectors & matrices
- Combines scripting & modules & graphics
- Has grow exponentially since mid 1980s-toolboxes

- Many open source competitors we might eventually look at – Python, Google Docs, others …
- Modern engineering requires learning new software quickly
- Many web resources for learning
- Many published books/manuals are now online in the UW library. For example, O'Reilly Publisher

Engineers that learn, Build tools

- Many ways to solve a problem
- Use what you know – quick, easy, reliable
- Move beyond what you know – slower, harder, buggy – Is it worth the investment?
- BUT this is the only way to learn new skills
- Especially true in modern technology – web tools, publishing skills, computing, etc
- It was always true, but now you need to be able to learn on your own – at your own pace

- The best way to learn is to try something new with a deadline. The Build, Test, Improve cycle