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Prerequisites:
- Probability, Random Process, and Introduction to Communication Systems (preferred)
Syllabus

- **Textbook:**

- **References:**
• Schedule:
  • Thursday BCD

• Classroom:
  • ED B01

• Office Hours: To Be Determined...
Course Content

- Chapter 1: Introduction
  1.1: Elements of a Digital Communication System
  1.2: Communication Channels and Their Characteristics
  1.3: Mathematical Models for Communications
  1.4: A Historical Perspective in the Development of Digital Communications

- Chapter 2: Deterministic and Random Signal Analysis
  2.1: Bandpass and Lowpass Signal Representations
  2.2: Signal Space Representations of Waveforms
  2.7: Random Processes
    (2.7.2 Cyclostationary Process will be incorporated into Chapter 3.)
  2.8: Series Expansion of Random Processes
  2.9: Bandpass and Lowpass Random Processes
Course content

- **Chapter 3: Digital Modulation Schemes**
  - 3.1: Representation of Digitally Modulated Signals
  - 3.2: Memoryless Modulation Methods
  - 3.3: Signaling Schemes with Memory
  - 3.4: Power Spectrum of Digitally Modulated Signals

- **Chapter 4: Optimum Receivers for AWGN Channels**
  - 4.1: Waveform and Vector Channel Models
  - 4.2: Waveform and Vector AWGN Channels
  - 4.3: Optimal Detection and Error Probability for Band-Limited Signaling
  - 4.4: Optimal Detection and Error Probability for Power-Limited Signaling
  - 4.5: Optimal Detection in Presence of Uncertainty
  - 4.6: A Comparison of Digital Signaling Methods
  - 4.8: Detection of Signaling Schemes with Memory: Maximum Likelihood Sequence Detector (Viterbi Detector)
Chapter 5: Carrier and Symbol Synchronization

5.1: Signal Parameter Estimation
5.2: Carrier Phase Estimation
5.3: Symbol Timing Estimation
5.4: Joint Estimation of Carrier Phase and Symbol Timing
5.5: Performance Characteristics of ML Estimators

Chapter 6: An Introduction to Information Theory

6.5: Channel Models and Channel Capacity
6.6: Achieving Channel Capacity with Orthogonal Signals

(These two sections will be incorporated into Chapter 4.)
Chapter 9: Digital Communication Through Band-Limited Channels

1. 9.1: Characterization of Band-Limited Channels
2. 9.2: Signal Design for Band-Limited Channels
3. 9.3*: Optimum Receiver for Channels with ISI and AWGN
4. 9.4*: Linear Equalization
(The last two sections will be partially covered!)

Chapter 11: Multichannel and Multicarrier Systems

1. 11.1: Multichannel Digital Communications in AWGN Channels
2. 11.2: Multicarrier Communications
Chapter 13: Fading Channels I: Characterization and Signaling

1. 13.1: Characterization of Fading Multipath Channels
2. 13.2: The Effect of Signal Characteristics on the Choice of a Channel Model
3. 13.3: Frequency-Nonselective, Slowly Fading Channel
4. 13.4: Diversity Techniques for Fading Multipath Channels
5. 13.5: The RAKE Demodulator
We will **not** cover . . .

- **Chapter 6: An Introduction to Information Theory**
  Will be covered by **Information Theory** (消息理論)

- **Chapter 7: Linear Block Codes**
  Will be covered by **Error Correcting Codes** (編碼理論)

- **Chapter 8: Trellis and Graph Based Codes**
  Will be covered by **Error Correcting Codes** (編碼理論)

- **Chapter 10: Adaptive Equalization**
  Special topic in Digital Communications
We will **not** cover ... 

- **Chapter 12: Spread Spectrum Signals for Digital Communications**
  
  Will be covered when our course schedule allows

- **Chapter 14: Fading Channels II: Capacity and Coding**
  
  Advanced topics in *Information Theory and Error Correcting Codes*

- **Chapter 15: Multiple Antenna Systems**
  
  Advanced topics in Digital Communications

- **Chapter 16: Multiuser Communications**
  
  Advanced topics in Digital Communications
Homework: None

Quizzes: None

Two Midterms (each 30%) and Final 40%
  - Closed Books: Most of the problems will be from the slides.

First Midterm: Chapters 2, 3 and 4
Second Midterm: Chapters 12 and 13
Final: Chapters 9 and 11 (possible Chapter 5)