Course Outline

AAiT
Addis Ababa Institute of Technology
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Addis Ababa University
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Graduate Program
School of Electrical and Computer Engineering

Course Outline

1. Introduction
   - Course overview
   - Essential elements of digital communication systems
   - Communication channels
2. Source coding
   - Information and measure of information
   - Coding for analog and discrete sources
3. Characterization of communication signals and systems
   - Representation of baseband and bandpass signals and systems
   - Signal space representation: Orthogonal expansion of signals, modulated waveforms and their vector-space representation
   - Spectral representation of modulated signals: Power spectra of modulated signals

Course Outline …

4. Discrete data detection (Receivers for AWGN Channels)
   - Correlation demodulators, matched filters
   - Optimum detector, Maximum likelihood detector, MAP detector
   - Performance of optimum receivers for memoryless modulation; Probability of error for binary, M-ary orthogonal signals, PAM, PSK and QAM
   - Performance analysis of Communication systems; Regenerators and link budget analysis
5. Carrier and symbol synchronization
   - Signal parameter estimation, the likelihood function, carrier phase and symbol timing estimation
   - Performance characteristics of ML estimators
   - Band-limited channels: characterization, signal design and performance evaluation

Course Outline …

6. Channel capacity and channel coding
   - Introduction and survey of Block and Convolutional codes
7. Signal design for band-limited channels
   - Characterization of band-limited channels
   - Signal design: Design for no ISI and for controlled ISI
8. Communication through band-limited channels
   - Optimum ML receivers
   - The ISI channel model
   - Linear equalization: mean square error equalizer and decision-feedback equalization
   - Introduction to adaptive equalization

Course Outline …

- Text: John G. Proakis, *Digital communications*, 4th or 3rd edition
- References:

1. E.A Lee & D.G Messerschmitt, *Digital Communications,* 2nd edition
2. J.M Wozencraft & I.M Jacobs, *Principles of communication Engineering*.
3. J.G Proakis and M. Salehi. *Communication systems Engineering*.
4. Bernard Sklar, *Digital Communications: Fundamentals and Applications*, 2nd Edition
5. MIT OCW course materials for the course 6.450: available at ocwmit@aau.edu.et.; relevant sections will be announced in class from time to time

Course Outline …

- Course Administration – Assignments
  - There will be assignments and you are expected to do and hand in the assigned problems
  - The assigned problems are vehicles for learning, thus cooperation among yourselves, including discussions, teaching others and learning from others, in doing the assignments is encouraged
  - However, what you hand in must be your individual work
  - Assignments are handed in by the end of the class in which they are due
  - Assignments may include small projects or term papers.

Course Outline …

- Project
  - A research project related to topics in digital communications is a required portion of this course
  - Details of possible topics and requirements for the work shall be provide in class
- Examination
  - There will be at least one mid-semester and a final examination
  - Date of the mid- Semester exam will be announced in class
- Course Grade:
  - Assignments and project 20-30%
  - Mid-Semester Exam 30%
  - Final Exam 40-50%