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New Jersey Institute of Technology

ECE 421 Digital Data Communication

Textbook: Modern Digital and Analog Communication Systems
4th Edition, B. P. Lathi, Oxford (3rd edition is usable with some efforts)

Catalog Course Description: Topics include signal classification, correlation, spectral analysis, noise, signal transmission through linear systems, principles of digital data transmission, AM, FM and pulse modulations, sampling and digitalization of signals, inter-symbol interference and equalization, channel capacity, data compression techniques, error detection and correction methods.

Course description and outline:
Covers communications basics and some topics in digital communications most germane to data communication. Topics include signal classification, correlation, spectral analysis, energy and power spectral density, white noise, signal transmission through linear systems, sampling and quantization, and principles of digital data transmission.

Prerequisite:
ECE232, Math333 or ECE321

Course Learning Objectives:
Students will be able to:
1. Understand and apply the fundamentals of digital data communications;
2. Utilize and design basic schemes for wireless cellular, Wi-Fi access, broadband Internet and other systems.

Relevant ABET Student Outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-2);
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (CLO 1-2);
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1-2).

Topics to be covered:

Fundamentals
- Introduction
- Fourier Techniques (Fourier series and Fourier transformation)
- Signal Analysis and Linear Systems (unit impulse signal, signal's energy and power, energy/power signal, ESD, PSD, correlation, orthogonal signal, ideal and practical filters)
- Information Theory and Huffman Coding (information measure, entropy, encoding, uniquely decodable coding, optimal coding)

Analog Communications (very briefly)
- Double-sideband Suppressed Carrier (DSB-SC) Modulation (DSB)
- Amplitude Modulation (AM)

- Frequency Modulation (FM) Digital Communications

- Sampling
- Quantization
- Pulse Modulation (PAM, PCM, PWM, PPM, DPCM, DM; detection)
- Carrier Systems (ASK, FSK, PSK, DPSK; detection)
- Line Coding
- Scrambling
- Detection Error Probability
- M-ary Communications

Weekly schedule:

- Weeks 1 - 6. Chapters 1, 2 and 3
- Week 7: 1st exam and Chapter 6.
- Weeks 8 – 10: Chapter 6 and Chapter 14 (or Chapter 15 in 3rd edition)
- Week 9: 2nd exam and start Chapter 7.
- Weeks 10 - 15: Chapter 7 and project assigned
- Week 15: Final exam and project is due

Tentative Quiz/Exam schedule:

1st Exam is held after Chapters 1, 2 and 3, in October.
2nd Exam is held after Chapters 6 and 14, in late October or early November. Final exam is held after Chapter 7, in December (the end of semester). Quizzes: There will be a quick quiz the first 10 minutes of class
Project: There will be one project during the semester
HW: Will be assigned after every class

Grading policy:

1st Exam: 20 %
2nd Exam: 20%
Final Exam: 35%
Homework: 5%
Quizzes: 10%
Project: 10%

Attendance:

Students missing three classes or more without legitimate reasons (as discussed in the class) will not be eligible to join quizzes and final exam.

NJ Honor Code Statement:

NJIT Honor Code will be upheld. Any violations will be brought to the immediate attention of the Dean of Students.