EE 343 Introduction to Communication Systems

Credits: 3

Categorization of credits: engineering topic

Instructors: A. Kuh, A. Host-Madsen, N. Prasad Santhanam

Text Book and Other Required Materials: B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 4th ed. 2009.

Designation: Required for Systems Track students and elective for others.

Catalog Description: Experiments illustrating the basic principles of communication systems

Pre-requisites: EE 315 Signal and Systems Analysis, EE 342 Probability and Statistics (corequisite), EE343L Communication Systems Lab (corequisite)

Class/Lab Schedule: one 3 hour laboratory per week

Topics Covered: The course gives an introduction to digital and analog communications. This is done by applying techniques learned in EE 315 Signals and Systems Analysis and EE 342 Probability and Statistics.

- Fourier Analysis, signal representation, and signal transmission: 3 weeks.
- Ampllitude Modulation, Frequency Division Multiplexing: 2 weeks.
- Sampling, Time Division Multiplexing, and Quantization: 2 weeks.
- Probability, Random Variables, Detection problem, Additive White Gaussian Noise: 1.5 weeks.
- Random processes, autocorrelation function, power spectral density, matched filter: 1.5 weeks.
- Performance of Digital Communication Systems: 2 weeks.
- Digital Data Transmission, pulse shaping: 1 week.
- Spread Spectrum Communications, Code Division Multiplexing: 1 week.

Course Objectives and Their Relationship to Program Objectives:

The student develops an understanding of the basic principles of digital and digital analog communication systems. The student applies knowledge of linear time invariant systems, Fourier analysis, and sampling theorem to study linear modulation, pulse amplitude modulation systems, pulse shaping, and spread spectrum systems. The students review probability theory and studies

random processes to apply to digital communications (matched filters, performance of digital modulation systems). [Program Objectives this course addresses: 1, 2, 3 and 4.]

Course Outcomes and Their Relationship to Program Outcomes:

The following are the course outcomes and the subset of Program Outcomes (numbered 1-7 in square braces "[ ]") they address:

- Review Fourier analysis, linear time invariant systems, and signal transmission. [1, 2]
- Study amplitude modulation systems discussing advantages and disadvantages (power, bandwidth, transmitter and receiver complexity). [1, 2, 4]
- Study sampling theorem, quantization, and coding. Representation of analog signals by digital data. [1, 2]
- Probability, random variables, random processes, Gaussian processes. [1, 2]
- Transmission of digital data, pulse shaping, inter-symbol interference. [1, 2, 4]
- Performance of digital modulation systems (ASK, PSK, FSK, QAM). [1, 2, 4]
- Study spread spectrum system, code division multiplexing. [1, 2, 4]

Contribution of Course to Meeting the Professional Component

Engineering topics: 100%

Computer Usage:

Students use MATLAB to design and simulate different communication systems and study signal and system properties.

Design Credits and Features:

EE 343 has 0.5 unit of design credit. In class, the instructor discusses tradeoffs between using different communication systems. In homework assignments students conduct analysis and simulate communication systems using MATLAB to investigate these tradeoffs.

Person(s) preparing syllabi and date: A. Kuh Oct. 7, 2014; Yingfei Dong, June 14, 2021.