

EE 360 – Communication Systems

Designation: EE elective course for electrical engineering majors.

University Bulletin Description: EE 360 (3) Generic communication system; signal transmission; digital communication systems; amplitude modulation; angle modulation.

Prerequisite: EE 350.

Prerequisites by Topics:

1. Understanding and the ability to use Fourier analysis, circuit analysis, and complex variables in the solution of linear circuits and systems.
2. Understanding of basic linear circuit constants and variables.

Textbook/Required Materials:

Modern Digital and Analog Communication Systems, 3rd Ed. B.P. Lathi, Oxford University Press, New York, 1998

Learning Outcomes:

This course provides the foundational education in analog and digital communication system analysis and design. Through lecture and out-of-class assignments, students are provided learning experiences that enable them to:

1. Analyze and design basic communications systems, particularly with application to noise-free analog and digital communications.
2. Apply concepts and techniques from Fourier analysis and circuit analysis to communication systems.
3. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

Topics:

1. INTRODUCTION (1 lecture)
Communication systems; analog and digital messages; signal-to-noise ratio, the channel bandwidth, and the rate of communication; modulation
2. REVIEW OF SIGNALS (1 lecture)
Size of a signal; classification of signals; some useful signal operations; unit impulse function; signals and vectors; signal comparison: correlation; signal representation by orthogonal signal set; trigonometric Fourier series; exponential Fourier series
3. REVIEW OF FOURIER ANALYSIS (1 lecture)
Aperiodic signal representation by Fourier integral; transforms of some useful functions; some properties of the Fourier transform; signal transmission through a linear system; ideal and practical filters; signal distortion over a communication channel; signal energy and energy spectral density; signal power and power spectral density; numerical computation of the Fourier transform: the DFT.
4. AMPLITUDE (LINEAR) MODULATION (6 lectures)
Baseband and carrier communication; amplitude modulation: double standard (DSB); amplitude modulation (AM); quadrature amplitude modulation (QAM); amplitude modulation: single sideband (SSB); amplitude modulation: vestigial sideband (VSB); carrier acquisition; superheterodyne AM receiver
5. ANGLE (EXPONENTIAL) MODULATION (6 lectures)
Concept of instantaneous frequency; bandwidth of angle-modulated wave; generation of FM waves; demodulation of FM; FM receiver
6. SAMPLING AND THE PULSE CODE MODULATION (6 lectures)
Sampling theorem; pulse-code modulation; differential pulse code modulation (DPCM); delta modulation
7. PRINCIPLES OF DIGITAL DATA TRANSMISSION (6 lectures)

A digital communication system; line coding; pulse shaping; M-ary communication; digital carrier systems; digital multiplexing

8. SOME RECENT DEVELOPMENTS AND MISCELLANEOUS TOPICS (3 lectures)

Class/laboratory schedule: Two 75-minute lectures per week.

Computer usage:

Matlab and Simulink are used to facilitate analysis of communication systems in lecture.

Laboratory Projects/Assignments:

None.

Contribution to Meeting the Requirements of Criterion 5. Curriculum:

This course contributes to both the engineering topics and design components.

This course provides an analysis and design emphasis in the area of communications systems. It is a prerequisite to the senior elective course on communication system performance analysis in the presence of noise (EE 460). Topics pertaining to economics and manufacturability are considered in the context of communication system circuit design and construction.

Relationship to Program Outcomes:

- O.1.1. Graduates will possess mathematics skills necessary for electrical engineering.
- O.2.3. Graduates will understand the basic concepts of linear systems and how they interact with continuous-time signals.
- O.3.1. Graduates will have in-depth technical knowledge in one or more areas of specialization.
- O.3.2. Graduates will have practical understanding of the major electrical engineering concepts and demonstrate application of their theoretical knowledge of the concepts.
- O.4.1. Graduates will interact with industry both within and outside of a classroom setting.
- O.4.2. Graduates will develop an appreciation of continuing educational and professional development.
- O.6. Graduates will appreciate their role as engineers in society.

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