THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Introduction to Analog and Digital Communications

ECE 5000

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Communications channel modeling, analog communication schemes, digital communication schemes, error rate analysis, and error control coding.

Prerequisites and Co-requisites:
Prereq: 3050, and Stat 3470 or Physics 3700; or Grad standing.

Course Goals / Objectives:
- Be competent in the fundamentals of communication channel modeling (e.g., filterplus- noise model, multipath propagation, complex-baseband model)
- Master fundamental techniques for analog communication (e.g., AM, QAM, VSB, FM)
- Be competent in random signals and noise (e.g., Marcum?s Q function, power spectrum, autocorrelation, filtering of a random signal)
- Master concepts in pulse-shaped digital communications (e.g., pulse shaping, matched filtering, raised-cosine pulses, Nyquist criterion)
- Be competent in error analysis of un-coded digital communications (e.g., eye and constellation diagrams, decision regions, gray coding)
- Be familiar with concepts in error control coding
- Be familiar with communication over dispersive channels (e.g., equalization) and parallel digital communication schemes (e.g., CDMA or OFDM).
- Be competent in using a high-level programming language (e.g., Matlab) for communication system simulation and analysis

Course Topics:

- Communications problem
- Review of relevant signals and systems concepts (Fourier transform, Dirac delta, linear systems, filtering)
- The communications channel model (filter + noise, multipath)
- Analog communications (e.g., AM, large-carrier AM, QAM, VSB, FM, discriminator)
- Review of random signals and noise (e.g., power spectrum, autocorrelation, filtering of random processes).
- The complex-baseband channel model.
- Pulse-shaped digital communications (pulse shaping, receiver filtering, Nyquist criterion, raised-cosine pulse, matched filtering, square-root raised-cosine pulse)
- DSP implementation of digital communications (sinc reconstruction, downsampling, discrete-time channel representation, fractional sampling)
- Error analysis (eye diagram, constellation diagram, symbol alphabets, decision regions, symbol error rate, gray coding)
- Error control coding
- Parallel communication (generalizing the pulse shape, generalizing the matched filter, orthogonal pulse shapes like OFDM and CDMA, non-orthogonal pulse shapes, matched filtering)
- Communication over dispersive channels (effective pulse shape, equalization, CP-OFDM)

Designation:
Elective