

1. Course Abstract: Digital communications is the standard communication framework used in several communication platforms like Local Area Networks(LANs), Wireless and Satellite Communications. In contrast with analog communication, digital communication deals with transmission and reception of a finite number of messages. The receiver does not reproduce what was transmitted, it classifies the received signal into appropriate message classes.

In this course, we will begin with a comparison of analog and digital communication systems. We will then proceed to studying and modeling *noise* the reason behind the existence of communication engineers. Baseband and Bandpass modulation and demodulation techniques forms the core of the course. If time permits, the course will be concluded with a discussion on *fading channels*.

2. Course Contents:

- (a) Comparison of Analog and Digital Communication systems
- (b) Statistical modeling of Signals: Energy and Power Spectral Density(PSD), Auto-correlation.
- (c) Statistical modeling of Noise: Random variables, Random/Stochastic processes, PSD, Stationarity - Strict sense and Wide-sense. Ergodicity, LTI system on stationary stochastic processes.
- (d) Overview of a Digital Communication system
- (e) Baseband Modulation: Sampling and Quantization, PCM, Duobinary coding.
- (f) Baseband Demodulation: ML and MAP receiver/classification, Vector representation of signals, E_b/N_0 as a performance metric. Inter-Symbol Interference and Pulse-shaping, Channel Equalization and Eye Pattern.
- (g) Bandpass Modulation: Why should one modulate? ASK, PSK, FSK, DPSK, Coherent and Non-coherent detection and comparison.

3. References:

- (a) Bernard Sklar, Digital Communications: Fundamentals and Applications, 2nd ed., Pearson.
- (b) John Proakis, Digital Communications, 4th ed., McGraw Hill.

4. Course evaluation: Note that the distribution given below might change by about 5% in each component.

- (a) Mid Sem: 30%
- (b) End Sem: 40%
- (c) Pop-Quiz: 15%
- (d) Regular Lab submission: 15%.