



Pre-requisites

Probability theory with emphasis on Gaussian random process; signal space concepts; linear algebra

Objectives

1. To provide students an understanding of the concepts related to transmission and reception techniques for communications.
2. To provide communication concepts and techniques required for implementation of a digital communication transceiver and application of these concepts in a system context.
3. To provide concepts and techniques required for holistic understanding of a communication system. The concepts taught in class will be discussed in the context of wired telephony, cellular communication systems, satellite communications, and deep space communications.

Contents

Communication problem and system models: elements of communication systems, communication channels and their characteristics, mathematical models for communication channels, multiple access techniques, link budget analysis, baseband/IF subsystems and RF subsystems: radio receivers, power amplifiers, antenna.

Representation of deterministic and stochastic signals: Random noise characterization in communication systems, signal-to-noise ratio, characterization of communication signals and systems: signal space representations, representation of analog and digitally modulated signals, spectral characteristics of modulated signals.

Optimal receivers: Receivers for signals corrupted by AWGN, error performance Analysis of receivers for memory-less modulation, optimal receivers for modulation methods with memory, performance analysis of digital subscribers loop systems.

Carrier and Symbol Synchronization: Carrier recovery and symbol synchronization in signal demodulation, carrier phase estimation, symbol timing estimation.

Spread spectrum signals for digital communications: Model of spread spectrum communication system, direct sequence spread spectrum signals, frequency hopped spread spectrum signals, synchronization of spread spectrum systems.

Learning Outcomes

1. Ability to analyze and design basic communications systems.
2. Ability to apply concepts and techniques from communication theory to design communication systems.
3. Develop the ability to compare and contrast the strengths and weaknesses of various communication techniques for various channel types.

Books

Proakis, J. G. and Salehi, M., Communication System Engineering, 2nd Ed., McGraw-Hill Higher Education 2008
Sklar, B. and Ray, P. K., Digital Communications: Fundamentals and Applications, 2nd Ed., Pearson Education Inc. 2009

Haykin, S., Communication Systems, 4th Ed., Wiley Press 2001

Lathi, B. P. and Ding, Z., Modern Digital and Analog Communication Systems, 4th Ed., Oxford University Press 2010

Proakis, J. G. and Salehi, M., Digital communications, 5th Ed., McGraw-Hill Higher Education 2008

Madhow, U., Fundamentals of Digital Communication, 1st Ed., Cambridge University Press 2008

Dixon, R. C., Spread Spectrum Systems with Space Applications, 3rd Ed., Wiley India Pvt Ltd. 2010

Homework Assignments

Homework assignments are given every week, starting in the 3rd week of the semester. Each problem set is due one week after it has been handed out.



EE 313: Communication Systems

July - November 2015

Homework Submission: Homework assignments will be submitted electronically, as pdfs. Homework reports may be prepared by hand, in LaTeX, or even using Microsoft Word. If by hand the homework need to be scanned to pdf. Note that student will need to name file "Name_hwX.pdf" (e.g. second homework file "Arun_hw2.pdf") in order to submit it.

Discussion Session

During Friday lecture every 3rd week, starting in the 5th week of the semester. In the discussion session we will review basics, investigate material covered in class from a different perspective, answer questions, and discuss recent developments in the field.

Class

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| Lectures | Monday, Tuesday - 9 AM, Friday - 11 AM |
| Tutorial | Monday - 4 PM |
| Office Hours | Monday 5PM-6PM |
| Room | Lectures 2102; |

Evaluation

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| Homework Assignments | 0% |
| Mid-Semester I | 20% |
| Mid-Semester II | 20% |
| Quizzes (2) | 10% |
| End-Semester | 50% |

Instructor

Arun Kumar Singh
singhak@iitj.ac.in
Phone: 208
Office: 2101, Academic Block II

Moodle Link

<http://172.16.100.118/moodle>