

ECE 423 Digital Communications

Required for Electrical Students

Catalog Data

ECE 423 Digital Communications (5 Credits)

This course focuses on the representation of signals and noise, Gaussian processes, correlation functions and power spectra, linear systems and random processes, performance analysis and design of coherent and noncoherent communication systems, phase-shift-keying, frequency-shift-keying, and M-ary communication systems, optimum receivers and signal space concepts, information and its measure, source encoding, channel capacity, and error correcting coding. Each week lecture meets for 200 minutes and lab meets for 150 minutes.

Required Textbook

- “Digital Communications: Fundamentals and Applications, (2nd Edition)”, Bernard Sklar, ISBN: 978-0130847881.

Recommended Textbook

- “Schaum's Outline of Analog and Digital Communications Electromagnetics, (2nd Edition)”, ISBN: 978-0071402286.
- “Digital Communications, (5th Edition)”, John Proakis and Masoud Salehi, ISBN: 978-0072957167.
- “Fundamentals of Digital Communication”, Upamanyu Madhow, ISBN: 978-0521874144.

Coordinators

Hani Mehrpouyan

Relationship to Student Outcomes

This course relates to student outcomes EAC b, c, and k.

Student Learning Outcomes, Students will

1. Carry out experiments that investigate the concepts of amplitude and pulse code modulation, Nyquist sampling theorem, multiple access schemes using modern measurements tools such as spectrum analyzers, digital oscilloscopes, Matlab, and National Instruments testing boards (EAC b and k).
2. Design communication systems based on the availability of specific bandwidth and probability of error while meeting throughput and quality of service (QoS) requirements, respectively (EAC C).
3. Selecting various modulation schemes based on a trade off between throughput and error probability requirements (EAC C).

Prerequisite by topic

- Differential and integration calculus
- Vector Calculus
- Signals and Systems
- Freshman level electricity and magnetics

- Algebra
- Trigonometry

Lecture Topics

This one-quarter first course is aimed at providing a firm foundation in Digital Communications to both specialist and non-specialists undergraduates.

Class Schedule

Meets for 5 hours of lecture and 2:30 hours of laboratory exercises each week for 10 weeks.

Computer Usage

Matlab.

Laboratory Projects

1. Amplitude Phase Shift Keying
2. Pulse Code Modulations.
3. Supplementary Material for Lab2.
4. Sampling and Nyquist in PCM
5. Supplementary Material for Lab3.
6. Time Division Multiple Access
7. Error Probability Binary Phase Shift Keying (BSPK) and Quadrature Phase Shift Keying (QPSK)
8. Optical Communications

Professional Component

Contributes towards the Electrical Engineering Topic Courses.

Design Content Description

- *Approach:* The design component is provided through lecture materials, laboratory exercises, homework, and tests.
- *Lectures:* 80%
- *Labs:* 20%

Prepared by

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Approved by

Approved by CEE/CS Department on December 2012.