ECEN 604 - Channel Coding for Communication Lectures by Graduate Students

Department of Electrical and Computer Engineering
Texas A&M University, College Station, TX 77843

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Syllabus

All topics will be taught with an example-based approach. We will give the essential theory in the notes that you can print and bring to the lectures. The purpose is that you mainly concentrate on the lecture and not spend too much time in taking notes. You can write down comments in the notes as you listen to the lecture. During the lecture, we will explain the concepts primarily using examples.

The approximate number of lectures each of the topics is given in parentheses.

1. Introduction - motivation, design trade-offs, simple codes, memoryless channels. (1)
2. Groups, Binary Linear Codes, Generator and Parity-check matrices, Properties. (1)
3. Fundamental bounds, Cosets, Syndromes, Decoding. (1)
4. Binary Cyclic Codes, Polynomial notation, Properties. (1)
5. Abstract Algebra essentials (2)
   - Groups, rings, fields.
   - Primitive elements, Conjugacy classes, factoring polynomials in a field.
   - Extension fields, minimal polynomials.
   - Non-binary cyclic codes.
6. Reed-Solomon and BCH codes (2)
   - t-error correcting RS codes.
   - Design of the generator polynomial.
   - Maximum Distance Separable (MDS) property.

- The signal and transform domain interpretation of RS codes.
- Properties, bounds, performance, applications.

7. Convolutional codes (3)

   - Construction, properties, encoding.
   - Viterbi decoding example (ML decoder for convolutional codes).

8. Overview of Modern Coding Theory (1-2)

   - Information Theory (briefly), notion of Channel Capacity.
   - Recent codes and comparison. E.g. LDPC, Polar
   - New applications. E.g. Distributed Storage Systems (DSS)