KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE430- INFORMATION THEORY AND CODING
042

Course Objectives:

1. Understand the difference between "data" and "information" in a message.
2. Learn how to analyze and measure the information per symbol emitted from a **source.**
3. Learn how to analyze the information-carrying capacity of the communication **channel.**
4. Learn how to design source **compression** codes to improve the efficiency of information transmission.
5. Learn how to adapt and tailor known **error control codes** for use in particular applications.
6. Learn the basic theory needed for data **encryptions**.

Course Content:

- Information Theory: 6 Weeks
  - Uncertainty, Information, and Entropy
  - Source-Coding Theorem
    - Huffman Coding
    - Lempel-Ziv Coding
  - Discrete Memoryless Channels (DMC)
  - Mutual Information
  - Channel Capacity
  - Channel Coding Theorem
- Error-Control Coding: 7 Weeks
  - Block Codes, Linear Codes, Hamming Codes
  - Generator Matrix
  - Parity-Check Matrix
  - Syndrome
  - Cyclic codes
- Convolutional Codes: 2 Weeks
  - Convolutional Encoder
  - Tree Representation of Convolutional Codes
  - Finite-State Machine Code Representation
  - Trellis Representation of Convolutional Codes

Prerequisite: EE315, EE370

Textbook:
R. B. Wells, **Applied Coding & Information Theory for Engineers**, Prentice Hall, NJ 1999
Material: **Ch. 1:** 1.1-1.5 **Ch. 2:** 2.1-2.3 **Ch. 4:** 4.1-4.5 **Ch. 5:** 5.1-5.4 **Ch. 6:** 6.1-6.2

References:

1. B. Lathi, ***Modern Digital and Analog Communication Systems***, 4th Edition, Oxford Publishing, 1998.
2. S. Haykin, ***Communication Systems***, 4th Edition, John Wiley & Sons, 2001.
3. R. W. Hamming, ***Coding and Information Theory***, 2nd Ed., Prentice-Hall Inc.,1986
4. J. Proakis and S. Salehi, ***Communication Systems Engineering***, Prentice Hall, 1994.

GRADING

- **Grade Distribution**
  - Attendance 4 %
  - Quizzes 10 %
  - Projects and Assignments 16 %
  - Major Exam I **(Tue. March 22, 6:30-8:30pm)** 20 %
  - Major Exam II **(Tue. May. 10, 6:30-8:30pm)** 20 %
  - Final Exam (Comprehensive) 30 %

- ***Absence:*** Every unexcused absence results in -0.5 , 8 absences results in 0 out of 4 in the attendance and class performance, Two late arrival= One absence.
- **Official Excuses**: Official excuses have to be verified from the Students' Affairs Dept. Personal excuses will not be accepted.

INSTRUCTOR:

Dr. Ali Hussein Muqaibel Office 14-217 Tel: 1595 Email: muqaibel@kfupm.edu.sa
Web Site: **http://faculty.kfupm.edu.sa/ee/muqaibel** or WebCT
O.H.'s: Sat. & Mon. 10:00–10:50AM, Tue.10:30-11:30AM

An office meeting in Tuesday 4:00-5:00pm may be possible with e-mail pre-arrangement
My office hours are also available through my web

Desired Course Outcomes:

1. Students will demonstrate ability to evaluate the information rate of various information sources.
2. Students will demonstrate ability to design lossless data compression codes for discrete memoryless sources.
3. Students will demonstrate ability to evaluate the information capacity of discrete memoryless channels and determine possible code rates to achievable on such channels.
4. Students will demonstrate an ability to compensate for channel memory through the design of appropriate data translation codes.
5. Students will demonstrate an understanding of the mathematical theory of linear channel codes for error detection and correction.
6. Students will demonstrate the ability to select and design simple linear block error correcting codes.
7. Students will demonstrate an ability to implement cyclic block codes using feedback shift register logic circuits.
8. Students will demonstrate ability to select and design simple convolutional codes.