# KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
## ELECTRICAL ENGINEERING DEPARTMENT

### EE430- INFORMATION THEORY AND CODING
### SPRING SEMESTER (082)

**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

**Important Dates:**

- Major Exam I (**Tuesday 7 April in class time**)
- Major Exam II(**Sunday 24 May in class time**)

**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:** 6.1-6.3

**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.
5. Fazlollah M. Reza, **An Introduction to Information Theory**, Dover1994.
6. Robert McEliece, **The Theory of Information and Coding**, Cambridge, 2004.


## GRADING

- **Grade Distribution**
  - Attendance 05 %
  - Quizzes and HW 15 %
  - Projects 15 %
  - Major Exam I (**Tuesday 7 April in class time**) 15 %
  - Major Exam II(**Sunday 24 May in class time**) 15 %
  - Final Exam (Comprehensive) 35 %

- ***Absence:*** University policy will be applied. More than 9 unexcused absences result in DN.
- **Official Excuses**: Official excuses have to be verified from the Students' Affairs Dept. Personal excuses will not be accepted.
- **No makeup for quizzes and majors**. Late projects and homework assignments are not accepted.

## INSTRUCTOR:


Dr. Samir Al-Ghadhban Office 59-0076 Tel: 2244 Email: **samir@kfupm.edu.sa**
Web Site: **http://faculty.kfupm.edu.sa/ee/samir** or WebCT

**Office Hours: Sunday and Tuesday. 11:30am -1:00pm**.

## 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 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.