EE 571 Digital Communications I

- **Prerequisites:** EE370, EE315 or equivalent courses.

- **Instructor:** Prof. Salam A. Zummo, Office: 59-2086 or 68-261, Phone: 7776, 2844
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- **Course Objectives:**
  - Understand basic components of digital communication systems.
  - Design optimum receivers for digital modulation techniques.
  - Analyze the error performance of digital modulation techniques.
  - Design digital communication systems under given power, spectral and error performance constrains.


- **Course Outline:** (Time and emphasis may be adjusted as needed)
  - **Review:** (2 Weeks)
    Sampling theorem, analog-to-digital conversion and PCM, random variables and stochastic processes.
  - **Detection Theory:** (2\frac{1}{2} Weeks)
    Vector channels, detection of signals in noise, decision rules such as MAP and maximum likelihood rules, waveform channels, error probability of baseband signals.
  - **Modulation Techniques:** (4 Weeks)
    Bandpass signal representation, noise characterization in bandpass systems, orthogonal expansion of signals, phase and frequency shift keying, quadrature modulation, differential and M-ary modulation schemes, coherent and non-coherent receivers, correlator, matched filter and envelop detector.
  - **Performance of Modulation Techniques:** (2 Week)
    Computation of the error probability for different modulation techniques and water-fall error curves.
  - **Spectral Characterization:** (2 Week)
    Spectral characterization of modulation techniques, bandwidth definitions, pulse shaping, spectrally-efficient modulation schemes such as OQPSK, \frac{7}{4}-QPSK, MSK, GMSK and CPM.
- **Comparison of Modulation techniques: (1 1/2 Week)**
  Channel capacity theorem, maximum information rate in a communication system, power and spectral efficiency of modulation techniques, link budget.

- **Projects’ Presentations: (2 lectures)**

- **Textbook:**
  - Lecture notes.

- **References:**

- **Homework Assignments:**
  Homework assignments will be issued about once every two weeks. Collaborative work is encouraged between students. However, solutions are to be worked out and submitted individually.

- **Grading Policy:**
  - Homeworks 20%
  - Exam I 20% Tuesday of Week 6 - Class time (March 3)
  - Exam II 20% Tuesday of Week 12 - Class time (April 21)
  - Final Exam 30% Tuesday May 26 at 7:00 PM
  - Projects 10%