1. **ECE 437, Communication Systems II**

2. **Credits**: 3  
   **Contact Hours**: 2.5


   a. **Other Supplemental Materials**: None

   b. **Specific Course Information**:

      a. **Brief description of the content of the course (Course Catalog Description)**: Statistical analysis of information transmission systems. Probability of error, design of receivers for digital transmission through additive white Gaussian noise channels and bandlimited channels. Spread spectrum communication systems. Channel capacity, source and error control coding.

      b. **Pre-requisites or Co-requisites**: ECE 331; ECE 436 or con reg

      c. **This is a Selected Elective course**.

   c. **Specific Goals for the Course**:

      a. **Course Outcomes**:

         1. Understand the application of linear system theory to the implementation of analog communication systems

         2. The student will be able to understand and use signal space ideas to carry out probability-of-error calculations for various signaling schemes in the additive white Gaussian noise (AWGN) channel.

         3. Produce system-level designs for modulators and demodulators for AM-large Carrier, DSB (double sideband), 2-channel multiplexed DSB, SSB (single sideband), and FM
(frequency modulation).
4. The student will be able to calculate the maximum bit rates and error probabilities for zero intersymbol interference (ISI) regimes and for controlled ISI regimes in bandlimited channels.
5. Understand the design tradeoffs for the aforementioned modulation schemes with respect to bandwidth and noise immunity.
6. The student will have a basic familiarity with the concept of channel capacity for AWGN channels, as well as the essential concept behind channel coding.

- **ABET Student Learning Outcomes**:

(a) Ability to apply mathematics, science and engineering principles.
(b) Ability to design a system, component, or process to meet desired needs.
(e) Ability to identify, formulate and solve engineering problems.
(i) Recognition of the need for and an ability to engage in life-long learning.
(k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

- **Brief List of Topics to be Covered**:

- Review of LTI systems, probability, and WSS Gaussian random processes.

- Introduction to signal space ideas with application to signaling over an additive white Gaussian noise (AWGN) channel; various signaling schemes, including phase shift keying (PSK), pulse amplitude modulation (PAM), quadrature amplitude modulation (QAM), and frequency shift keying (FSK)

- Minimum probability of error receiver architectures for AWGN channel and different signaling schemes, including non-coherent detection for FSK

- Probability-of-error calculations for AWGN channel for various signaling schemes

- Digital PAM transmission over bandlimited AWGN channels; zero ISI, controlled ISI; probability of error calculation.

- Introduction to AWGN channel capacity and the concept of channel coding.