**Course Topics**

**EEE 556: Detection and Estimation Theory**

**Prerequisites:** (a) EEE 554 (Random Signal Theory) or equivalent graduate level course on random variables, probability density functions, expectations, moments, Gaussian random variables, discrete and continuous time random processes, wide-sense stationary processes, autocorrelation functions, power spectral densities; and (b) basic knowledge in digital signal processing, linear and matrix algebra.

**Course Description:** Combines the classical techniques of statistical inference and the random process characterization of communication, radar, and other modern data processing systems.

**Course Topics:**

• Monte Carlo simulations to evaluate detection and estimation algorithm performance

• Receiver operating characteristics, hypothesis testing, Neyman-Pearson theorem

• Detection of deterministic signals with known parameters in Gaussian noise; matched

filters

• Detection of random signals with known characteristics; estimator-correlator; linear

model

• Estimation bias, variance, Cramer-Rao bounds and Fisher matrix; Bayesian   
estimation, maximum likelihood estimation, minimum mean-squared estimation (MMSE)

• Detection of deterministic signals with unknown parameters; signal parameter

estimation; Bayesian approach and generalized likelihood ratio test

• Detection of random signals with unknown characteristics; Unknown noise parameters

• Signal processing applications, including biomedicine, communications, radar, sonar.