**Course Topics**

**EEE 581 Filtering of Stochastic Processes**

**PREREQUISITES:** Random signal analysis, linear systems, or instructor approval

**Catalog Description:** Modeling, estimation, and filtering of stochastic processes, with emphasis on the Kalman filter and its applications in signal processing and control.

**COURSE TOPICS:**

I. Introductory Materials

Stochastic processes, stationary processes, independence, covariance function and spectrum, Bayes rule, statistical inference, mean-square error, ARMA process, Gaussian processes, white noise, parameter estimation

II. Optimal Estimation

The conditional mean, linear least mean square estimator, maximum likelihood estimator, maximum a posteriori estimator, sequential estimation

III. Filtering of Stationary Processes

Spectral factorization, Wiener filtering

IV. System Models

The concept of state, Markov processes, linear systems driven by stochastic processes

V. Optimal State Estimation for Linear Systems Linear mean-square predictor and filter, the Kalman filter (propagation of probability density function), filter stability and convergence

VI. Nonliner Filtering

Extended Kalman filter, unscented Kalman filter, Bayesian filtering, Guassian sum estimators, particle filters

VII. Optional Materials

Dynamic programming and optimal stochastic control, and LQG control