## STAT-813 Statistical Signal Processing (3 Credit Hours)

1. Objectives

This course aims to introduce students to the estimation and model building of spectrum data, including signal filtrating and detection.

2. Course Contents

Random processes, in both continuous- and discrete-time. Second-order description: expected value, correlation function and power density spectrum, Sampling processes, Jointly defined processes: cross-correlation function, linear filtering, Karhunen-Loève expansion, Constrained and unconstrained optimization, Parameter estimation: mean-squared error, MAP, maximum likelihood, Linear and Spectral estimation, Levinson recursion, Adaptive filters, Optimal filtering: Wiener, Kalman and Bayesian filters, Compressive sensing, Sequential detection, Detection of signals in noise and unknown parameters. Related applications/computations with R.

3. Recommended Books:

i. Loren, D.Lutes, S.Shahron. Stochastic Analysis of Structural and Mechanical Vitrating, Prentice Hall (2001).
ii. Oppenheim Schafer. Discrete-Time Signal Processing, Prentice Hall PTR New Jersey (2003).
iii. Stevan M.K. Fundamental of Statistical Signal Processing Volume-II Detection Theory (1998).
iv. Therrien. Discrete Random Signals and Statistical Signal Processing (1992).

4. Outcomes

On successful completion of this course, students will be able to model the random processes, in both continuous- and discrete-time. Students will be able to make traditional and advanced filtration of signals from noise data, moreover, the students will be able to analyze and model the spectrum data.