Course Description: This course introduces the basic analytics for financial engineering and econometrics, topics include financial transactions and econometric data management, correlation, linear and multiple regressions for financial and economic predictions, financial time series analysis, portfolio theory and risk analysis. It will provide a foundation of basic theory and methodology as well as applied examples with techniques to analyzing large financial and econometric data. Hand-on experiments with R will be emphasized throughout the course.

Prerequisites: Graduate standing (Undergraduate engineering math: Calculus, probability theory, statistics, and some basic computer programming skills. Some background in stochastic process and differential equation would also be helpful.)

Textbooks:

Required:

Recommended References:

Optional Readings:

Assignments and Exams:

There will be five hand-in assignments during the semester, an individual mini term project, as well as a mid-term exam and a final exam, both in-class. The exams will not be open book. However, you will be permitted a two-sided “cheat sheet” with notes and/or formulae.

Grading:

The assignments, mini project, mid-term, and final exams constitute 30%, 25%, 20% and 25% of the grades respectively.

Schedule:

Unit #1: Introduction; review of elementary inferential statistics and R lab
Unit #2: Basic financial transactions; returns and fixed income securities;
Unit #3: Exploratory financial data analysis; transformation and kernel density
Unit #4: Univariate distributions: heavy-tailed and mixture financial models
Unit #5: Multivariate statistical models: covariance and correlation in financial data
Unit #6: Linear regression: LSE, MLE, linear prediction in econometrics
Unit #7: Mid-term exam
Unit #8: Financial time series modeling: autocorrelation, ARMA, forecasting
Unit #9: Multivariate models: multivariate time series in finance
Unit #10: Portfolio theory: risky assets and efficient portfolio
Unit #11: Capital asset pricing model: CAPM for portfolio analysis
Unit #12: Factor models and principal components
Unit #13: Risk management
Unit #14: Course Review
Unit #15: Term project presentation
Unit #16: Final exam