# EE 218 Power System Steady State and Market Analysis Syllabus

### Course Purpose:

This graduate level class covers power system steady state and market analysis. In the steady state analysis section, system security criteria and security assessment, state estimation, automatic generation control, contingency screening and security constrained optimal power flow will be covered. In the market section, the electricity market structure, security constrained economic dispatch and unit commitment, financial transmission rights, forward markets, and market power issues are covered.

### Textbook:

### A. J. Wood and B. F. Wollenberg, Power Generation, Operation, and Control, 2nd Ed., John Wiley and Sons, NY, 1996

D. S. Kirschen and G. Strbac, Fundamentals of Power System Economics, 1st Ed., Wiley, 2004. (Optional)

### Course Topics:

* Introduction to Power System Operation and Control [Chapter 1 W&W]:
  + Power System Operation and Control Under a Vertically Integrated Utility
  + Power System Operation and Control Under Competitive Market Structure
* Optimal Power Flow and State Estimation [Chapters 4 and 12 W&W]
  + AC Optimal Power Flow Analysis
  + DC Optimal Power Flow Analysis
  + Power System State Estimation Problem
* Power System Security Assessment [Chapter 11 W&W]:
  + Introduction to Power System Security
  + Power System Security Criteria
  + Power System Security Assessment
  + Contingency Analysis
* Automatic Generation Control [Chapter 9 W&W]:
  + Overview of Generation Control Problem
  + Generator Model, Load Model
  + Prime-Mover Model, Governor Model
  + Generation Allocation
* Electricity Market [Chapters 1, 3 and 5 K&S]:
  + Electricity Market History
  + U.S. Electricity Market Structure
  + Market Products
  + Market Implementation and Operations
* Economic Dispatch and Security Constrained Unit Commitment [Chapters 3, 5 W&W]
  + Economic Dispatch Problem
  + Security Constrained Unit Commitment Problem
  + Unit Commitment Solution Methods
* Financial Transmission Rights and Forward Markets [Chapters 2 and 8 K&S]:
  + Financial Transmission Rights (FTR)
  + FTR Auction and Congestion Risk Hedging
  + Electricity Related Forward Market
* Market Power and Manipulation in Electricity Market [Chapter 2 K&S]:
  + Market Power in Electricity Market
  + Historical Market Manipulation Events
  + Design Market Power Mitigation Rules

### Weekly Schedule:

* Week 1-2: Overview Power System Operation/Control and Optimal Power Flow: Introduction, Power System Operation and Control Under Vertically Integrated Utility and Competitive Market Structure, AC Optimal Power Flow, DC Optimal Power Flow.
* Week 3-4: State Estimation and Power System Security: Power System State Estimation Problem, Power System Security Criteria and Security Assessment, Contingency Analysis.
* Week 5-6: Automatic Generation Control: Generation Control Problem, Models for Generation, Load, Prime-Mover, Governor and Generation Allocation.
* Week 7-8: Overview of Electricity Market and Security Constrained Unit Commitment: Electricity Market History, Structure and Products, Market Implementation and Operations, Security Constrained Economic Dispatch and Unit Commitment Problems.
* Week 9-10: Financial Transmission Rights, Electricity Forward Market and Market Manipulation: Introduction to Financial Transmission Rights, Congestion Risk Hedging, Electricity Forward Market, Market Power and Market Manipulation.

### Prerequisites:

EE 155 OR EE 155V, EE 132 AND (ENGR 160 OR ENGR 160V OR EE 231)

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### Grading (Percentage):

Homework – 50%

Final Exam – 50%

### Online Students:

Homework will be submitted to the faculty directly through email [nyu@ece.ucr.edu](mailto:nyu@ece.ucr.edu).

Exams will be proctored by Examity <http://examity.com/>.