**ECEP 6301 - Power System Control and Operation**

**Instructor**: A. P. Sakis Meliopoulos

**Description**: An introduction to methods for the real time operation and control of power systems; to study the hardware and software technologies of modern energy management systems (EMS).

**Text**: A. P. Sakis Meliopoulos, Power System Modeling, Analysis and Control

**Additional texts**:

1. A. J. Wood and B. F. Wollenberg, Power Generation Operation and Control, John Wiley & Sons, Inc., Second Edition, 1996.

2. Selected technical papers to be given in increments.

**Grading Policy:**

Homework 20 %

Quiz 25 %

Term Project 20 %

Final 35 %

**Topics**

**The Power System Control Problem**

Control Functions

Operational Constraints/System Operating States

Vertically Integrated Operation

Independent System Operation – Standard Market Design

**Review of Energy Management Systems**

Real Time Modeling Subsystem

Energy/Economy Functions and Control

Security Monitoring and Control Subsystem

Smart Grid Technologies

**Analysis Techniques**

The Power Flow Problem

Solution Techniques

Large Scale Systems

Sparsity Techniques

Security Assessment/Contingency Analysis

Power System Equivalents

**Real Time Modeling**

The SCADA System, IEDs and PMUs

Communications, Computers

Network Configuration

State Estimation

Data and Topology Error Detection

**Energy/Economy Functions and Control, Part I**

Description of Control Loops

Automatic Generation Control

Frequency/Interchange Control

Economic/Pollution Dispatch/Optimal Power Flow

Open Markets

Ancillary Services under Deregulation

**Energy/Economy Functions and Control, Part II**

Operations Planning

Electric Load Forecast

Reactive Power Control

Supply Management Options and Impact

Scheduling and Control of Energy Storage

Unit Commitment

**System Security Monitoring and Control**

Real Time Modeling

Security Monitoring and Security Controls

Voltage Security – Dynamic vs Static VARs

Simultaneous Transfer Capability Analysis

Risk Assessment/Impact of Deregulation