

**Georgia Institute of Technology**  
**School of Electrical and Computer Engineering**

**ECE6320**

**Power Systems Control and  
Operation**

**Fall 2016**

**Time and Place:** TTh 3:05-4:25 pm, Room: ECE - TBD.

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

**Office:** E-164, Phone: 404 894-2926  
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e-mail: [sakis@comcast.net](mailto:sakis@comcast.net)  
Course web site: <http://home.comcast.net/~energia/> plus T-square

**Office hours:** MW 1:00 - 3:00 pm

**Course objectives:** To present 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); to study impact of smart grid technologies on grid operations.

**Text:** A. P. Sakis Meliopoulos, *Power System Modeling, Analysis and Control* (it will be posted on the course web site. Chapters will be updated during the semester).

**Additional texts:**

1. A. J. Wood, B. F. Wollenberg, and G. B. Sheble, *Power Generation Operation and Control*, Wiley, Third Edition, 2013.
2. M. Kezunovic, S. Meliopoulos, V. Venkatasubramanian, and V. Vital, *Applications of Time-Synchronized Measurements in Power System Transmission Networks*, Springer, 2014.
3. Selected technical papers to be given in increments.

<b>Grading policy:</b>	Homework	20 %	
	MidTerm Quiz	25 %	(October 6, 2016)
	Term Project	20 %	(Due last day of classes)
	Final	35 %	

**Term Project:** Details will be given the third week of the semester. Students will be able to select one of two or three suggested projects.

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### **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, Cyber-Physical Security

### **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 (Legacy SE, Distributed SE)
- 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**

- Static vs Dynamic Security Assessment
- Security Monitoring and Security Controls
- Voltage Security – Dynamic vs Static VARs
- Transfer Capability / Congestion Management
- Risk Assessment/Impact of Deregulation