**Northeastern University**
**Department of Electrical and Computer Engineering**
**ECEG393 Power System Operation and Control**

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Course Syllabus

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**Course Goals**:

This course is intended for first and second–year graduate students, and it aims to provide tools and techniques needed to analyze and quantify phenomena that arise in operation and control of modern power systems. The problems to be considered have a wide ranging importance in power systems and include analysis of steady state and control of power systems dynamics. These problem areas to a large degree share a common mathematical framework.

The first part of the proposed course will cover a classical study of steady states in power systems and the solution of some voltage stability problems associated with them of very recent vintage. The goal is to present problems (and solutions) of load flow with several modifications, namely frequency deviations and voltage–sensitive loads. The second part of the course will cover modeling, analysis and controller design for electromechanical transients in power systems (load variations, frequency and power transmission dynamics). Connections will be established with modern robust control theory.

Matlab will be used as a primary analysis, design and simulation tool. Other simulation tools may be used as well - please contact the instructor.

**Instructor**: Alex Stankovic, 303 Dana, 373-3007, astankov@ece.neu.edu

**Subject text**: P. Kundur, *Power System Stability and Control*, EPRI–McGraw-Hill, 1994.

**Prerequisites**:

There are **no** absolute requirements; the desirable prerequisites for this course are core MS courses and Power Circuit Analysis (ECE 3302 & 3303). A willingness to do supplemental reading and instructors permission needed otherwise. Familiarity with Matlab is also recommended.

**Grading policy**:

There will be a midterm project (40 % of the total grade) and a final project.

**Homework and Term Project**:
There will be weekly and biweekly homeworks in this course. Although homeworks do not contribute to the final grade directly, they are essential for understanding the course material. In the second half of the course a term project will be assigned to each student, involving analysis, simulation, and case studies using of the material learned in class (60 % of the final grade).

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**Tentative Schedule**

1. Introduction
2. Part I Steady–state operation problems
   (a) Power Quality
   (b) Decomposition of power system phenomena in the time–domain
   (c) Standard load flow problem formulation
   (d) Solution algorithms (Newton–Raphson and problem specific methods)
   (e) Sparse matrix techniques and other implementation issues
   (f) Novel steady–state problems – frequency dependence, voltage sensitive loads, solution bifurcations.
3. Part II Topics in control of power system dynamics
   (a) Dynamic models of power system components
   (b) Linearized dynamics of power systems
   (c) Control of frequency and tie-line exchange
   (d) Control of voltages and reactive power flows
   (e) Design of robust controllers in power systems.