Master Course Description for EE 454 (ABET Sheet) ======================================

Title: POWER SYSTEM ANALYSIS

Credits: 4

[UW Course

Catalog Description](http://www.washington.edu/students/crscat/ee.html#ee454)

Coordinator: Daniel S. Kirschen, Close Professor of Electrical Engineering

Goals: To learn the modeling and computational techniques used in power system planning and operation.

Learning Objectives: At the end of the course, the students should be able to

1. *Analyze* the steady-state performance of a power system
2. *Perform* power flow computations and *interpret* the results of these computations
3. *Identify* what actions should be taken to improve the voltage profile or the line flows in a power system
4. *Perform* economic dispatch calculations

Textbook: J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, *Power Systems Analysis and Design*, Sixth Edition, 2016, CENGAGE Learning.

Prerequisites by Topic:

1. Three phase circuits
2. Transformers
3. Synchronous machines
4. Real and reactive power concepts

Topics:

1. Models of power system components (generators, load, transmission lines)
2. Techniques for modeling large power systems
3. Formulation of the power flow problem
4. Solution of the power flow problem using the Newton-Raphson Method
5. Control of power system frequency
6. Control of power system voltage

Course Structure: The class meets for 4 hours of lectures/discussion per week. Weekly homework is assigned. Students must also develop and test a computer program that perform a power flow calculation.

Computer Resources: Computer Program for Power Flow Analysis, MATLAB, Python

Laboratory Resources: Computers for instruction in EE labs

Grading: Homework 25%, Computer projects 25%, Midterm 25%, Final exam 25%.

Outcome Coverage:

1. (H) **Problems**

- *An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics:* This course has an extensive component of power system modeling and analysis. Mathematical models of power system components are integrated into a system. Students use circuit analysis techniques to calculate the voltages, currents, and power flows in a power system. Students use numerical algorithms to solve the power flow problems. Basic optimization techniques are needed to determine the economic dispatch of a power system. The class includes various examples of power system operational problems such as line overloads and under-voltage conditions. Students are asked to identify unacceptable system operating conditions and to identify ways to meet the operating constraints. Homework problems require the students to identify the proper models and calculation techniques for power system problems.

2. (M)**Design** - *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors:* In the computer projects, students are asked to formulate the operating constraints, calculate the operating values of the system, determine if the system meets the operating limits and identify the remedial actions. A state-of-the-art power flow software package is used for the power flow problems. Students also design a computer program to perform power flow computations.

3. (L) **Communication** - *An ability to communicate effectively with a range of audiences:* Students submit written reports on their computer projects.

4. (H)**Responsibility** - *An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts:* The lectures and discussion address the broad economic, social and political context in which power systems are built and operated. Students are encouraged to take these non-technical constraints into consideration when studying power system operation and development.

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