

Energy Systems –Fall 2015 Syllabus for the PhD Qualifier in the Energy Area

Candidates should be prepared to answer questions on 4 out of the following 6 major topics. Candidates must inform Prof. Kirschen at least 5 days in advance of the examination of the topics that they have selected.

1. Power system analysis

- Power flow
- Fault calculation
- State estimation
- Optimal power flow

2. Power system dynamics

- Modeling
- Transient stability
- Voltage stability
- Small signal stability

3. Power system operation and control

- Economic dispatch
- Optimal power flow
- Unit commitment
- Frequency control
- Voltage control

4. Power system economics

- Electricity markets
- Congestion management

5. Power electronics

- Power electronics devices
- Power electronics circuits
- Configuration and operation of basic rectifiers and inverters
- Applications of power electronics in power system
- Motor drives

6. Electricity generation technologies

- Conventional generation
- Renewable generation
- Integration of renewable energy generation

In preparing for this examination, the student may find the following books useful:

- *Power System Analysis* by John Grainger Jr., and William Stevenson

- *Power System Analysis* (Second Edition) by Arthur R. Bergen and Vijay Vittal
- *Power Generation, Operation and Control* (Second Edition) by A. Wood and B. Wollenberg
- *Electric Energy: An Introduction* (Third Edition) by Mohamed A. El-Sharkawi
- *Fundamental of Power System Economics*, by D. Kirschen and G. Strbac
- *Power Electronics: A First Course* by N. Mohan
- *Fundamentals of Electric Drives* by Mohamed A. El-Sharkawi
- *Fundamentals of Power Electronics* (Second Edition) by Erickson and Maksimovic