**Summary**

Learn the technologies and methodologies used in the context smart electrical grids and be able to deploy/implement/test them in a lab environment.

**Content**

1. Modern monitoring: phasor measurement units technology, synchrophasors extraction processes and time alignment
2. Smart grid communication; reliability, real time and security issues
3. Topology assessment and contingency analysis of power grids
4. Admittance matrix calculus, numerical solution of the load flow problem and state estimation
5. Energy management and dispatch plans, the optimal power flow problem
6. Demand response

**Keywords**

Smart grid, power systems

**Learning Prerequisites**

**Required courses**

Electric power systems, power distribution networks, TPC/IP Networking

**Recommended courses**

Signal processing, discrete optimization methods, model predictive control, industrial electronics.

**Important concepts to start the course**

Understanding of electrical grids and communication networks.

**Learning Outcomes**

By the end of the course, the student must be able to:

• Design monitoring and control platforms for smart grids
• Test a smart grid
• Implement a smart grid
• Analyze performance of a smart grid
Transversal skills

• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Continue to work through difficulties or initial failure to find optimal solutions.
• Demonstrate the capacity for critical thinking
• Manage priorities.
• Use both general and domain specific IT resources and tools

Teaching methods

Ex cathedra, classroom integrated exercises and computer laboratory sessions.

Expected student activities

Attend lectures and labs
Do lab homeworks
Attend test sessions with clickers

Assessment methods

Tests during semester (20%), Written exam (30%) and graded lab reports (50%)

Supervision

Office hours No
Assistants Yes
Forum Yes

Resources

Moodle Link

• http://moodle.epfl.ch/course/view.php?id=14163

Prerequisite for

Master projects in the areas of power systems and energy conversion systems.