Summary
The purpose of this teaching lab is to put together all the concepts learned during the course into electrical energy by the implementation of an islanded production unit. The number of places is limited, therefore the student must contact the teacher before the beginning of the course.

Content
The goal of this teaching lab is to follow all the steps for setting-up of an islanded production unit.

The group consists of a direct current machine and of a synchronous machine.

The DC machine is used to model an hydraulic turbine. To do this a speed control will be implemented in a DSP. The whole design will be made such as, the choice of controller type, the type of control, the type of criteria (symmetric or meplat), measurement of small time constants, the controller implementation (C code), and tests under steady state as well as in transient.

The synchronous machine is used as a generator and commissioning of industrial voltage regulator (Unitrol of ABB) will be made. Will also follow a customization of the coefficients of the control as well as tests in transient and steady state. The group will then be tested on different loads (resitive and capacitive loads and induction machine).

Finally, the different production units will be connected together to create an interconnected islanded network and inherent interconnection/synchronization problems will be addressed.

The following will be studied:
• Modeling of a hydraulic turbine by a DC machine
• Tests on the synchronous machine (determination of the parameters)
• Speed control
• Voltage regulator
• Islanded production unit
• Interconnection of islanded units

During this teaching lab the student is left very free and independent. A “global” order is given but the way forward is not explained and the student must put his skills out to analyze problems and reflect on the paths to follow to reach the goal.

Keywords
• Production unit
• DC machine
• Synchronous machine
• Speed control (DSP)
• Voltage regulator (Unitrol)
• Islanded network
• Interconnection of islanded production units

Learning Prerequisites

Required courses
EE-490(c) Lab in electrical energy systems

Recommended courses
EE-360 Conversion d'énergie
EE-361 Machines électriques (pour EL)
EE-365 Power Electronics
EE-370 Réseaux électriques

Learning Outcomes
By the end of the course, the student must be able to:
• Perform an interconnection with other production units
• Analyze problems
• Create a production unit
• Use an industrial voltage regulator
• Perform tests on electrical machine
• Design a speed control
• Test an islanded production unit
• Apply all the knowledge learned as a student in electrical energy

Transversal skills
• Use a work methodology appropriate to the task.
• Set objectives and design an action plan to reach those objectives.
• Demonstrate the capacity for critical thinking

Teaching methods
Practical work in groups

Expected student activities
Attend every session and participate actively

Assessment methods
Obligatory continuous. Lab books are given back for correction during the semester and a final oral examination.

Supervision
Assistants Yes

Resources
Websites

- http://tplaime.epfl.ch