EE-472  
**Smart grids technologies**  
Paolone Mario

<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
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<tbody>
<tr>
<td>Electrical and Electronical Engineering</td>
<td>MA2, MA4</td>
<td>Obl.</td>
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<td>Energy Science and Technology</td>
<td>MA2, MA4</td>
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<table>
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<tr>
<th>Language of teaching</th>
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<tbody>
<tr>
<td>Credits</td>
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<tr>
<td>Session</td>
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<td>Exam</td>
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<td>Exercises</td>
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<td>Practical work</td>
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**Summary**

Learn the technologies and methodologies used in the context of the operation of future power grids and be able to deploy/implement/test them.

**Content**

1. Modern monitoring of power systems: synchrophasors estimation, time dissemination/alignment and phasor measurement units.
2. Grid topology assessment and compound admittance matrix calculus.
3. Formulation of the nodal injection and branch flow models of the load flow problem.
5. The optimal power flow problem.
6. Forecasting techniques of loads and stochastic renewables.
7. Stochastic oprimal power flow problems and applied model predictive controls.

**Keywords**

Smart grid, power systems

**Learning Prerequisites**

**Required courses**

Fundamental of electrical circuits and systems I and II, principles of power systems, convex optimization.

**Recommended courses**

Signal processing, discrete optimization methods, model predictive control.

**Important concepts to start the course**

Understanding electrical grids operational principles.

**Learning Outcomes**

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

- Design monitoring and control platforms of smart grids
- Test a smart grid
- Implement a smart grid
• Analyze the 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.

Teaching methods
Ex cathedra, classroom integrated exercises and computer laboratory sessions.

Expected student activities
Attend lectures and labs
Do lab homeworks
Do online quizzes

Assessment methods
Written exam (50%) and graded lab reports (50%)

Resources
Moodle Link
• https://go.epfl.ch/EE-472

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