

EE-456

**Hydropower plants: generating and pumping units**

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Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Opt.
Energy Science and Technology	MA1, MA3	Opt.

Language of teaching	English
Credits	2
Session	Winter
Semester	Fall
Exam	Written
Workload	60h
Weeks	14
<b>Hours</b>	<b>2 weekly</b>
Courses	1 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

Master Lecture on the different layouts of hydropower plants. Detailing the specification of generating units (with Pelton, Francis, Kaplan and Bulb turbines), and pumped-storage hydropower plants (reversible and ternary units).

**Content**

- Introduction to hydropower and statistics
- layout of hydropower plants. storage and run-of-the river power plant
- Integrating new renewable energy with pumped storage power plants
- Type of Machines
- Global quantities and Energy losses
- Power balance
- Velocity triangles and Euler equation
- Turbine and Pump hydraulic Characteristics
- Sustainability of hydropower technology

**Keywords**

Hydropower plant, hydraulic turbine, storage pump and pump-turbine

**Learning Prerequisites****Required courses**

Introduction to electrical engineering, Physics  
Conversion d'énergie

**Learning Outcomes**

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

- Assess / Evaluate Capacity of a Hydropower Plant
- Specify the type of generating or pumping unit
- Assess / Evaluate the power production and sustainability standards compliance

**Transversal skills**

- Use a work methodology appropriate to the task.
- Set objectives and design an action plan to reach those objectives.

### Teaching methods

ex cathedra lectures with working case studies and exercices

### Expected student activities

attendance at lectures completing exercises and reading written material

### Assessment methods

written exam

### Resources

#### Ressources en bibliothèque

- [Cavitation / Franc](#)
- [Turbomachines hydrauliques / Henry](#)

#### Notes/Handbook

slides handout

#### Moodle Link

- <https://go.epfl.ch/EE-456>

### Prerequisite for

Electromechanical conversion  
master project