EFS8AB TURBOMACHINERY HYDRO AND WIND POWER

EFS8AB **Turbomachinery - Applied to Hydro and Wind Power**	**ECTS Credits:** 2 **Duration:** 21 h	**Semester:** S8

Person(s) in charge:

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Keywords: Turbomachinery, pumps, turbines

Prerequisites: General mechanics, fluid mechanics, incompressible fluids, notion of pressure drop

Objective:

Understand how pumps and turbines work and how to size them

Program and Contents:

Give a global presentation of the different fluid machines (displacement machines and turbomachinery) used in transforming energy, with focus on hydraulic energy. We will look at : turbomachinery balancing, the description of the different machinery categories and their scopes of use, the nature of flows around the mobile and/or fixed elements of the machines, the notions of trend lines and efficiency, the causes of losses and operating limits. Finally, an introduction to wind turbines is given towards the end of the module. The course's structure is as follows :

1. Elements of solid mechanics: balancing techniques, rigid body mechanics, centre of mass, inertia tensor, axes of inertia
2. Introduction to fluid machines: Global description and classification of the various types of machines. General theorems. Quick revision of the notions of head and head loss, flow around a profile, velocity triangle.
3. Turbo machines for incompressible fluids : Theoretical and real characteristics, losses, efficiency, conception of axial and centrifugal machines. Centrifugal pumps, propellers. Pelton, Francis, and Kaplan turbines.
4. Similitude : Rateau's invariants, specific speeds
5. Introduction to wind turbines : Presentation of the different types of both vertical and horizontal axes wind turbines. Notions of wind turbines modelling.

Abilities:

Levels	Description and operational verbs
Know	The different types of turbo machines : positive, negative displacement machines, pumps, turbines. Understand the way they work.
Understand	Know, understand and apply Euler's theory of momentum conservation applied to determining turbomachinery's theoretical head for incompressible perfect fluids.
Apply	Know, understand and apply the notion of energy ladder in the turbo machines for real viscous fluids. Take into account the inner head loss.
Analyse	Choose and size turbo machines to fit actual given specifications. Analyse the energy balance and evaluate the possible choices in terms of energy efficiency.
Summarise	Know and understand Betz's theory for wind turbines.
Assess	

Evaluations:

☑ Written test	☐ Continuous Control	☐ Oral report	☐ Project	☑ Written report