Last update: 08-05-2019

820741 - EHM - Hydropower and Ocean Energy

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering

Teaching unit: 729 - MF - Department of Fluid Mechanics

Academic year: 2019

Degree: MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: Spanish, English

Teaching staff

Coordinator: Eduard Egusquiza

Prior skills

Background in Fluid Mechanics and Hydraulic machinery

Learning objectives of the subject

Introduction. Understand the electricity demand and generation, the variations in the consumption and the characteristics of the main types of power plants generating energy. Know the advantages and disadvantages of hydro power compared with other types of power plants.
Hydraulic systems. Be aware of the main types of water power systems comparing conventional hydro (peak), run-of-river (base) and pump-storage. Understand the operation of a water power plant. Know the main components of a typical water power system and the evolution of the mechanical energy in it. Use properly and calculate the terms head, power and efficiency. Learn how to calculate the energy produced by a hydropower unit.
Hydropower units. Know the main components of a hydropower unit understanding the operation depending on head and guide-vane opening using hill charts. Know the main types of hydraulic turbines (reaction and action machines) with their main characteristics and performance.
Energy transfer. Understand the basics of the energy transfer in a hydraulic turbine from the Euler equation. Understand the main flow characteristics in terms of velocity pressure and dissipation. Learn how to calculate the average velocity fields and the energy converted into mechanical energy by the turbine depending on operating conditions.
Cavitation. Understand the basics of cavitation phenomena and the main types of cavitation than may occur in hydraulic turbines. Calculation of the setting levels.
Transients. Understand the start-up and cost-down transients with the associated problems of run-away speed and water hammer.
Marine energy. Know the methods to extract energy of the seas using tidal plants, marine current turbines and wave energy converters. Know the main types of devices and operating principles.
Maintenance. Know the typical maintenance types, the main types of damage and the methods for monitoring the units. Understand the basics of vibrations generated and its use for the surveillance of the machine condition.

Last update: 08-05-2019

820741 - EHM - Hydropower and Ocean Energy

Study load

Total learning time: 125h	Hours large group:	0h	0.00%
	Hours medium group:	30h	24.00%
	Hours small group:	0h	0.00%
	Guided activities:	10h	8.00%
	Self study:	85h	68.00%

Last update: 08-05-2019

820741 - EHM - Hydropower and Ocean Energy

Content

Water power and marine energy	Learning time: 2h Theory classes: 1h Guided activities: 1h

Description:
Introduction
Energy generation and demand
Advantages and importance of hydropower
Types of systems
Dam systems
Run-of-river
Pumped storage
Hydraulic system components
Trash-racks
Valves
Penstock
Draft tube
Energy transfer basics
Energy transfer
Head, discharge, power, efficiency
Hydropower unit components
Turbine and generator
Shaft, coupling
Bearings and seals
Types of turbines
Classification
Francis
Kaplan
Pump-turbines
Marine energy.
Energy from the seas
Tidal energy. Tidal plants. Examples
Marine currents. Marine current turbines. Classification and types. Horizontal shaft and vertical shaft.
Comparison with wind turbines. Advantages and disadventages.
Waves. Wave devices: Rusell, Pelamins, sea snakes, Wells turbines
Maintenance and vibrations.
Main types of damage. Maintenance types
Vibration generation: main excitation forces and machine response
Protection of machine. Brief analysis of standards
Basics of vibration analysis

Bibliography