

Centre	University College of Engineering of Vitoria-Gasteiz
Name of subject	26050 – Hydraulic Facilities and Machines
Qualification	Degree in Mechanical Engineering
Type	Compulsory
Credits	6 ECTS
Year	3
Term(s)	2nd
Department	Nuclear Engineering and Fluid Mechanics
Language	Spanish and Basque

Outcomes / Objectives

Hydraulic pump project, network operation and regulation. Project on different types of water turbines.
Hydroelectric power stations.

Syllabus

Hydraulic turbomachines: overview and fundamental principles. Hydraulic machines and the main parts of a turbomachine are studied and classified, including forms of representation and velocity triangles. Nomenclature for heights, flow rates, power, losses and efficiency is also included, for both pumps and turbines. The subject also studies the application of the fundamental theorem of turbomachinery or Euler's theorem to turbines and pumps, as well as the different applications of hydraulic turbomachinery. Similarities and dimensional analysis applied to turbomachinery. The similarities and analogies required between two turbomachines in order for a transfer of their respective behaviours to occur are analysed. The Buckingham theorem is used to determine the most important dimensionless parameters in turbomachinery, analysing the fundamental theorem of Combes-Bertrand-Rateau. The concept of specific speed is introduced and examples of homologous turbomachines presented. Water turbopumps. The elements, construction types, characteristic curves, regulations and operation of turbopumps are studied. Positive displacement machines. The different types of positive displacement machines are studied, including their elements, form of operation and characteristic curves. Pumping stations. The calculation and construction details of simple, compound and high pressure pump stations. Fans and ventilation facilities. The elements, construction types, characteristic curves, regulation and operation of fans are analysed, as well as their application to ventilation facilities. Hydroelectric power stations. The layout of hydroelectric power stations is described, and the types of waterfalls to consider are analysed, along with hydroelectric power plant types and main parts. A river flow rate calculation problem is also studied, as well as the different types of characteristic curves and regulation systems. Water turbines. The elements, construction types, characteristic curves, regulation and operation of water turbines are analysed. Wind farms. The general theory of wind turbines and Betz's law is explained, and the different types of available wind turbines described. Water supply and sanitary sewer networks. The collection, regulation, transport and distribution of water is studied, as well as the collection and distribution of wastewater.

Methodology

Teaching Method

Face-to-Face Teaching Hours

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
48			12					

Student Hours of Non Face-To-Face Activities

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
72			18					

Compulsory materials

Department's notes. Set of department's problems. Outline of laboratory practicals.

Bibliography

Basic Bibliography

- Turbomáquinas hidráulicas. Claudio Mataix. Editorial ICAI. 1975.-
- Manual de Bombas. Igor J. Karassik, William C. Krutzsch, Warren H. Fraser, Joseph P. Messina. McGraw-Hill. 1976
- Ingeniería Hidráulica aplicada a los sistemas de distribución de agua. Ed.: E. Cabrera, V. Espert, J. García-Serra, F. Martínez. Unidad docente de mecánica de fluidos de la Universidad Politécnica de Valencia. 2 volúmenes. 1996.
- Nuevo manual de instalaciones de fontanería y saneamiento (adaptado al Código Técnico de la Edificación). Franco Martín Sánchez. AMV ediciones. 2008

In-depth Bibliography

- Máquinas hidráulicas. Gonzalo López Patiño, Fco. Javier Martínez Solano. Departamento de Ingeniería hidráulica y medio ambiente, Universidad Politécnica de Valencia. 1999.
- Bombas centrífugas. Igor J. Karassik y Roy Carter. CECSA. 1987.
- Teoría y problemas de máquinas hidráulicas. Antonio Viedma Robles y Blas Zamora Parra. Horacio Escarabajal editores. 2008.
- Turbomachinery. Basic Theory and applications. Earl Logan Jr. Ed. Marcel Dekker. 1993.

Magazines

- Ingeniería del agua
- Tecnología del agua
- El instalador.
- Montajes e instalaciones.
- Fluidos.

Websites

- Hydraulic Institute. www.pumps.org
- Pump-Flo Co. www.pump-flo.com/manulist.asp
- Animated software company, www.animatedsoftware.com
- www.pump-zone.com