30018 - Fluid Machines and Installations

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	436 - Bachelor's Degree in Industrial Engineering Technology
ECTS	6.0
Year	2
Semester	Second semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

The course studies the behavior of fluids along their transport ducts and mobile elements that produce the movement.

1.2.Recommendations to take this course

It is advisable to have studied and understood properly the basic subject of Fluid Mechanics. There are concepts of this subject used extensively in the development of this one. It is desirable that students adopt a system of continuous study and frequently using tutorials with the teacher to resolve any doubts that will surely arise in the learning of the subject.

1.3.Context and importance of this course in the degree

The subject of "Hydraulic Machinery and Systems" is an integral part of the group of compulsory subjects within the industrial branch. It is a subject of 6 credits ETCS taught in the second semester of the second year. It is a constituent material of a fundamental part of industrial engineering such as fluid transport and distribution, as well as the interaction of these with mobile and fixed elements in power generating machines.

1.4.Activities and key dates

At the beginning of each course, dates and times of lectures will be found on the degree website, which can be found at:

http://titulaciones.unizar.es/

At the beginning of the course students will also know the dates and locations of the necessary examinations in order to pass this subject.

2.Learning goals

2.1.Learning goals

The student, in order to pass this subject, should demonstrate the following

30018 - Fluid Machines and Installations

He/She understands the operation and applications of fluid machinery

She/He is capable of sizing a fluid machine subject to general technical specifications.

He/She has the ability to size a fluid installation.

He/She is able to apply efficiency criteria in the design of a facility.

She/he can design operating protocols of facilities based on criteria of efficiency, economy and reliability.

2.2.Importance of learning goals

Graduates in Industrial Engineering Technologies will face in their professional life many situations in which in one way or another will have to work with facilities using fluids. This subject is the key for them to be designed with basic criteria of energy efficiency.

3.Aims of the course and competences

3.1.Aims of the course

The subject and its expected results meet the following approaches and objectives:

The Hydraulic Machinery and Systems subject focuses on the calculation and design of fluid systems and its active elements: pumps and turbines.

The hydraulic design of a fluid machine consists in determining the best shape it must have to provide to / receive from the fluid the specified power. To this end the influence of the internal geometry of the machine in the fluid energy / machine interaction is described in a simplified one-dimensional theory.

The calculation of facilities requires the use of optimization with respect to specified criteria for the design of an energy-efficient installation. The optimization process will focus on pumping facilities that are the most common in industrial engineering practice.

3.2.Competences

After taking the course, students will be more competent to ...

Apply the knowledge of fluid mechanics and the calculation, design and testing of systems and turbomachines.

Solve problems and make decisions with initiative, creativity and critical thinking.

Use the techniques, skills and tools of industrial engineering required in its practice.

Continuously learn and develop independent learning strategies.

30018 - Fluid Machines and Installations

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student can choose between two ways of evaluation, through a global exam or through partial exams.

1: Global exam

According to the exam schedule will be two calls for the global exam. In both a comprehensive written test of the subject, which will represent 97.5% of the final grade will be held. During the course two teamworks will be proposed to the students which will provide the remaining 2.5% of the final grade.

The overall written test will consist three parts

- Problem # 1 (30% of the final grade)

- Problem # 2 (30%)

- Theoretical and practical issues:

Theory * (30%)

* Practices (7.5%)

A minimum of 3 points out of a maximum of 10 in each of the parts of the exam is required to be considered for the global average.

The two teamworks will be required for obtaining 2.5% in addition to the written note for the final test.

If the student has chosen not to make the scheduled laboratory work along the course, evaluation of this part will be done through a practical test in the laboratory. This test will replace the questions related to the lab work in the written exam, which will also result in 7.5% of the final grade. The student must obtain a minimum score of 3 out of 10 to average with the rest of the blocks.

1I: Subtests

If desired, the student can take two partial exams. The first will be held midcourse and the second coinciding with the final examination of the first call. To follow this method of evaluation, the student must present the proposed works and make the practices of the subject. The taking of these tests means that the first call of exam is used up.

If the first partial exam is not passed, the student cannot go to the second one, it must go to the global exam. If the student passes the first partial exam, he may choose to make it to the second partial exam or to the global exam on the first call.

The structure of the first partial exam is:

- Problem (30% of the final score)

- Theoretical and practical issues (15%)

And the second test:

- Problem (30%)

- Theoretical and practical issues:

Theory * (15%)

* Practices (7.5%)

Similarly, a minimum of 3 points out of a maximum of 10 in each of the parts of the partial tests will be required and the teamwork will account for 2.5% of the final grade.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

For the subject a learning process is designed based on the following:

1. Lectures, given to the entire group, in which the teacher will explain the theory of the subject and resolve problems relevant to the calculation of duct systems and the geometry of pumps / turbines.

2. Lab. These practices are highly recommended for a better understanding of the subject because elements described

and calculated on the blackboard are seen in actual operation.

3. Tutorials related to any topic of the subject.

5.2.Learning tasks

Lectures. They are developed at the rate of four hours per week, to complete the 50 hours that we consider appropriate to complete the syllabus.

Lab practices. Five sessions will be held at two hours per session with groups of three / four students. Initially scheduled practices are:

1. Dismantle and selection of centrifugal pumps

2. Pump tests. Cavitation.

3. Fan tests

4. Measurement of losses in pipelines and other elements

5. Simulation of pumping facilities.

Study and personal work. This off-site part is valued at about 90 hours, necessary for the study of theory, problem solving and reviewing of lab work filling forms.

Tutorials. Each teacher will publish a scheduled timetable to attend the students throughout the semester.

5.3.Syllabus

Module 0. Introduction. Types and operation of fluid machines. Classification of fluid machines.

Module 1. Review of principles. Energy exchange in turbomachinery. Powers, losses and efficiencies.

Module 2. Fundamental Theory of turbomachinery. Geometric and kinematic aspects of flow impeller.

Module 3. Theory 1-D of radial turbomachinery. Characteristic curves. Aerodynamic theory of axial machines and turbines.

Module 4. Dimensional analysis on turbomachinery. Modeling. Scale effects.

30018 - Fluid Machines and Installations

Module 5. Specific parameters.

Module 6. Operation of pumping and ventilation lines. Fluid distribution networks.

Module 7. Flow control in lines pumping and ventilation.

Module 8. Cavitation. Effects of cavitation in turbomachinery. Dimensional analysis on cavitation.

5.4.Course planning and calendar

Lectures of theory and problems are given in the timetable established by the center, as well as the hours assigned to the lab work.

5.5.Bibliography and recommended resources

http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=60802&Identificador=C70003

- García Rodríguez, Juan Antonio. Teoría de máquinas e instalaciones de fluidos / Juan Antonio García Rodríguez y Esteban Calvo Bernad . - 1ª ed. Zaragoza : Prensas de la Universidad de Zaragoza, 2013
- Mataix, Claudio. Turbomáquinas hidráulicas : turbinas hidráulicas, bombas, ventiladores / Claudio Mataix . - 2ª ed. rev. y corr. / Por Antonio Arenas ; con la colaboración de Eva Arenas y Alexis Cantizano Madrid : Universidad Pontificia de Comillas 2009
- Turbopumps and pumping systems / Ahmad Nourbakhsh ... [et al.] Brelin [etc.] : Springer, cop. 2008