Universidad Zaragoza

Academic Year/course: 2024/25

30018 - Fluid Machines and Installations

Syllabus Information

Academic year: 2024/25
Subject: 30018 - Fluid Machines and Installations
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. Basic Information

1.1. Objectives of the subject

The subject Machines and Fluid Installations focuses on the calculation and design of fluid installations and their active elements: pumps and turbines.

The hydraulic design of a fluid machine consists of the determination of the best constructive form that it should have to provide/receive the specified energy to/from the fluid. For this purpose, the influence of the internal geometry of the machine on the fluid/machine interaction energy is described with a simplified one-dimensional theory.

The calculation of installations requires the use of optimization criteria with respect to specified criteria that allow the design of an energy efficient installation. Special emphasis will be placed on pumping installations, which are the most common in industrial engineering practice.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement.

1.2. Context and meaning of the subject in the degree syllabus

The subject Fluid Machines and Installations is an integral part of the group of compulsory subjects within the industrial branch. This is a subject of 6 ETCS credits that is taught in the first semester of the third year. It is constituent material of a fundamental part of industrial engineering such as the transport and distribution of fluids, as well as the interaction of these with the mobile and fixed elements in power generation machines.

1.3- Recommendations to take the subject.

It is recommended to have taken and properly understood the Fluid Mechanics subject of the 3th semester. There are concepts of this subject used profusely in the development of the present one. It is advisable that students adopt a system of continuous study and that they make frequent use of the tutorials with the professor to solve those doubts that will surely arise in the learning of the subject.

2. Learning results

2.1. Competencies

Specific competencies:

C35: Ability to apply knowledge of fluid mechanics and the calculation, design, and testing of systems and fluid-mechanical machines.

C37: Ability to use experimental techniques to characterize the performance of mechanical systems.

Generic competencies:

C4: Ability to solve problems and make decisions with initiative, creativity and critical thinking.

C6: Ability to use engineering techniques, skills and tools necessary for engineering practice.

C10: Ability to learn continuously and develop autonomous learning strategies

2.2. Learning results

1. To understand the operation and applications of fluid machines.

2. Be capable of dimensioning a fluid machine subject to general technical specifications.

3. Have the ability to size a fluid installation.

4. Apply efficiency criteria in the design of an installation.

5. Know how to design protocols for the operation and exploitation of facilities based on efficiency, economy and reliability criteria.

2.3. Importance of learning results

Graduates in Industrial Technologies Engineering will face in their professional life multiple situations in which in one way or another they will have to work with facilities that transfer fluids. This subject is the key to ensure that they are designed with basic energy efficiency criteria.

3. Syllabus

Unit 0. Introduction. Types and operation of fluid machines. Classification of fluid machines. Unit 1. Review of principles. Energy exchange in turbomachines. Powers, losses and yields.

Unit 2. Fundamental theory of turbomachines. Geometric and kinematic aspects of impeller flow.

Unit 3. 1-D theory of radial turbomachines. Characteristic curves. Aerodynamic theory of axial machines and aeroturbines.

Unit 4. Similarity theory in turbomachines. Modeling. Scale effects. Unit 5. Specific parameters.

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

Unit 7. Flow regulation in pumping and ventilation lines.

Unit 8. Cavitation. Effects of cavitation in turbomachines. Similarity in cavitation.

4. Academic activities

4.1. General methodological presentation

1. Lectures, given to the whole group, in which the professor will explain the theory of the subject and will solve problems relevant to the calculation of installations and the determination of the geometry of pumps/turbines.

2. Laboratory practices. These practices are highly recommended for a better understanding of the subject because they show in real operation elements whose calculation is done on the blackboard.

3. Tutorials related to any topic of the subject.

4.2- Learning activities.

Attendance to all learning activities is of special relevance to acquire the competencies of the subject.

Lectures: They will be developed at a rate of four hours per week, until completing the 50 hours that we consider fit to dedicate to complete the syllabus.

Laboratory practices. Five sessions will be held at a rate of two hours per session with subgroups of three/four people Study and personal work. This non-attendance part is valued at about 90 hours, necessary for the study of theory, problem solving and script revision

Tutoring. Each teacher will publish a schedule for student attention throughout the term.

4.3- Planning of learning activities and calendar of key dates

The lectures on theory and problems are given in the timetable established by the center, as well as the hours assigned to practical classes.

The presentation of the papers will take place on the last day of class.

The dates and times of the course will be available on EINA's website: http://eina.unizar.es

Likewise, students will have at the beginning of the term the dates and places of the exams required to pass this subject.

4.4- Recommended bibliography and resources

The updated bibliography can be found in the BR of the BUZ

5. Assessment system

The evaluation will be carried out by means of a global written test in the two official exams established for this purpose by EINA.

The examination will consist of four parts:

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

- Problem #2 (30%)

- Theory (20%)

- Questions on laboratory practices (20%)

A minimum of 3 points out of 10 will be required in each of the above mentioned parts of the exam (Problem 1, Problem 2, Theory and Practicals) in order to be averaged.

The student has the option of doing a course assignment. If you choose to do so, the weight of the overall exam in the final grade will become 95% (the exam grade is multiplied by 0.95) and the remaining 5% will come from the evaluation of the work.

6. Sustainable Development Goals

3 - Good Health & Well-Being
6 - Clean Water and Sanitation
7 - Affordable and Clean Energy