Universidad Zaragoza

Academic Year/course: 2022/23

28829 - Fluid Mechanics

Syllabus Information

Academic Year: 2022/23
Subject: 28829 - Fluid Mechanics
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 424 - Bachelor's Degree in Mechatronic Engineering
ECTS: 6.0
Year: 3
Semester: Second semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The subject studies the behavior of fluids through theirs path and hydraulic machines.
In the course, students will apply theories of fluids mechanical machine systems in a wide var

industrial sectors with special attention to turbomachines and their principles of operation.

These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree: **4.4** By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship

1.2. Context and importance of this course in the degree

The subject "Fluid Mechanics: Systems and Machines" focuses on the calculation and design of fluid installations and facilities with special focus on pumps and turbines.

The selection of the optimum machine type in the design of an installation involves the appro

calculation based on the fluid / machine interaction characteristics and the industrial envir

1.3. Recommendations to take this course

The subject "Fluid Mechanics: Systems and Machines" has not had mandatory prerequisites, but students of the Degree in Mechatronics are advised to have passed the previous subject of Fluid Engineering.

2. Learning goals

2.1. Competences

The student will acquire the following generic and specific competences:

- **GI03**: Knowledge of basic and technological materials that will enable our students to learn new methods and theories which will provide them with sufficient versatility to face new situations.
- **GI04**: The capacity to solve problems with initiative, take decisions, show creativity, foster critical reasoning and the

ability to communicate and transmit knowledge, abilities and skills in the field of Industrial Engineering.

- **GC02**: The ability to interpret experimental data, contrasting this data with theoretical data and so draw conclusions.
- **GC03**: The ability to use abstract thinking and logical reasoning.
- **GC04**: The ability to learn in a continuous, self-taught and autonomous way.
- **GC05**: The ability to assess options.
- **GC08**: The ability to pinpoint technical information as well as being able to understand and value it.
- **GC10**: The ability to put together technical documents and be able to present them with the help of adequate computer tools.
- **GC14**: The ability to understand not only the functioning but also be able to develop the maintenance of mechanical, electric and electronic machines and installations.
- **GC15**: The ability to analyse and apply simplified models to technological equipment and applications which enable the students to forecast how they may behave.
- **GC17**: The ability to correctly interpret plans and technical documents.
- **EMO3**: Apply knowledge of the fundamentals of fluid mechanic systems and machines.

2.2. Learning goals

- Recognise fluid and thermal applications in mechanical systems.
- Carry out and interpret plans and diagrams in relation to the regulations and appropriate symbiology.
- Understand the functioning and application of fluid machines.
- The student is able to measure a fluid machine which has been subject to general technical specifications.
- The student is able to measure a fluids installation.
- Resolve those technical aspects linked to the design of fluid mechanics machines and their application to industry.
- Identify and know the functionality of those elements which are part of hydraulic circuits, as well as their normalised representations.
- Apply laws relative to fluids in movement in hydraulic systems.
- The student is able, taking into account the knowledge of the need of the mechanical work that needs to be carried out, to design a hydraulic circuit which will fulfil that specific need, both intuitively and systematically.

2.3. Importance of learning goals

This subject has a marked engineering character, that is to say, it offers a training made up of contents which can be immediately applied and developed in the workplace and in the professional field. Knowledge pertaining to the general laws of fluids in movement, and those technical aspects linked to the systems and applications of hydraulic machines are of enormous importance in numerous industrial environments.

3. Assessment (1st and 2nd call)

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

The student must show that he/she has achieved the learning results expected by means of:

?Laboratory practice: In each of the practice sessions the results obtained and the process followed will be taken into account. Once the practice sessions have been carried out, the student will hand in a report dealing with them. This activity will be marked out of 10 and the student must achieve a minimum mark of 4 in order to be able to have an average mark. This activity will be done on an individual basis.

?**Written exams and proposed project work.** The written exam may include theoretical questions, problem solving and theoretical-practical questions. The proposed projects may substitute the exam of one part of the subject in the continuous assessment method. These activities will be marked out of 10 and the student must achieve a minimum mark of 4 in each one in order to be able to have an average mark.

Assessment Activity	Weighted Mark
Laboratory practice	20%
Written exams and proposed Project work	80%

In order to be able to access the Continuos Assessment System an 80% minimum attendance in class will be required (practice sessions, technical visits, classes, etc.)

Global Assessment Test.

Final Assessment Global Test.

The student must choose this option, when owing to the student?s personal situation he/she is unable to adapt to the rhythm of work demanded by the continuous evaluation system or has previously failed or wishes to increase his/her mark having already taken part in the above mentioned kind of assessment.

Just as in the continuous assessment system, the final assessment global test must aim at checking if the learning results have been achieved, in addition to contributing to the acquisition of diverse competences which must be carried out my means of even more objective methods.

The final assessment global test will consist of the following group of assessable activities:

?Laboratory practice: In each of the practice sessions the results obtained and the process followed will be taken into account. Once the practice sessions have been carried out, the student will hand in a report dealing with them. This activity will be marked out of 10 and the student must achieve a minimum mark of 4 in order to be able to have an average mark. This activity will be done individually.

?**Written exams and proposed project work.** The written exam may include theoretical questions, problem solving and theoretical-practical questions. The proposed projects may substitute the exam of one part of the subject in the continuous assessment method. These activities will be marked out of 10 and the student must achieve a minimum mark of 4 in each one in order to be able to have an average mark.

Assessment Activity	Weighted Mark
Laboratory practice	10%
Written exams and proposed Project work	90%

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

1 Lectures: The theoretical concepts of the subject are explained and illustrative examples are developed as a support to the theory when necessary, focus on the calculation of installation, the characteristic curves of pumps/fans/ turbines and the calculation and development of industrial applications based on Hydraulic systems.

2. Laboratory Workshop. These classes are highly recommended for a better understanding of the concepts because those items whose calculation is done in theory classes are shown in working mode.

3. Tutorials related to any concept of the subject. This activity is developed in a face-to-face mode with a defined schedule or through the messaging and forum of the virtual classroom Moodle.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

4.2. Learning tasks

The course includes the following learning tasks:

- Lectures. it will take 4 hours per week till the 40 hours, necessary to accomplish the objectives of the subject study, will be reached.
- Laboratory Workshop. it will take 10 sessions of 2 hours duration. The group is divided up into various groups, according to the laboratory capacity.
- Study and personal work. This non-face-to-face part is valued in about 90 hours, necessary for the study of theory, problem solving and revision of documents.
- Individual tutorials. Each teacher will publish a schedule of attention to the students throughout the four-month period.

4.3. Syllabus

The course will address the following topics:

- Topic 1. Fluid machines Classification, Euler equation, Momentum theorem, Triangle speeds, Classification of hydraulic pumps.
- Topic 2. Rotodynamic pumps, Similarity relations, The impeller, Yield and Power, Characteristic curves, Applications in industrial systems.
- Topic 3. Fans and hydraulic turbines, Definition and classification. Action and Reaction turbines, Net height. Losses, yield and power, Applications in industrial systems.
- Topic 4. Study Pneumatic-hydraulic components, Design techniques of hydraulic circuits, Calculation of the

installation and its elements, Transmissions and hydraulic controls, Interpretation of phase diagrams in the study sequences, Control schemes, automatic wiring, Applications in the design, optimization and maintenance of circuits.

- Topic 5. Final project on the practical application.

4.4. Course planning and calendar

The theory classes and problems are given in the timetable established by the faculty, as well as the hours assigned to the practices.
The presentation of the works will be done on the last day of class of the subject.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28829