Universidad Zaragoza

Year : 2019/20

60802 - Fluids Engineering

Syllabus Information

Academic Year: 2019/20
Subject: 60802 - Fluids Engineering
Faculty / School: 110 -

Degree: 532 - Master's in Industrial Engineering

ECTS: 4.5
Year: 1
Semester: 532-First semester o Second semester
107-First semester
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

Ingeniería de Fluidos is an obligatory subject of the Máster en Ingeniería Industrial and is thus designed to develop some of the specific competences of an Ingeniero Industrial. The subject covers matters related to the modules Tecnologías Industriales and Instalaciones, Plantas y Consturcciones Complementarias.

1.3.Recommendations to take this course

The contents of this subject ar based on the concepts and methods of Fluid Mechanics as a whole, including its applications to fluid machines and fluid handling equipment and rigs. For those students that are acquainted with Fluid Mechanics from previous studies or degrees there are no further requisites. Otherwise students should take "Máquinas e Instalaciones de Fluidos" before taking "Ingeniería de Fluidos". Nevertheless the student should be familiar with key concepts of previous related subjects from his undergraduate courses.

Work and effort at a continuous pace are strongly advised during the course for a succesful outcome. The help of the lecturer is available during the classes as well as during tutorship time every week.

2.Learning goals

2.1.Competences

2.2.Learning goals

In order to succeed the student must prove the following:

He knows and is capable of applying the design and analysis methods for hydraulic machinery as well as pumping and ventilation systems.

That he knows the instrumentation and control of fluid machinery and is capable of designing and selecting appropriate equipment for a given application.

He understands the transient effects in fluid systems and is able to make predictive calculations.

He knows the specific characteristics of compressible flows and is able to analyze compressible flows in machinery and systems.

He has an understanding of acoustic phenomena in fluid systems and can design and analyze noise generation and control.

He knows the foundations of multiphase flow and has acquired the competenceto analyze and design its applications including pneumatic transport and particle separation.

2.3.Importance of learning goals

This subject adresses the following goals:

Fluid engineering lies on the basis, often playind a key role, of countless devices and systems in idustrial processes. It is

therefore key to provide the industrial engineer with a solid foundation as well as strong analytical and design skills that can be applied to a wide variety of situations and systems encompassing those traditionaly associated with this field (hydraulic machinery, fluid transport and engineering) and many others wher fluids paly a relevant role (thermal and energy engineering, process plants, automotive snd construction engineering and many others).

The student enrolling in Ingeniería de Fluidos is aware the foundations of fluid mechanics as well as the techniques and tools available for flow analysis, mainly oriented towards fluid machinery and fluid transport systems. The goal of this course is to provide the student with additional knowledge and advanced analytical tools that supplement his undergraduate skills and knowledge of fluids engineering.

The contents of this course have been designed and oriented towards the enlargement of the knowledge base and the deepening and complexity of the problems he can address. Therefore advanced analysis and design of fluid engineering processes as well as instrumentation, optimization and control of fluid machinery, multiphase flow, acoustics,compressible flow and transients that have not been dealt with at the undergraduate level have been included.

3.Assessment (1st and 2nd call)

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

The student will be required to prove that he has accomplished the required learning results by means of the following assessment activities

Option 1: Ongoing assessment

This option consists of several assessment activities carried out during the semester. The assessment will consist in two or three tests plus the practical and or laboratory reports. The final mark will be a wieghted average of the different activites. The precise number of tests and reports as well as their share in the final grading will be made available at the begining of the semester.

Option 2: Final Exam

A final writen exam at the end of the semester encompassing the contents of the classes and the practical sessions amounting to 100% of the mark. The date and place of the final exam will be officially published by the EINA.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

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

- **Lectures**. The whole group of students is expected to attend these lectures where the basic theretical principles of the course will be explained and discussed, illustrated with exercises and problems. Students will be prompted to discuss the theory as well as to participate in the solution-finding process of the exercises. Attendance to lectures is strongly recommended for a succesful outcome.
- **Laboratory and computer sessions**. These compulsory sessions will take place in smaller groups (between 3 and 12 students) and will be used in the assessment system. Task instructions for each session will be available in advance.
- **Tutorials**. Individual and small group sessions targeting a more detailed or deeper knowledge of particular theoretical questions or practical exercises. The lecturer's office hours will be published on Moodle platform at the begining of the semester.
- **Autonomous work and study**. This is the backbone of the learning process and as such enough time must be devoted to it. It is estimated that some 85 hours of study time is needed on average to pass this course, which comprises the understanding of theoretical concepts, ability to solve exercises, and writing of reports.

4.2.Learning tasks

The course includes the following learning tasks:

TEACHING SESSIONS

- **T1 Lectures** (22 hours). Three weekly hours with the whole group of students. The main theoretical concepts of the course will be explained by the lecturer. Attendance and active participation by the student is fundamental to a succesful outcome.
- **T2 Practice sessions** (15 hours). Classroom sessions in which exercises are proposed, solved and discussed by the lecturer. Active participation of students will be encouraged and strongly recommended. Open discussions ensuing an exercise or case solving will help get hold of difficult concepts and subtleties.
- **T3 Laboratory and computer sessions** (8 hours). Small group working sessions in the lab or in the computer room under the teacher's guidance to apply concepts and practice abilities explained in lectures. Two sessions with a duration of 2 hours each will be held in the fluid mechanics laboratory and two more sessions with the same

duration will be held in the computer lab.

- **Tutorials** (4 hours)**.** The lecturer's office hours include 6 hours per week. This time represents an excellent opportunity for students to clarify concepts, solve problems or discuss strategies for exercise-solving.

AUTONOMOUS WORK

- **T7 Autonomous work and study** (60 hours)
- **T8 Assessment tests** (4 hours)

4.3.Syllabus

The course will address the following topics:
Section 1. Instrumentation in fluid flow systems

- General concepts
- Pressure measurements
- Speed and flow measurements

Section 2. Multiphase flows

- Particle dynamics in fluid flow
- Particle separation and cleaning systems
- Neumatic transport systems

Section 3. Compressible flow

- Gas flow general properties
- Isentropic, isthermal and adiabatic flow. Flow with heat interaction
- Gas lines. Valves and other elements in compressible flow

Section 4. Transients in fluid systems

- Characteristic times in fluid systems
- Fluid inertia. Mass oscillations
- Elastic fluid systems. Water hammer

Section 5. Acoustics

- Measurement of the sound intensity
- Noise generation in fluid systems
- Plane waves. Reflection and transmission of sound waves
- Noise propagation and attenuation in fluid systems

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website and the Moodle platform.

The schedule of classes will be available at the EINA web page before the commencement of the course:
http://eina.unizar.es

The exam dates and places as well as the deadlines for the reports will be made available at the begining of the academic period.

4.5.Bibliography and recommended resources

http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=60802&Identificador=C70003
http://biblos.unizar.es/br/br_citas.php?codigo=60802&year=2019