Universitat de Lleida

DEGREE CURRICULUM

FLUID MECHANICS

Coordination: ILLA ALIBES, JOSEP

Academic year 2021-22

FLUID MECHANICS 2021-22

Subject's general information

Subject name	FLUID MECHANICS
Code	102112
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Automation and Industrial Electronic Engineering	2	COMPULSORY	Attendance-based
Bachelor's Degree in Energy and Sustainability Engineering	2	COMPULSORY	Attendance-based
Bachelor's Degree in Mechanical Engineering	2	COMPULSORY	Attendance-based
Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering	2	COMPULSORY	Attendance-based
Master's Degree in Industrial Engineering (M 2021)	1	COMPLEMENTARY TRAINING	Attendance-based
Master's Degree in Industrial Engineering	1	COMPLEMENTARY TRAINING	Attendance-based
Not informed	2	COMPULSORY	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	0.4	2.6	3
Number of groups	10	4	2

Coordination	ILLA ALIBES, JOSEP
Department	COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING

Teaching load distribution between lectures and independent student work	Attendance time: 60 h. Home work: 90 h.
Important information on data processing	Consult this link for more information.
Language	Catalan
Distribution of credits	Theory: 3 cr Problems: 2.5 cr Practicum: 0.5 cr

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CRESPO GUTIÉRREZ, ALICIA	alicia.crespo@udl.cat	3	
FONS SOLE, ESTANISLAU	estanislau.fons@udl.cat	9,8	
ILLA ALIBES, JOSEP	josep.illa@udl.cat	7,6	

Subject's extra information

A fluid is a state of matter aggregation characterized by the property of adopting the form of the vessel which contains it, and mainly refers to liquids and gases. The Fluid Mechanics is the wide branch of physics concerned with the phenomena related to fluid movement. In the present course, based on physics and on differential and integral calculus, the basic principles of the mechanics of incompressible fluids will be explained using a deductive conceptual approach.

In order to successfully follow the course it is strongly recommended to refresh the basic concepts of physics and calculus. Some of the problems proposed during the course will require the use of numerical computational techniques, for that reason it is greatly valuable the ability to use a programmable pocket calculator or having the knowledge of some programming language (Basic, Fortran, C, Matlab,...). The default language used in the course will be Matlab, available at the computers from the EPS.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera: http://www.publicacions.udl.cat/

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.

- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

-To understand the properties of a fluid and the concept of pressure.

-Determine the hydrostatic pressure distribution inside a fluid and the force on a submerged surface.

-Deduce the basic equations of fluid mechanics, continuity, energy and momentum, from the basic laws of physics.

-Apply the fluid mechanics equations to elemental facilities problems.

-Calculate the charge losses in a pipe.

-Interpret the characteristic curves of pumps and use them in the design and operation of elemental facilities.

Competences

Degree-specific competences

- GEM7. Knowledge of applied thermodynamics and heat transfer. Basic principles and their application to solve engineering problems.
- GEM8. Knowledge of the basic principles of fluid mechanics and its application to solve problems in the field of engineering. Calculation of pipes, channels and fluid systems.

Degree-transversal competences

- EPS1. Capacity to solve problems and prepare and defence arguments inside the area of studies.
- EPS2. Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.
- EPS7. Capacity to work in situations with a lack of information and/or under pressure.

Subject contents

1. Classification of pumps

2. Centrifugal pumps. Euler equation

3. Head looses, power and yield of a pump

4. Characteristic performance. Operation point

5. Cavitations. The NPSH concept

6. Similitude in turbo machines.

Methodology

Master class, where the basic concepts are exposed in a deductive sequence.

Problem solving. The methodology to solve the typical problems is exposed, starting from the basic concepts.

Practicum, will be performed at the laboratory in groups of 5 people. Each group will then present a report analyzing the experimental data.

Written exam. At day and time established by the study board. Each student has to solve by its own the proposed questions in a limited time. The students know the punctuation criteria.

Development plan

Week	Methodology	Contents	Attendance hours	Autonomous working hours
1-8	Master class Problems	Chapters 1 and 2	32	48
9	Written exam (E1)	Chapters 1 and 2	3	
10-13	Master class Problems	Chapters 3 and 4	16	24
14-15	Practicum	Practicum at laboratory	4	12
16	Written exam (E2)	Chapters 1 a 4 Practicum	3	

Evaluation

By mid semester there is a written exam (E1) including all subjects taught during that period. By the end of the semester there is another exam (E2) including all subjects discussed during the semester. There will be a mark on the laboratory work (P) and a mark reflecting the global appraisal of the professor (A). The mark of the first opportunity will be calculated as:

$$NO1=0.75*\max\{(E1+E2)/2, E2\} + 0.2*P + 0.05*A$$

If anyone does not succeed in this first attempt there will be a second opportunity to pass the course through a final examination (EJ) which includes all stuff of the course. The mark of this second opportunity will be calculated as:

$$NO2=0.75*EJ + 0.2*P + 0.05*A$$

All exams will be done in the dates established by the Direction of the EPS. Practicum at the laboratory will be carried out during the last two weeks of the semester in a timetable agreed with the students. Practicum is subject of the exams too.

The presence of a serious error in a test or exam disqualifies it.

Bibliography

Recommended bibliography

Basic references

-J.Agüera Soriano, “Mecánica de fluidos incompresibles y turbomáquinas hidráulicas”, 5ª ed., Editorial Ciencia3 S.A., 2002 (ISBN: 84-95391-01-05)

- Claudio Mataix, “Mecánica de fluidos y máquinas hidraulicas” , 2ª ed.,Ediciones del Castillo S.A., Madrid 1986 (ISBN: 84-219-0175-3).

-J.B.Franzini, E.J.Finnemore, "Mecànica de fluidos con aplicaciones en Ingenieria", 9ªed., McGraw-Hill, 1999, (ISBN: 84-481-2474-X)

-V.L. Streeter, E.Benjamin, K.W. Bedford, “Mecánica de los fluidos”, Ed. McGraw-Hill, 9ª ed., 2000 (ISBN: 968-600-987-4).

Additional references

-Merle C. Potter; David C. Wiggert, “Mecánica de fluidos, 3ªed”, Ed. Thomson, 2002.

-Irving H. Shames, “Mecánica de fluidos”, Ed. McGraw-Hill, 1995.

-Frank M.White, “Fluid Mechanics”, Ed. McGraw-Hill, 1986