Universitat de Lleida

DEGREE CURRICULUM

FLUID MECHANICS

Coordination: BARTOLI SOLER, ESTHER

Academic year 2022-23

FLUID MECHANICS 2022-23

Subject's general information

Subject name	FLUID MECHANICS
Code	102332
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's degree in Industrial Organization and Logistics Engineering	2	COMPULSORY	Attendance-based
Common branch in industrial engineering programs - Igualada	2	COMPULSORY	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	1	2	3
Number of groups	2	1	1

Coordination	BARTOLI SOLER, ESTHER
Department	COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING
Teaching load distribution between lectures and independent student work	60 hours classroom lessons Self study 90 hours
Important information on data processing	Consult this link for more information.
Language	Catalan, Spanish
Distribution of credits	3 praula, 1 pralab1, 2 pralab2

FLUID MECHANICS 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BARTOLI SOLER, ESTHER	esther.bartoli@udl.cat	5	
CUADROS DOMENECH, SARA	sara.cuadros@udl.cat	2	

Subject's extra information

Previous knowledge

To be able to take this course, the student must have a minimum knowledge of the following topics:

- Industrial processes in general: Basic knowledge about the flows that can be made. Amount of movement, Bernouilli's equation.

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

- Laboratory gown from UdL
- 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/

There will be a specific service for the *Campus Universitari d'Igualada*.

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

General objectives

When finishing the subject the student or student must be able to:

- Understand the basic principles of fluid transport.
- To know the flow of fluids for the design of liquid and gas transport systems.
- Know the main elements of the fluid transport networks and calculate the main parameters based on the characteristic equations.
- Know and apply the appropriate units in each case.

Competences

Basic:

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

B04 That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

Transversal

CT1. To develop a proper understanding and oral and written expression of Catalan and Spanish.

CT5. To apply essential notions of scientific thinking.

FLUID MECHANICS 2022-23

General competences

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To sSolve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical Engineering.

Specific competences

CE8. To conceptualize the basic principles of fluid mechanics and their application to solving problems in the field of engineering. To calculate pipes, channels and fluid systems.

Subject contents

1. Basic concepts
1.1. Fundamental laws
1.2. Transport mechanisms
1.3. Speed equation for molecular transport of amount of movement. Newton law for viscosity
1.4. Speed equations for turbulent transport
1.5. Basic parameters and units Introduction.

2. Fundamental equations
2.1. Introduction
2.2. Basic laws of fluid mechanics
2.3. Reynolds transport theorem
2.4. Conservation of the mass
2.5. Conservation of the amount of movement
2.6. Theorem of the kinetic moment
2.7. Equation of energy
2.8. Flux without friction: the equation of Bernouilli

3. Circulation of fluids in ducts / conduits
3.1. Introduction
3.2. Profile of speeds in a conduction of circular section
3.3. Viscous flow in ducts
3.4. Circulation regimes
3.5. Charging losses
3.6. Laminar flow
3.7. Turbulent flow
3.8. Permanent flow incompressible through simple pipes
3.9 Piping systems

4. Hydraulic machines
4.1. Incompressible fluids
4.1.1. Pumps
4.1.2. Hydraulic turbines
4.2. Compressible fluids
4.2.1. Alternative compressor
4.2.2. Fans
4.2.3. Turbines

5. External flow
5.1. Heat transmission
5.1.1. Heat Exchangers.
5.1.2. Evaporators
5.1.3. Flow in devices used for heat transfer between two phases

6. Special Circulations
6.1. Flow in porous media
6.2. Circulation of fluids through a bed of solids
6.2.1. Filtering
6.2.2. Fluidization and pneumatic transport
6.3. Movement of solids in the fluid
6.3.1. Sedimentation
6.3.2. Hydraulic classification
6.3.3. Flotation
6.3.4. Stirring and Mixing of Liquids

The project taught in the secon year 2nd semester integrates the following courses: Fluid Mechanics, Industrial Automation and Foundations of Electronic Engineering . If a student has already passed two of the subjects that are part of the project, he must make a project solely on the part of fluid mechanics.

Methodology

Master classes, where they are taught by the teacher, with the explanation of the basic concepts.

Problems, the methodology of solving types problems based on the basic concepts is exposed.

Practices, They are carried out in the laboratory in groups to be determined. Each group will have to prepare a report with the analysis of the experimental data collected.

Written evidence, on day and time set by the study direction. Each student must solve questions and problems in a limited time. The student knows the punctuation criteria

The project taught, The integrator project is a work that is done in coordination with several subjects of the course: Electronic Engineering Basics, Industrial Automatization, Fluid Mechanics

in order to deal with an engineering problem in a transversal way.

It is a group work (preferably 3-4 people).

The project coordinator will monitor the tasks to be submitted, as outlined in the timeline provided at the beginning of the course.

All the subjects involved in the project will be registered jointly. In the circumstance that the students might have passed more than 50% of the subjects involved in the project, they will be allowed to write an equivalent project focused on the subject they are currently taking.

FLUID MECHANICS 2022-23

Development plan

Week	Methodology	Contents	Classroom/Virtual hours	Self study hours
1-8	Master class Problems	Chapters 1,2,3,4	30	50
9	Written exam (E1)	Chapters 1,2,3,4	2	
10-13	Master class Problems	Chapters 5,6	16	30
14-15	Practicum	Practicum at laboratory	10	10
16	Written exam (E2)	Chapters 5,6	2	

The follow-up of the integrator project will be carried out during the course during class hours.

Evaluation

Halfway through the semester, a written test (E1) will be taken, corresponding to the subject taught during this first part and representing 25% of the overall mark. At the end of the semester there will be another written test (E2) with the total of the subject taught corresponding to 45% of the overall mark. There will also be a practical note (P) that represents 10% of the overall mark and a note of the integrating project (PI) that also represents 20% of the overall mark.

The note will be:

NO1 = 0,25 E1 + 0,45 E2 + 0,10 P + 0,20 PI

Those who have not passed the subject at the first opportunity may take a final examination of recovery (ER) that will include all the subjects taught during the course. The final grade of the subject will be:

NO2 = 0,70 ER + 0,10P + 0,20PI

Tests E1, E2, and ER will be carried out on the dates set by the Studies Directorate. The practices will be done during the last weeks of the course agreed with the students.

Note: in case the student does not develop the project or equivalent work, the mark of the subject will be Not attended.

Bibliography

White, Frank M. Mecánica de fluidos. Madrid: McGraw-Hill, 2008 (6a ed.). ISBN 978-84-481-6603-8

Streeter, Victor L.; Wylie, E. Benjamin; Bedford, Keith W. Title Mecánica de los fluidos. México: McGraw-Hill, 2000 (9a ed.). ISBN 958-600-987-4

Orchillés, A. Vicent; Sanchotello; Margarita. Mecànica de fluids. Valencia: Universidad de Valencia. Servei de publicacions, 2007. ISBN 843-706-562-3

Çencel, Yunus A.; Cimbala, John M. Mecánica de fluidos : fundamentos y aplicaciones. México, D.F.: McGraw-Hill, 2006. ISBN 970-10-5612-4