

Course guide 220132 - 220132 - Fluid Mechanics II

Last modified: 02/04/2024

Academic year: 2024	ECTS Credits: 3.0 Languages: English		
	BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).		
	BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).		
Degree:	BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).		
Teaching unit:	729 - MF - Department of Fluid Mechanics.		
Unit in charge:	Terrassa School of Industrial, Aerospace and Audiovisual Engineering		

LECTURER

Coordinating lecturer: Josep M Bergadà I Granyó

Others:

TEACHING METHODOLOGY

The course is develops through lectures including theoretical sessions imparted with the aid of powerpoint presentations and more applicative and more visual sessions with videos, stellar catalogues and simulations

LEARNING OBJECTIVES OF THE SUBJECT

The initial idea is to learn how to solve fluid mechanics problems which due to its complex mathematical resolution cannot be solved in a first stage fluid mechanics subject. The information gathered will also be applicable to similar problems in different subjects.

As in many universities a very important part of a second level of fluid mechanics is related to gasdynamics, this is exactly what would be lectured next in the present subject. Many applications of gas-dynamics are to be found in industry and aeronautics.

The last part of this small subject will introduce some applications of computer fluid dynamics, related to the previous sub chapters. It is very important for the students to realize that some problems can just be solved via using some specific techniques.

STUDY LOAD

Туре	Hours	Percentage
Self study	45,0	60.00
Hours large group	30,0	40.00

Total learning time: 75 h



CONTENTS

Module 1: Numerical integration of differential equations obtained in fluid mechanics problems

Description:

1. The students will need to solve real fluid mechanics problems via finding out the differential equations related and solving them using software's like Mapple or Matlab.

Related activities:

Via working in teams the students will solve real problems which will need the use of medium level mathematics and software's available. Each group will need to solve 2 or three real problems. The use of software and basic programming will be needed.

Full-or-part-time: 25h

Theory classes: 10h Self study : 15h

Module 2: Gasdynamics

Description:

2. The bases of gas-dynamics will be established and will be linked with the design of valves, pipes, aeroplanes, rockets etc. Normal and oblique shock waves will be part of the information to be gathered.

Related activities:

Via working in teams the students will solve real problems which will need the use of medium level mathematics and software's available. Each group will need to solve 2 or three real problems. The use of software and basic programming will be needed.

Full-or-part-time: 35h

Theory classes: 15h Self study : 20h

Module 3: Introduction to computer fluid dynamics

Description:

3. As it will be clearly stated in the previous two sections. There are many problems in fluid mechanics in which the differential equations governing the physics related are too complex to be solved using medium level mathematics; it is therefore needed to use a different approach. So far, and mostly due to the shortage of time some examples of integrating the Reynolds equation of lubrication will be covered.

Related activities:

Via working in teams the students will solve one real problem. The use of basic programming will be needed.

Full-or-part-time: 15h Theory classes: 5h Self study : 10h

GRADING SYSTEM

EXAMINATION RULES.

Students, in teams, will need to complete some assessments and present them in class. The qualification will be linked to the quality of the work performed.



BIBLIOGRAPHY

Basic:

 Bergadà Granyó, Josep M. Mecánica de fluidos: breve introducción teórica con problemas resueltos [on line]. 3a ed. Barcelona: Iniciativa Digital Politècnica, 2017 [Consultation: 09/03/2023]. Available on: <u>http://hdl.handle.net/2117/111266</u>. ISBN 9788498806885.

- Bergadà Granyó, Josep M; Kumar, Sushil. Fluid power, mathematical design of several components. Hauppauge, New York: Nova Science Publishers, Inc, 2014. ISBN 9781629483160.

- Zucrow, M. J.; Hoffman, J. D. Gas dynamics. Vol. 1, Gas dynamics. New York: John Wiley & Sons, 1976.

Complementary:

- Anderson, John David. Modern compressible flow: with historical perspective [on line]. 4th ed. New York: McGraw-Hill, 2021 [Consultation: 09/10/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6212 892. ISBN 9781260590043.

- Emanuel, George. Gasdynamics, theory and applications. New York, N.Y: American Institute of Aeronautics and Astronautics, cop. 1986. ISBN 0930403126.

- Liepmann, H. W.; Roshko, A. Elements of gasdynamics. Mineola [NY]: Dover Publications, 2001. ISBN 0486419630.