

Academic Year: ( 2023 / 2024 )

Review date: 20-05-2022

Department assigned to the subject: Thermal and Fluids Engineering Department

Coordinating teacher: RUBIO RUBIO, MARIANO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Engineering Fluid Mechanics or similar (Bachelor)  
Advanced Fluid Mechanics (1st term)

**OBJECTIVES**

Competencies and learning results acquired by the student:

- Knowledge of a repertoire of experimental techniques, commonly used in Fluid Mechanics, as well as their physical and mathematical basis. This knowledge must enable the student to choose the most adequate technique for a particular problem.
- A critical attitude towards the interpretation of experimental results, either obtained by him/herself or found in the literature.

**DESCRIPTION OF CONTENTS: PROGRAMME**

- Fluid properties measurements
- Flow meters and pitot tubes
- Thermal anemometry (Hot wire)
- Laser Doppler Anemometry (LDA/LDV)
- Introduction to signal analysis
- Interferometric techniques (Schlieren, Shadowgraphy)
- Laser Induced Fluorescence (LIF)
- Particle Image Velocimetry (PIV)

**LEARNING ACTIVITIES AND METHODOLOGY**

- Lectures where the techniques are described
  - Software-based (Matlab) lectures for signal and image analysis
  - Practical sessions where different techniques will be used to characterize some relevant flows
- The students will have to deliver reports based on the measurements concerning three of the explained techniques. For instance:
- + Viscosity measurement through image analysis
  - + Hot wire
  - + Laser Doppler Anemometry

**ASSESSMENT SYSTEM**

- Scientific-technical reports on the lab techniques 90%:
  - + Viscosity measurement through image analysis 20%
  - + Thermal anemometry 35%
  - + Third technique lab 35 %
- Continuous assesment of the students progress 10%
  - + Kahhot!-wise game-quizzes

<b>% end-of-term-examination:</b>	0
<b>% of continuous assessment (assigments, laboratory, practicals...):</b>	100

**BASIC BIBLIOGRAPHY**

- Cameron Tropea (Ed.) Handbook of experimental fluid mechanics, Springer, 2007
- H.H. Bruun Hot-wire anemometry, Oxford Science Publications, 1995

- John G. Webster Measurement, instrumentation and sensors handbook, CRC Press, 1999
- Markus Raffel Particle image velocimetry : a practical guide, Springer, 2007
- Richard J. Goldstein Fluid Mechanics Measurements, Taylor & Francis, 1996

#### BASIC ELECTRONIC RESOURCES

- Finn E. Jørgensen, DANTEC DYNAMICS . How to measure turbulence with hot wire anemometers:  
<http://web.iitd.ac.in/~pmvs/courses/mel705/hotwire2.pdf>