Aerodynamics I

Academic Year: (2019 / 2020) **Review date: 08-06-2018**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: FLORES ARIAS, OSCAR

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Advanced Mathematics
Fluid Mechanics I
Fluid Mechanics II

OBJECTIVES

Fundamental and applied knowledge of Aerodynamics.
Fundamental and applied knowledge of the simplified laws that govern the fluid motion around aerodynamic bodies.
Fundamental and applied knowledge of the principles that allow the prediction of forces and moments on bodies moving through a fluid. In particular, generation of lift, drag and moments on airfoils (incompressible, subsonic and supersonic regimes) and wings (incompressible regime).

DESCRIPTION OF CONTENTS: PROGRAMME

Introduction to Aerodynamics. Incompressible, subsonic, transonic, supersonic and hypersonic regimes. Potential flow, linearization. The Kutta-Joukowski theorem and D'Alambert's paradox.

Incompressible flow over airfoils. The vortex sheet. The Kutta condition. Kelvin's circulation theorem and the starting vortex. Assymetric and symmetric linearized problems. The aerodynamic center. Drag, stall and high-lift devices.

Incompressible flow over finite wings. The Biot-Savart law. Prandtl's lifting line theory. Effect of the aspect ratio.

Linear theory of subsonic compressible flows. Prandtl-Glauert correction. Other compressibility corrections. Critical Mach number, Mach Divergence and the area rule. Supercritical airfoils.

Supersonic airfoils. Linearized potential theory.

LEARNING ACTIVITIES AND METHODOLOGY

Theory sessions.
Problem sessions working individually and in groups.
Lab-sessions with specific software.

ASSESSMENT SYSTEM

End-of-term exam (60%)
Class tests (20%)
Lab sessions (20%)

In order to pass the subject, two requirements need to be met:

1) to have a MINIMUM mark of 4.0/10 in the end-of-term exam;
2) to have a minimum overall mark of 5.0/10 (weighing 60% the end-of-term exam mark and 40% the mark of the continuous evaluation).

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- J.M. Gordillo & G. Riboux Introducción a la Aerodinámica Potencial, Paraninfo, 2012
- John. S. Anderson, JR. Fundamentals of Aerodynamics, Mc Graw Hill, 2011

ADDITIONAL BIBLIOGRAPHY

- E.L. Houghton, P.W. Carpenter Aerodynamics for engineering students, Edward Arnold.
- H. Schlichting, E. Tuckenbrodt Aerodynamics of the Airplane, Mc Graw Hill, 1979
- Ulgen Gulcat Fundamentals of modern unsteady aerodynamics, Springer, 2010