Mechanics of Flight II

Academic Year: (2021 / 2022) **Review date: 04-06-2021**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: SANCHEZ ARRIAGA, GONZALO

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Mechanics applied to Aerospace Engineering
Aerodynamics I
Flight Mechanics I

OBJECTIVES

Flight Mechanics II is an introduction to the static stability of aircraft. The longitudinal analysis includes the total lift and pitch torque curves for an aircraft, trimming conditions, limits for the location of the center of mass, neutral point in stick fixed and stick free conditions, and the stick force. Cruise conditions, a symmetric pull-up and a coordinated turn are considered. The lateral-directional analysis includes the roll and yaw stiffness of aircraft.
The course discusses the relation between the handling qualities of the aircraft and its design. A short introduction to automated flight control is given.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to aircraft stability
   1.1 Basic concepts on equilibrium and stability
   1.2 Static and dynamic Stability

2.- Longitudinal static stability with load factor equal to one
   2.1 Lift and pitch moment curves of a flying wing
   2.2 Lift and pitch moment curves of an aircraft
   2.3 Static stability analysis in stick fixed conditions. Neutral Point
   2.4 Static stability analysis in stick free conditions. Neutral Point
   2.5 Stick force

3.- Longitudinal static stability with load factor different to one
   3.1 Lift and pitch moment curves
   3.2 Pull-up and turn
   3.3 Neutral points in stick fixed and sitck free conditions.
   3.4 Stick force

4.- Lateral-Directional static stability
   4.1 Introduction
   4.2 Lateral force
   4.3 Yaw stability
   4.4 Yaw control
   4.5 Roll stability
   4.6 Design means to achieve roll stability
   4.7 Roll Control

5) Identification of stability and control elements
   5.1 Static, acrobatic and power kites
   5.2 Commercial aircraft
   5.3 Transport aircraft
   5.4 Military aircraft

LEARNING ACTIVITIES AND METHODOLOGY

Theoretical sessions.
Exercise sessions working individually and in groups.
Laboratory sessions with simulation software.

ASSESSMENT SYSTEM

Final exam (60%)
Practical problems with evaluation of reports (40%)
Required minimum mark on final exam: 4/10

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

BASIC BIBLIOGRAPHY

- Bernard Etkin and Lloyd D. Reid. Dynamics of Flight, Wiley, 1996

- M. A. Gomez Tierno, M. Pérez Cortés y C. Puentes. Mecánica de Vuelo, Instituto Universitario de Microgravedad "Ignacio Da Riva", 2009

- M. V. Cook Flight Dynamics Principles, Elsevier, 2007

ADDITIONAL BIBLIOGRAPHY

- Alfred Cotterill Kermode Mechanics of Flight, Longman, 1996

- Bandu N. Pamadi Performance, Stability, Dynamics and Control of Airplanes, American Institute of Aeronautics and Astronautics Inc, 2004

- Bernard Etkin Dynamics of Atmosopheric Flight, Dover Publications, 2005

- Francis J. Hale Introduction to Aircraft Performance, Selection and Design,, Wiley, 1984

- Holt Ashley Engineering Analysis of Flight Vehicles, Courier Dover Publications, 1992

- Mario Asselin An Introduction to Aircraft Performance, AIAA Educational Series, 1997

- Robert C. Nelson Flight Stability and Automatic Control, WCB/McGraw Hill, 1998

- Shiva Kumar Ojha Flight Performance of Aircraft, American Institute of Aeronautics and Astronautics, 1995