

## Mechanics of Flight

Academic Year: ( 2017 / 2018 )

Review date: 28-04-2017

Department assigned to the subject: Department of Bioengineering and Aerospace Engineering

Coordinating teacher: SANCHEZ ARRIAGA, GONZALO

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

## STUDENTS ARE EXPECTED TO HAVE COMPLETED

Introduction to Flight Mechanics  
Aerodynamics  
Aerospace Propulsion

## COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

Mechanics of Flight is designed to introduce students to the performance, stability, and control of aircraft. Particular attention is given to mathematical models and techniques for analysis, simulation of the aircraft motion, and evaluation of flying qualities, with brief discussion of guidance, navigation, and control. Topics include equations of motion, configuration aerodynamics, and longitudinal/lateral/directional motions.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Mechanics of Flight
  - 1.1. Subject of Mechanics of Flight
  - 1.2. Elements of the Aircraft
  - 1.3. Aircraft Reference Geometry
  - 1.4. Reference Frames
    - 1.4.1. Basic Reference Frames
    - 1.4.2. Transformations
  - 1.5. Summary of vocabulary
2. Equations of Motion
  - 2.1. Kinematics
  - 2.2. Dynamics
  - 2.3. External forces
    - 2.3.1. Aerodynamic Terms
    - 2.3.2. Propulsive Terms
  - 2.4. Examples
3. Performances
  - 3.1. Level Flight and Gliding Flight
  - 3.2. Flight in Vertical Plane
  - 3.3. Turning Flight
  - 3.4. Takeoff and Landing
  - 3.5. Energy Methods
  - 3.6. High Speed Flight and Aircraft in Ground Effect
4. Static Stability and Control
  - 4.1. Longitudinal Stability and Control
    - 4.1.1. Stick Fixed Conditions
    - 4.1.2. Stick Free Conditions
    - 4.1.3. In maneuver
  - 4.2. Lateral-Directional Stability and Control

## LEARNING ACTIVITIES AND METHODOLOGY

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

## ASSESSMENT SYSTEM

Final exam (60%)

Practical problems with evaluation of reports and oral exam (40%)

Required minimum mark on final exam: 4/10

**% end-of-term-examination:** 60

**% of continuous assessment (assignments, 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
- Mario Asselin An Introduction to Aircraft Performance, AIAA Educational Series, 1997

#### ADDITIONAL BIBLIOGRAPHY

- Alfred Cotterill Kermode Mechanics of Flight, Longman, 1996
- Angelo Miele Flight Mechanics, Vol.1 , Addison-Wesley Pub. Co., 1962
- Bandu N. Pamadi Performance, Stability, Dynamics and Control of Airplanes, American Institute of Aeronautics and Astronautics, Inc., 2004
- Barnes Warnock McCormick Aerodynamics Aeronautics and Flight Mechanics, Wiley, 1995
- Bernard Etkin Dynamics of Atmospheric Flight, Dover Publications, 2005
- Bernard Etkin, Lloyd D. Reid Dynamics of Flight. Stability and Control, Wiley, 1996
- Cubierta delantera Barnes Warnock McCormick Aerodynamics Aeronautics and Flight Mechanics, Wiley, 1995
- Francis J. Hale Introduction to Aircraft Performance, Selection and Design, Wiley, 1984
- Holt Ashley Engineering Analysis of Flight Vehicles, Courier Dover Publications, 1992
- M. V. Cook Flight Dynamics Principles, Elsevier, 2007
- Mario Asselin Introduction to Aircraft Performance, American Institute of Aeronautics and Astronautics, 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