

# Introduction to Flight Dynamics

Syllabus Number

2B303

Basic Major Subjects

Elective Requisites 2  
credit

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## 1. Course Description

Students will learn the basic configuration of the aircraft, the methods of estimating aerodynamic forces, equations of motion of the aircraft, and maneuvering and stability characteristics of the aircraft. Lecture materials are shown on screens via Powerpoint presentations. These lecture materials are also printed and distributed. I sometimes also use the videos.

I am not going to explain the deployment of formulae precisely. I do not read verbatim the lecture materials.

I proceed with the lecture in the hope that students will understand conceptually and qualitatively.

Questions are accepted anytime.

## 2. Course Objectives

The goal of this course is to learn the basic knowledge of performance, stability, and maneuverability of fixed-wing aircraft. The subjects in this course includes the basis of motion equations that is necessary in order to understand the flight characteristics of the fixed-wing aircraft, and the knowledge of estimation methods of aerodynamic forces of the aircraft and the control surfaces.

## 3. Grading Policy

Evaluation is done by web test via LMS, conducted at the final examination period (100%).

However, in addition to the attendance rate, there is a requirement for taking the LMS exam. Read "Note" below.

Regarding the LMS test, feedback is given by scoring comments, etc.

## 4. Textbook and Reference

Textbook

加藤寛一郎、他 『航空機力学入門』ISBN-13: 978-4130610438 東京大学出版会

Reference

内藤子生 『飛行力学の実際』ISBN-13: 978-4930858269

However, the reference book above is out of print. I can provide copybooks that are authorized by the copyright owner at actual cost.

Also, since textbooks on "Introduction to Aeronautical Engineering" are useful for many, refer to it. 日本航空技術協会

## 5. Requirements(Assignments)

Every lecture material will be posted on LMS in principle one week before class. (This does not apply to periods when LMS is not yet available, such as first time and second time.)

Be sure to look through the lecture materials of the next lesson as preparatory learning, and organize it as yourself as to where it is difficult to understand and participate in the lecture.

In the lecture, we do not follow lecture materials one by one and word by word. So it's a good idea to prepare and learn and to ask questions on the spot or ask again for explanation. (1.5 hours)

Review is also important. I will have LMS exercises submitted within one week after lecture. I will set it so that students can try several times. I think that students can review by checking their understanding situation by reviewing. (1.5 hours)

If you do not submit this properly, you cannot have the web test at the end of the term, so read "Note" below.

## 6. Note

Students cannot take the web test at the end of the term if the number of submitted LMS tests for understanding check after lecture are not more than two thirds of the total number of LMS tests.

## 7. Schedule

- [1] Basic knowledge - basic matters concerning aircraft structure, atmosphere, altitude, speed.
- [2] Estimation method of aerodynamic force - Method of estimating aerodynamic force, such as lift, drag, etc., acting on aircraft.
- [3] Estimation method of aerodynamic force (continued).
- [4] Basic performance - Performance such as takeoff, climb, cruise, descent, landing.
- [5] Equations of motion and coordinates - Aircraft equations of motion and coordinate systems.
- [6] Small perturbation equations of motion - Understanding of basic flight characteristics of aircraft.
- [7] Stability derivatives - About the method of getting stability derivatives appearing in the equation of motion.
- [8] Stability derivatives (continued).
- [9] Longitudinal static stability and balance - Static stability against changes in aircraft attack angle and speed.
- [10] Maneuvers and center of gravity position - Longitudinal and lateral maneuvers, stability and control, center of gravity position constraints.
- [11] Longitudinal stability and control - longitudinal stability and control of the aircraft.
- [12] Lateral stability and control - lateral stability and control of the aircraft.
- [13] Gust response - Atmospheric disturbances to be considered when designing an aircraft.
- [14] Flight path angle control - flight path angle, altitude control.

[15]      Review of previous exercises, recent topics, etc.