

# Fundamental Design Technology of an Airplane

Syllabus Number

2B216

Special Subjects

Elective 2 credit

HIRAMOTO, Takashi

## 1. Course Description

In this course, students will learn about the load applied in flight, the arrangement and the function of structural members and the aircraft design mainly focusing on structural design. Students will understand the basic knowledge in aircraft design and will form the basis for deepening their understanding in future specialized fields. Specifically, students estimate the wing loading based on the three views and the specifications, and perform a rough design of spar structure.  
In this course, students will learn about DP1 and DP2.

## 2. Course Objectives

The aim is to understand an overview of the airframe conceptual design as the followings.

- (1) Understand and calculate the characteristics of the wing shape and the meaning of the main parameters
- (2) Estimate the wing load from the airframe configuration and performance
- (3) Estimate the load distribution to be applied to the structural member from the wing load
- (4) Understand the process of designing the structural members

## 3. Grading Policy

In this course, the task will be divided into five parts. Evaluation of the grade will be based on the achievement.

Students will be given the feedback on the content of the submission each time. The tasks are related to each other. It is necessary to make sure when completing each time.

## 4. Textbook and Reference

Textbook

There is no specific textbook. The necessary materials will be distributed for each lecture.

Reference

T. Torigai, S. Kuse Structural design of an airplane,  
ISBN 978-4930858771 Japan Aviation Technology Association  
K. Rinoie Aircraft Design Law&quot,  
ISBN 978-4339046199 Corona

## 5. Requirements(Assignments)

General knowledge of the aircraft will be needed for each lecture. It is recommended to take Introduction to Aeronautical Engineering (in the second semester) before taking this course. Tasks are in series, and each task will take time for checking or presentation. Please keep in mind that non-submission of tasks will be difficult to complete this class.

## 6. Note

## 7. Schedule

- [1] Aircraft Configuration: Understand the relationship between aircraft design and development in the history.
- [2] Process of aircraft design: Learn the necessary things while concerning the “flow” of aircraft design.
- [3] Planning of aircraft development: Learn the process from market research to starting development.  
[Task 1] Drawing of three views
- [4] Basics of aerodynamic design: Understand the characteristics of wings, and the basics of wing design such as three-dimensional wings.
- [5] Airframe shape and main specifications: The parameters characterizing the airframe shape are obtained from three views.  
[Task 2] Aircraft Specifications
- [6] Load and structural design: Understand the load applied to the aircraft.
- [7] Fuselage structure (1): Learn the basic fuselage structure.  
[Task 3] Weight estimation and performance (estimated from statistical data)
- [8] Fuselage structure (2): Understand the background of fatigue design, which is an important design point especially for pressurized fuselage.
- [9] Wing structure (1): Learn the basic wing structure and wing-to-body joint method.
- [10] Wing structure (2): Learn about the role and design of ribs, ailerons and flaps.  
[Task 4] Create a structural diagram of the wing. Set the arrangement of the spars and ribs referring to other examples.
- [11] Calculation of wing load: [Task 5] The load applied to the wing is estimated from the primary specifications of the aircraft (weight, speed, load factor, etc.), and the bending moment distribution and shear force distribution applied to the spars are determined.
- [12] Aircraft structural materials: Understand the characteristics of the materials used in aircraft structures.
- [13] Design of spar: [Task 6] Design the spar flange using the conditions set in the previous task.
- [14] Landing gear and control system: Learn about aircraft take-off and landing, the structure of landing gear, and the mechanism of control system.
- [15] Summary: Present each thoughts on the basic wing designed.

