Introduction to Helicopter Engineering

Syllabus Number 2B215

Special Subjects
Elective 2 credit

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1. Course Description

The basic functions of the helicopter are understood in connection with the rotor blade mechanism principle, aerodynamic theory, and flight principle such as hovering. Students will also learn about basic equipment and power system overview, operational issues including noise and flight safety, and mechanisms of abnormal events that occur during operation such as settling with power and loss of tail rotor function.
In this course, you will gain the knowledge necessary to understand the on-site issues related to DP1.

2. Course Objectives

The goal of this lecture is to understand the flight characteristics of a helicopter with a unique shape and system, and to know the various devices that make up the helicopter, based on basic knowledge such as aerodynamics related to aircraft.
(1) Explain basic principles of aerodynamic theory, flight principles, stability, and maneuverability of helicopters
(2) Explain outline of mechanical device for flying
(3) Understand and explain the characteristics of the structure, landing gear, etc. that have a different aspect from the fixed wing aircraft

3. Grading Policy

The result is evaluated based on the regular examination. (100%)
Test results will be returned to each student and the necessary feedback will be given.

4. Textbook and Reference

Textbook
There is no textbooks in particular. Materials will be distributed for each lecture.
Reference
Y. Sato et al. Helicopter (New Aviation Engineering Course) (3rd edition),
ISBN 978-4901215312 Japan Aviation Technology Association
H. Suzuki Illustrated helicopter, ISBN 978-4062573467 Kodansha Blue Backs
A. Tsubota The Latest Knowledge of Helicopters,
ISBN 978-4797353341 Science Eye New Book

5. Requirements(Assignments)

As mentioned in the above, lecture is based on the knowledge of aviation engineering, so it is recommended to take “Introduction to Aeronautical Engineering,” and/or “Introduction to Flight Dynamics.”

6. Note

7. Schedule

[1] Overview of helicopter: Learn about the history of the helicopter, basic system configuration, applications, etc.
[2] Rotor system: Learn about the main rotor mechanism, hinges, hubs, swash plates, etc.
[3] Control system, transmission: understand the mechanism to fly the helicopter
[4] Helicopter dynamics: Learn basic mechanics including aerodynamics to understand helicopter maneuver
[5] Fundamentals of flight theory: Learning about momentum theory and wing element theory, which are the basis of rotor theory
[6] Hovering: Learn about balance of aerodynamic force and attitude control in hovering
[7] Forward flight: Learn about aerodynamics, aircraft balance and blade movement during forward flight
[8] Autorotation: Understand rotor movement and HV diagram during autorotation
[9] Power curves and Flight performance: Learn about power in helicopter flight and key performance related to power curves
[10] Tail rotor: Learn how helicopter tail rotor works
[11] Stability and maneuverability: Learn about helicopter flight stability and maneuverability features
[12] Structure and landing gear: Learn helicopter structure and landing gear characteristics (including differences with fixed wing aircraft)
[13] Engines and power systems: Learn about the features of engines used in helicopters and the outline of power systems
[14] Vibration and noise: Understand the causes of vibration of the helicopter, braking devices, and efforts to reduce noise
[15] Summary and exams: Summarize the entire lecture and deepen understanding of the helicopter