Summary
This course will provide the fluid dynamic background to understand how air flows around two- and three-dimensional wings and bodies and to understand the aerodynamics forces and moments acting on the objects as a result of the air flow.

Content
INTRODUCTION:
- Basic concepts
- Definitions
- Fundamental equations
STEADY INCOMPRESSIBLE FLOW PAST WINGS AND BODIES
- Potential flow
- Infinite wing theory
- Finite wing theory
UNSTEADY AERODYNAMICS
- Flapping wing flight
- Rotary wing air vehicles and wind turbines
APPLIED AERODYNAMICS
- Flow control
- Wing design

Keywords
airfoil, lift, drag, unsteady aerodynamics, flow separation, flow control

Learning Prerequisites
Recommended courses

• Incompressible fluid mechanics
• Fluid flow
• Hydrodynamics

Learning Outcomes
By the end of the course, the student must be able to:
• Describe the physical behaviour of a flow in scientific terms, AH1
• Link flow behaviour with non-dimensional parameters (e.g. Reynolds and Mach numbers), AH2
• Describe the physical differences between laminar and turbulent flows, AH4
• Describe in detail the physical phenomena associated with the interaction of a flow with a solid wall (as a function of its characteristics, e.g. roughness), AH5
• Describe flow in simple geometries, such as over a flat plate, in a tube, or around a sphere or airfoil, AH9
• Work out / Determine the flight characteristics from a wing shape and chose a wing shape to provide the desired flight characteristics, AH10
• Describe 3D effects resulting, for example, from a finite wing span or behind a blunt body, AH11
• Solve analytically or numerically the potential flow around an airfoil, AH19

Teaching methods
Lectures, written exercises

Assessment methods
Written examination

Supervision
Office hours Yes
Assistants Yes

Resources

Bibliography
• An Introduction to Flapping Wing Aerodynamics. Wei Shyy. Cambridge aerospace series, April 2013.

Ressources en bibliothèque
• Low-speed aerodynamics / Katz, Plotkin
• Fundamentals of Aerodynamics / Anderson
• Aerodynamics for engineering students / Houghton
• Fundamentals of modern unsteady aerodynamics / Gulçat
• Theory of wing sections / Abbott, von Doenhoff
• Aerodynamics of wind turbines
• An Introduction to Flapping Wing Aerodynamics / Shyy