

SYLLABUS

Aerodynamics 7.5 credits

F0037T

Aerodynamik

Course syllabus admitted: Autumn 2024 Sp 1 - Present

DECISION DATE
2024-02-15

Aerodynamics 7.5 credits F0037T

Aerodynamik

First cycle, F0037T

Education level	Grade scale	Subject	Subject group (SCB)
First cycle	G U 3 4 5	Strömninglära	Engineering Physics

Entry requirements

In order to meet the general entry requirements for first cycle studies you must have successfully completed upper secondary education and documented skills in English language and F0004T Physics 1, F0030T Continuum mechanics and Vector calculus as in M0032M Functions of several variables and computer tools. Or F0031T Hydromechanics and Vector calculus as in Mathematics M M0013M or equivalent. Good knowledge in English, equivalent to English 6.

Selection

The selection is based on 1-165 credits.

Course Aim

After the course the student should be able to

Knowledge and understanding

- Describe normal and oblique shock waves and 1D compressible flow in nozzles and diffusers.
- Explain the origin of drag and lift forces on different aerodynamic bodies

Skills and Abilities

- Apply suitable mathematical methods for a given aerodynamic problem in two dimensions.
- Apply compressible fluid flow equations to calculate properties of normal and oblique shock waves and the quasi-one-dimensional flow in nozzles and diffusers.
- Use commercial CFD software for aerodynamic calculations.
- Conduct aerodynamic experiments in a wind tunnel.

Evaluation and approach

- Explain limitations in analytical models of aerodynamic problems and determine when numerical methods or measurements need to be used.
- Critically review the results of simulations of aerodynamic problems, interpret the results, and compare results from different turbulence models.

Contents

Inviscid and incompressible fluid flow

Here the basic equations of inviscid and incompressible fluid flow are described.

Potential flow

The theory of potential fluid flow is presented and applied to some simple fluid flow configurations.

Airfoils

Potential flow is applied for the calculation of lift and moment distributions on airfoils.

Three-dimensional wing effects

Three-dimensional flow effects that are not present in the flow around airfoils are studied. Particularly the so called induced drag.

Inviscid and compressible flow

The basic equations of compressible fluid flow are presented. The equations are applied to normal and oblique shock waves and quasi-one-dimensional fluid flow in nozzles and diffusers.

Experimental work

Measurements of pressure and velocity are carried out in wind and water tunnels, as well as in a Laval nozzle using pressure transducers and particle image velocimetry.

Numerical work

Comsol multiphysics is used to study incompressible and compressible flow for some different aerodynamic flow cases.

Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

The course includes lectures, computer exercises and practical laboratory work. The student will be assigned four mandatory assignments during the course. The assignments will include theoretical, computational and experimental work, as well as an oral assessment. A mandatory water tunnel laboratory exercise which is independent of the assignments is also a part of the course.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. The learning objectives are examined through the mandatory assignments with the grades U G 3 4 5. The water tunnel laboratory work is mandatory and a lab report should be handed in.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Overlap

The course F0037T is equal to MTM174

Course offered by

Department of Engineering Sciences and Mathematics

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0004	Laboratory work	U G#	1.4	Mandatory	A14	
0007	Written and oral assignments	G U 3 4 5	6.1	Mandatory	A24	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Nils Almqvist, Head of Undergraduate Education 2024-02-15

Syllabus established

The syllabus was established by the Department of Applied Physics and Mechanical Engineering 2007-02-28, and remains valid from autumn 2007.