MJ2524 Aircraft Propulsion, Advanced Course 6.0 credits

Flygmotorteknik, fortsättningskurs

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

On 15/10/2021, the Dean of the ITM School has decided to establish this official course syllabus to apply from autumn term 2022 (registration number M-2021-2028).

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

MJ1112 Applied Thermodynamics, SG1220 Fluid Mechanics for Engineers and MJ2523 Aircraft Propulsion, General Course, or equivalent

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student should be able to:

1. Explain stationary 2D and 3D flow phenomena for turbomachinery components
2. Carry out aerodynamic 3D design of fan blades for turbofan engines
3. Explain fluid structure interaction in turbomachines
4. Describe non-stationary flow phenomena in turbomachines
5. Solve problems regarding aeromechanics for turbomachinery blades
6. Describe heat transfer for warm components, material aspects, combustion chamber principles and operational characteristics for thermal turbomachines
7. Carry out measurements and analyse the transient vane loads in an oscillating cascade
8. Discuss possible paths to reach the placed emission targets based on the current research

Course contents

The course is a continuation of MJ2523 Aircraft Propulsion, General Course and therefore starts at an advanced level. As the nucleus of contemporary aircraft engines consists of gas turbines, considerable focus is placed on understanding of complex aerodynamics in thermal turbomachines, and how engine components are designed to meet the requirements that are set on efficiency, reliability and safety.

The course starts with an introduction to calculus in one variable of flow inside engine, which is later widened to aspects of 2D and 3D analysis. Important aspects such as cooling in combustion turbines, mechanical effects, material and the properties of the system are highlighted in the course and introduced in relevant contexts. Aero-mechanical interplay between the flow and sub-components in aircraft engines and the aero-elastic phenomena that arise are studied thoroughly in the course.

Special focus is placed on discussion of aerodynamic design of vanes for turbofan engines, as these produce the majority of thrust in propulsion of passenger aircraft.

The needs of today and tomorrow for aircraft engines, and future trends and research approaches are discussed, in particular considering the defined targets towards fossil free air transportation. The different propulsion principles are analysed in view of their environmental impact, both from a noise and from an emission perspective.

Critical review of scientific articles will be carried out in the course to trigger discussions in an interdisciplinary environment. Calculation exercises will be performed to deepen the understanding of treated phenomena.

Examination

- LAB1 - Laboratory work, 1.0 credits, grading scale: P, F

- TEN1 - Written exam, 5.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.