MJ2244 Airbreathing Propulsion, Intermediate Course I 6.0 credits

Flygmotorteknik, fortsättningskurs I

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

Establishment

On 2019-10-15, the Dean of the ITM School has decided to establish this official course syllabus to apply from spring term 2020 (registration number M-2019-1353).

Grading scale

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

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

MJ1112 "Applied thermodynamics" 9 credits, SG1220 "Fluid Mechanics for Engineers" 6 credits and MJ2241 "Jet Propulsion Engines, General Course" 6 credits, or the equivalent

Language of instruction

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

Intended learning outcomes

The course intends to give an overview of important aspects in the thermal turbomachines with a focus on applications in the air transport sector and in the energy sector

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 turbo fan engines

3. Explain the fluid-structural interaction in thermal turbomachines

4. Describe the non-stationary flow phenomena in turbomachines

5. Solve problems regarding aeromechanics for turbo machinery 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

Course contents

The course is a continuation of MJ2241 Jet Propulsion Engines, General Course and therefore starts at an advanced level. As the nucleus of present-day aircraft engines consists of gas turbines, the course is to a large extent coordinated with the course MJ2430 Thermal turbomachinery. Propulsion of modern aircraft would not be possible without thermal turbomachines that are characterised by unrivalled power density.

The course starts with an introduction of simple calculus of one variable and turbomachine components and then the level of the course is extended to 2D and 3D analysis aspects. 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.

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.

Critical review of scientific articles will be carried out within the frame of the course to stimulate to discussions in an interdisciplinary environment. Practical assignments will be given to deepen the student's understanding of the phenomena treated in the course. A study visit to a gas turbine manufacturer or a relevant company is planned.

The course is given in English

Note: The course may not be chosen, if one follows or has taken the course MJ2430 Thermal turbomachinery.

Examination

- TEN1 - Written exam, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, 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.

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

Quizzes (non-mandatory) are given weekly and a minimum of 75% correct answers give bonus points at TEN1 if the grade awarded is E or higher. Furthermore, if at least 75% correct answers are given in the six first of a total of seven quizzes, the grade E is awarded for intended learning outcomes #4 and #6 and thus the problems corresponding to these ILOs at the examination, can be skipped.

Obsolete examination items will be assessed using supplementary tasks or complementary assignments during three years of time after the last course offering. Thereafter, the examination items according to the current official course syllabus, must be carried out.

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.