MJ2429 Turbomachinery 6.0 credits

Strömningsmaskiner

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

Course syllabus for MJ2429 valid from Autumn 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Language of instruction

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

Intended learning outcomes

After completing the course with a passing grade the student should be able to:

1. Explain and describe work principles for typical turbomachines, both the incompressibly working (water turbines, pumps) and compressibly working (turbines, compressors)

2. Solve problems, including deciding velocity triangles and solve problems for turbo machinery stages working in design or off-design mode, based on medium section analysis

3. Match a pump to a system and application of the affinity laws to create off-design properties

4. Apply design parameters for characterisation of turbomachinery stages and describe relations to thermodynamics, kinematics and performance for the stage

5. Describe the role of turbomachines in current and future sustainable energy system

Course contents

The course intends to give an overview of different types of turbomachines for energy transformation such as pumps, fans, compressors, water turbines, steam turbines and combustion turbines, both with respect to transformation to power and for cooling and indoor climate.

Almost 100% of the electricity in the world is produced in a process where turbomachines are an integral part. Turbomachines are in an abundance of products that are used in our daily life (pumps in refrigerators, fans in computers/cars, etc). Turbomachines are used to a very large extent in the propulsion of transportation (jet engines and propellers for aircraft, turbo chargers in cars). The relevant aerodynamic and thermodynamic concepts for each type of turbo machine are introduced and discussed in detail. The need of the day and the future of, and use of turbomachines are discussed and their future development trends are clarified in a general way. Details with respect to the structure of turbomachines are sketched. Calculation exercises to understand the physical context between the aerodynamics and the thermodynamics in the machine are done. The course is the basis for a more advanced course in turbomachine technology, that includes detailed studies, calculation methods and experimental methods for thermal turbomachines.

Disposition

The course is divided into an incompressible part that is assessed through TENA and partly with LAB1, and a compressible part that is assessed through TENB and partly with LAB1.

The course is given in English

If a low number of students are admitted to the course, it can be given in modified form, i.e. mainly as self-studies with guidance when necessary.

Specific prerequisites

MJ1112 Applied Thermodynamics, 9 credits or the equivalent +
MJ1401 Heat Transfer, 6 credits or the equivalent +
Fluid Mechanics, 6 credits or the equivalent, or a combination of these totalling at least 15 credits

Course literature

Vogt, D., 2005, “Lecture Notes in Turbomachinery”, Collection of short pdf documents, KTH, Heat and Power Technology

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Fransson, T. H. et. al. 2001, CompEduHPT: Computerized Educational Heat&Power Technology Program. HPT/KTH Stockholm, Sweden

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Valda artiklar

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Kompletterande litteratur (ej obligatorisk):

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Dixon, S.L., 1998

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"Fluid Mechanics and Thermodynamics of Turbomachinery" Fourth edition, Butterworth-Heinemann, Woburn, MA, USA, 1998 ISBN 0-7506-7059-2

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F
- TENA - Written exam, 2.0 credits, grading scale: A, B, C, D, E, FX, F
- TENB - Written exam, 2.5 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.

Quizzes (non-mandatory) are given weekly and a minimum of 75% right answers give bonus point to TENA or TENB if the grades awarded are E or higher.

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.

Other requirements for final grade

Examination (TEN1; 4.5 credits); laboratory exercises (LAB1; 1.5 credits).

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.