FMJ3390 Heat Pumps Technology 7.5 credits

Värmepumpsteknik

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 FMJ3390 valid from Autumn 2021

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Admitted to PhD studies
and have completed a undergraduate course in Thermodynamics.

Language of instruction

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

Intended learning outcomes

After the course the students should be able to:

- Describe the principles of heat pumping technologies and identify the main differences between the various system solutions in different applications.
- Using the main calculation tools, solve and analyze problems within the area of heat pumping technologies.
- Identify the sustainability factors attached to the use of heat pumping technologies in various energy systems.
- Describe some of the latest advances in heat pumping technologies in selected applications. Justify their implementation and compare them to traditional technologies.
- Specify opportunities of using heat-pumping systems in relation to your own research work. If already used suggest improvements to be implemented in future advanced systems.

Course contents

Heat pumping technologies exist in various application areas in our daily life covering many of our heating and cooling needs, such as air conditioning, heating, and refrigeration. The technology is considered as the most efficient, reliable, and cost effective in many application areas, this is why it is one of the most wide spread equipment on our planet, about 20 million households purchased heat pumps in 2019 according to International Energy Agency (IEA) statistic. There are many reasons why we should expect even greater increase in heat pumping technologies sales in the future, some of these reasons are: the need for efficient heating to replace conventional systems, urbanization, and increased living standards.

The expected greater role of heat pumping technologies in our future energy systems poses questions on sustainability; hence, more efficient systems that use environmentally friendly working fluids (i.e. refrigerants) will be needed. Additionally, new application areas, such as integrated energy systems, require heat pumps to operate in new system boundaries with new control strategies.

This course aims at providing deep understanding of refrigeration and heat pumping technologies in different application areas. A wide range of systems will be dealt with where technical, economic, and environmental aspects will be discussed as part of the sustainability.

The course will also introduce the students to certain chosen topics on the research front within the area of refrigeration and heat pump technologies. What are the key challenges for the heat pumping technologies in the future? and how to address them? What are the new application areas?

Examination

- PRO1 - Project, 2.5 credits, grading scale: P, F
- SEM1 - Seminars, 5.0 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.

Other requirements for final grade

Active participation in at least 80% of the seminars in the course. Active participation means that the student will have to either present or be engaged in asking critical questions on the topic.

Present the personal project and successfully respond to the questions.

Approved final report.

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.