UNIVERSITY OF BORÅS

Heat transfer in thermal applications
Värmeöverföring i termiska tillämpningar

7.5 credits
7.5 högskolepoäng

Ladok Code: A525TA
Version: 1.0
Established by: Committee for Education in Technology 2021-09-03
Valid from: Autumn 2021

Education Cycle: Second cycle
Main Field of Study (Progressive Specialisation): Energy Technology (A1F)
Disciplinary Domain: Technology
Prerequisites: Meets the requirements for admission to the Master Programme Resource Recovery — Sustainable Energy Technological Processes
Subject Area: Energy Technology
Grading Scale: Seven-degree grading scale (A-F)

Content

Thermal applications involve energy moving from one material to another. This can mean the release of binding energy in combustion and the formation of hot exhaust gases. These hot exhaust gases can then be made use of by, for example, forming superheated steam through heat exchange. This course is focused on heat transfer in combustion and includes conduction, convection, and radiation. Heat transfer by conduction is dependent on the material. Therefore inorganic coatings on heat exchanger surfaces are also included in this course, along with their possible impact through corrosion. Erosion is also discussed as it affects heat exchanger surfaces. Convection is dependent on external flow conditions which means that part of the course deals with impulse transfer to be able to calculate different flow fields. In addition to this, there is an introduction to numerical computation of differential equations and a computer-based computational program is used to be able to use different geometries.

Learning Outcomes

After completing the course, the student will be able to:

Knowledge and understanding
1.1 describe the driving forces of different kinds of heat transfer;
1.2 explain the flow around different objects and the appearance of boundary layers,
1.3 account for the basics of numerical calculations for differential equations,
1.4 account for how heat transfer is dependent on conditions in the various parts of an incinerator,
1.5 explain why phenomena such as impact and sintering occur,
1.6 describe the basics of oxide formation on metal components of incinerators,
1.7 explain different types of high-temperature corrosion -- why they appear and how they are countered,
1.8 explain why corrosion and erosion problems arise in thermal processes,
1.9 describe how corrosion and erosion mechanisms affect thermal processes.

Skills and abilities
2.1 implement heat balances in one or more dimensions for both stationary and dynamic systems,
2.2 calculate coupled heat transfer processes involving conduction, convection, and radiation;
2.3 apply a computer program to make calculations regarding coupled transfer processes,
2.4 calculate the composition of inorganic material coatings on heat exchanger surfaces and be able to determine when there is a risk of corrosion.

Evaluation ability and approach
3.1 determine whether the design of heat exchanger surfaces works for selected fuels and methods of combustion.

Forms of Teaching

Teaching takes the form of lectures, exercises, written assignments, as well as seminars. Teaching is conducted in English.

The language of instruction is English.

Forms of Examination

The course is examined through the following components:

- Examination
  Learning outcomes: 1.1-1.9, 2.1
  Credits: 4.5
  Grading scale: Seven-point grading scale (A-F)
- Seminar
  Learning outcomes: 1.1, 3.1
  Credits 1.0
  Grading scale: Fail or Pass
- Written assignments
  Learning Goals: 2.1-2.4
  Credits 2.0
  Grading scale: Fail or Pass

  The grade on the examination governs the grade on the entire course, which is issued only when all of the course components are
  completed and passed.

  If the student has received a decision/recommendation regarding special pedagogical support from the University of Borås due to disability or special needs, the examiner has the right to make accommodations when it comes to examination. The examiner must, based on the objectives of the course syllabus, determine whether the examination can be adapted in accordance with the decision/recommendation.

Student rights and obligations at examination are in accordance with guidelines and rules for
the University of Borås.

Literature and Other Teaching Materials

Student Influence and Evaluation

The course is evaluated in accordance with current guidelines for course evaluations at the University of Borås in which students' views are to be gathered. The course evaluation report is published and returned to participating and prospective students in accordance with the above-mentioned guidelines, and will be taken into consideration in the future development of courses and education programmes. Course coordinators are responsible for ensuring that the evaluations are conducted as described above.

Miscellaneous

The course is primarily a programme course and is part of the Master's Programme Resource Recovery — Sustainable Technological Energy Processes. This syllabus is a translation from the Swedish original.