

Course syllabus

Livsmedelsteknik I - Värmelära Food Technology I - Heat and Heat Transfer

YTHA30, 7,5 credits, G1 (First Cycle)

Valid for: 2015/16

Decided by: Education Board C

Date of Decision: 2015-04-20

General Information

Compulsory for: YL1

Language of instruction: The course will be given in Swedish

Aim

The aims of the course are to provide students with a deeper understanding of how various heating and cooling processes work based on principles of heat transfer, and to provide insight with respect to how these processes affect food quality. In addition, the course aims to give students practical knowledge in how to carry out temperature measurements in a correct manner in food material and processing equipment.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be able to explain different methods and equipments to measure temperature in food, air and on surfaces and their effects on accuracy and replication
- be able to describe and explain the different modes of heat transfer to the surfaces of food items and the different heat transfer mechanisms taking place in solid and liquid foods.
- be able to explain what is occurring with respect to energy content when food products undergo a phase change (for

example during freezing, thawing or evaporating), and describe how this latent heat can be utilized (both positively and negatively) in the context of food processing.

- be able to describe common methods and equipment for heating and cooling and their effects on food material properties.

Competences and skills

For a passing grade the student must

- be able to measure temperature using different types of measurement equipment as well as estimate the degree error on obtained values.
- be able to carry out a calibration of temperature sensors.
- be able to calculate the change in energy content of food during heating and cooling, as well as considering how the food's composition affects the energy content.
- be able to calculate required power for cooling, freezing, and heating equipment.
- be able to use a Mollier diagram to determine the relative humidity of air, wet bulb temperature and dew point.

Contents

Almost all forms of food preparation involve heating in some manner. The opposite of heating is cooling, which also is a very important process in the manufacturing of food products. These processes often include phase changes such as freezing, thawing, evaporating/concentrating, and the melting of fats. In particular it is the phase changes of water that is interesting from an energy utilization perspective.

This course deals with processes in which heat is transferred to; or removed from food. The course considers the different conduct methods of heat transfer to the surfaces of food, how it is transported in the food itself, and how the quality of the food is affected as a result. The following heating and cooling processes will be presented and explained: boiling, roasting/frying, microwave heating, deep-frying, cooling, and freezing. The course will result in the student being able to calculate how much energy is converted/ transported during these processes in order to choose equipment of appropriate capacity.

Examination details

Grading scale: UG

Assessment: Written examination in heat transfer; (theoretical and numerical), laboratory exercises, assignment and project report.

Parts

Code: 0115. **Name:** Written Examination: Calculation.

Credits: 2,5. **Grading scale:** UG. **Assessment:** written exam

Code: 0215. **Name:** Laboratory Experiments.

Credits: 0. **Grading scale:** UG. **Assessment:** all laboratory experiments

Code: 0315. **Name:** Written Report.

Credits: 1,5. **Grading scale:** UG. **Assessment:** written report

Code: 0415. **Name:** Written Task.

Credits: 1. **Grading scale:** UG. **Assessment:** assignment

Code: 0515. **Name:** Written Examination: Theory.

Credits: 2,5. **Grading scale:** UG. **Assessment:** written exam

Admission

The number of participants is limited to: No

Reading list

- Books.
- Nylander, A et all.: Livsmedelsvetenskap. Studentlitteratur, 2014, ISBN: 978-91-44-09567-7. Nylander A et all. Livsmedelsvetenskap, 2014, Studentlitteratur.
- Per Uno Ekholm, Lars Fraenkel, Sven Hörbeck : Formler & tabeller i fysik, matematik & kemi för gymnasieskolan. Konvergenta HB, 2013, ISBN: 9789197370882. Ekholm et all. Formelr & tabeller i fysik, matematik 6 kemi för gymnasieskolan, 2013, Konvergenta.
- Compendium in heat science and cold technology is possible to buy in the start of the course.
- Additional literature.
- O Andersen, Risum, Livsmedelsteknologi del 1. Lund1991: Studentlitteratur.
- From library or antiquarian.
- O Hans-Uno Bengtsson, Jan Boris Möller. Koka soppa på fysik. Boströms 1997.
- O Hans-Uno Bengtsson. Fysik för fakirer. Gleerups 1993.
- O Dahlgren Ö. Laga mat. Liber utbildning 1994, nytryck 2006.

Contact and other information

Course coordinator: Charlott Håkansson,
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Course homepage: <http://www.food.lth.se>

Further information: Attendance during field trips and guest lectures is mandatory. In the event students cannot attend (for a valid reason) an extra assignment with equivalent content may be substituted.