



# MJ2420 Combustion Theory 6.0 credits

## Förbränningslära

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 MJ2420 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:

ILO 1: Formulate theories, definitions and concepts for combustion and carry out a theoretical evaluation of combustion performance

ILO2: Apply theoretical models for performance calculations adapted to units such as boilers, furnaces, combustion engines and combustion turbines

ILO3: Evaluate and design appropriate combustion-technical solutions for real problems by applying analytical methods and present written solution proposals

## Course contents

The aim of the course is in-depth knowledge in combustion. The course includes analytical methods for evaluation of applications with combustion i.e. knowledge of how theories and analytical models can be applied for evaluation of real technical components such as boilers, furnaces, combustion engines and combustion turbines. Theories that are treated deal with mass transfer, chemical equilibrium, chemical kinetics and flame technical properties from basic combustion theories to simplified models for combustion of gases, liquids and solids. Applications are examined through detailed analysis of combustion concepts adapted to practical combustion devices.

## Disposition

Lectures are divided into three modules.

Module 1 (9 subareas and 13 lectures): Basic theories of combustion and calculations related to basic/simplified situations. Subareas that are included by this module are; basic combustion, reactions, chemical equilibrium, chemical kinetics, mass transfer, combustion in laminar and turbulent flames, the bases of liquid and fuel combustion.

Module 2 (4 lectures): focus on practical designs and operating conditions for combustion in combustion devices such as furnaces, boilers, combustion turbines and engines. Strong emphasis is placed on forming of pollution, technologies to prevent emissions as well as cleaning methods related to these applications. Invited visiting lecturers contribute with expertise from world-leading sectors in the combustion area.

Module 3 (2 lectures) introduces development and research related to combustion. Here is included e.g. catalytic combustion (CatCom) and high temperature combustion (HiTAC), but this will be updated as the development progresses.

### Laboratory exercise

Here, measurements on combustion are carried out with laminar and turbulent flames, to characterise the flame and its stability. The work should be documented in a laboratory report that is made in groups. The report should contain a clear description of the laboratory activities, its intended learning outcomes, analysis of results and conclusions. Participation in the lab and submission of the report are compulsory.

## Specific prerequisites

The courses MJ1112 Applied thermodynamics and MJ1401 Heat Transfer, or the equivalent

Knowledge of thermal processes for electricity production is recommended, e.g. via the courses such as Sustainable Power Generation (MJ2405) and Applied Heat and Power Technology (MJ 2426).

## Course literature

Turns, S. R. 1996. An Introduction to Combustion. McGraw-Hill, Singapore. ISBN 0-07-0655316.

## Examination

- INLA - Hand in assignment, 1.0 credits, grading scale: P, F
- INLB - Hand in assignment, 1.0 credits, grading scale: P, F
- LABA - Laboratory work, 1.0 credits, grading scale: P, F
- TENA - Written exam, 3.0 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.

## Other requirements for final grade

Passed all items (INLA, INLB, LABA, TENA) included in the course. The final grade for the whole course is decided by the examination grade TENA (A-F)

## 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.