Faculty of Science

FYSD31, Physics: Fundamental Combustion, 7.5 credits

Fysik: Grundläggande förbränning, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2025-04-22. The syllabus comes into effect 2025-04-22 and is valid from the spring semester 2026.

General information

The course is an elective course at the basic level for a scientific candidate or Master's degree (120 credits) in physics.

Language of instruction: English

Main field of study	*Specialisation*
Physics	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is to provide a fundamental understanding for the physical processes in combustion. Important areas are thermodynamics, chemical kinetics, radiation, transport processes. From this basic understanding, combustion phenomena and systems can be analysed such as autoignition, flame propagation, extinction, and pollutant formation. Improved understanding of combustion processes is highly important to improve efficiency and decrease harmful emissions, which is of global importance since most of the energy usage in the world can be related to combustion processes.

Knowledge and understanding

On completion of the course, the student should be able to

- describe how the concepts thermodynamics, chemical kinetics, radiation and transport processes are used to explain different properties of combustion processes

- describe the physical processes that take place in basic and practical combustion systems.

Competence and skills

On completion of the course, the student should be able to

- analyse a combustion process regarding efficiency and contaminants.
- calculate parameters as temperature and species concentration from thermodynamic data about a combustion process.
- write well structured laboratory reports with analysis of measurement data and discussion of sources of errors.
- summarise a project within the combustion area in writing and present it orally.

On completion of the course, the student should be able to

understand the essential information in an advanced English textbook.

solve assignments that require use of information from other sources than the course material for example via Internet and other available sources.

Judgement and approach

On completion of the course, the student should be able to

- give an account of the essential information in an advanced textbook in English within the subject
- solve assignments that require use of information from other sources than the course material for example via Internet and other available sources.

Course content

The course covers

- Thermochemistry
- Chemical equilibrium
- Adiabatic flame temperature
- Chemical kinetics
- Ignition processes
- Combustion Physics
- Premixed and Diffusion flames
- Turbulent combustion
- Emissions
- Combustion diagnostics
- Practical combustion systems

Course design

The teaching consists of lectures and exercises. Furthermore, a laboratory session and a written assignment are included, both of which are mandatory.

Assessment

Examination takes place throughout the course in the form of a written assignment and a laboratory report. At the end of the course, assessment includes a project presented both orally and in writing, as well as a written exam.

For students who do not pass the regular examination, an additional examination is offered in close proximity.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
To pass the course, students must achieve a passing grade on the written exam, laboratory report, assignment, and project, as well as participate in all mandatory components.

The grading scale for the laboratory report, assignment, and project is Fail or Pass, while the written exam is graded on a scale of Fail, Pass, and Pass with Distinction.

The final grade is determined by the exam grade. Well-executed assignment and project provide additional points on the regular exam.

Entry requirements

Admission to the course requires 45 credits in physics and 45 credits in mathematics, alternatively a bachelor's degree in physics or equivalent, in both cases including knowledge equivalent to FYSB24 Physics: Atomic and Molecular Physics, 7.5 credits. English 6/B and general entry requirements.

Further information

The course replaces FYSD11, Physics: Fundamental Combustion, 7.5 credits, and cannot be included in a degree together with it.

The course is fully co-taught with FBRF01, Fundamental Combustion, 7.5 credits, which is a course at Lund University Faculty of Engineering (LTH).

The course examination is scheduled in accordance with LTH's examination schedule.

The course is offered at the department of physics, Lund University.