LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Avancerade förbränningsmotorkoncept
Advanced Combustion Engine Concepts

MVKN55, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED M
Date of Decision: 2023-04-11

General Information

Elective for: M4-tt, MHET2
Language of instruction: The course will be given in English on demand

Aim

The objectives of the course are, 1) starting from the introductory course on internal combustion engines (ICEs), to provide an in-depth treatment of the ICE state of the art, and then, 2) on the basis of the current challenges for ICEs, to present ways to improve ICEs, including advanced concepts and alternatives; and 3) to provide the tools for investigating them.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to explain the design of advanced Otto and Diesel type engines and how to assess their strengths and weaknesses
- be able to explain the reasoning behind alternative engine concepts, and the challenges to overcome for them to make it to the market.

Competences and skills
For a passing grade the student must

- be able to use commercial computer software for gas exchange simulation of combustion engines

- be able to perform heat release analysis based on cylinder pressure data
- be able to, group wise with supervision, conduct measurement of cylinder pressure as function of crank angle on a laboratory combustion engine

Judgement and approach
For a passing grade the student must

- be able to assess an alternative engine design or control, for its strengths and weaknesses.

Contents

The course starts from the challenges facing current internal combustion engines. The historical development of engines is reviewed to better understand the reasons for current engine designs. Then, the state of the art is explained in more detail relative to the introductory course on ICEs, and expanded: the compression ignition engine combustion process is presented both with the classical model and the newer Dec model; and gas exchange processes are treated. Next, experimental and numerical tools are reviewed for investigating the processes occurring in engines, which are used in studying and improving engine designs. Advanced engine concepts are then discussed, with their merits and challenges. This includes advanced engine controls. Finally, an outlook is given as to where continued research and development of engines and fuels can lead, and how the combustion engine can be part of a sustainable future.

Engine combustion will be analyzed in laboratory exercises. Simulation exercises will also be conducted with the purpose of making the students identify the engine's response to changes to its components and settings as well as running engines virtually.

Optionally, a guest lecture will be given by an expert from industry.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written examination. The final grade is either Fail or one of the passing grades 3, 4 or 5 which correspond to 50, 65 and 80% of the maximum number of points respectively. Additionally, approved reports of the mandatory laboratory exercises are necessary to pass the course.

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.

Admission

Assumed prior knowledge: MVKN50 Introduction to Combustion Engines or MVKN51 Energy Converters for Sustainable Transport
The number of participants is limited to: No

The course overlaps following course/s: MVK106

Contact and other information

Course coordinator: Per Tunestål, per.tunestal@energy.lth.se
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