



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

El- och elhybridfordonsteknik

Electric and Electric Hybrid Vehicle Technology

EIEN41, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED E

Date of Decision: 2023-04-11

General Information

Elective for: E4-em, F4, F4-es, M5-tt, MD4, W5-et, MHET2

Language of instruction: The course will be given in English on demand

Aim

There is a large and growing need in the automotive industry for engineers with specialisation in electrical drives, power electronics and not least system aspects of electric vehicle control. This course has the ambition to give fundamental knowledge and skills in these areas.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- have good general knowledge of the design of a hybrid vehicle and the characteristics of the most important components of it,
- have good general knowledge of the composition of the drive line and the control of the energy flow in hybrid vehicle drive systems.,
- have good general knowledge of the energy supply system for a totally electrified transport system.

Competences and skills

For a passing grade the student must

- have developed the ability of choosing the most suitable drive line for a hybrid or electric vehicle for a certain range of application and of creating control strategies for it,
- have developed the ability of judging various solutions for drive systems and loading in relation to the energy supply system.

Judgement and approach

For a passing grade the student must

- have gained the self confidence to be able to model and analyze a electric vehicle drive and load systems.

Contents

Drive and auxiliary drive. Power, torque and speed. Combustion processes - Otto, Diesel, HCCI among others. Gear - manual, automatic, CVT among others. Efficiency and emissions. Fossil fuel, bio fuel - access, cost and performance. EV, HEV - series, parallel, mild, power split, FCV. Conventional servo steering, AC, brake, compressed air and so on. Electrically driven alternatives, function, efficiency. Demands for electric machines and power electronics in vehicles. Criteria for dimensioning. Lifetime, weight, price and so on. Field reduction, starting characteristics, torque ripple and so on. Various types of control, need for sensors. Fuel cells - principle, function and construction. Advantages and drawbacks with various designs. Development trends. Electric storage media - eg batteries and super capacitors.

Drive cycles, efficiency, and emission for some selected drive lines. Acceleration, start and other demands for the vehicle. Regenerative braking. The need for effect and energy storage in hybrid and FC vehicles.

The course includes 28h lectures, 6h computer exercises and self study supported by internet course material, in total 200h.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Passed simulation assignments give the grade of 3. For higher grades, an approved written exam is required.

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.

Parts

Code: 0118. **Name:** Simulation Assignments.

Credits: 7,5. **Grading scale:** UG. **Contents:** Simulation assignments

Code: 0218. **Name:** Written Exam.

Credits: 0. **Grading scale:** TH. **Contents:** Written exam

Admission

Assumed prior knowledge: Basic course in physics including mechanics.

The number of participants is limited to: No

The course overlaps following course/s: MIE100, EIEN40

Reading list

- Compendium in Electric and Electric Hybrid Vehicle Technology, IEA/LTH 2022.

Contact and other information

Course coordinator: Professor Mats Alaküla, mats.alakula@iea.lth.se

Course homepage: <https://www.lth.se/iea/utbildning/valfria-kurser-i-lund/el-och-elhybridfordonsteknik/>