

DIM-OPT-433 Automotive Engines

SEMESTER: Spring
CREDITS: 3 ECTS (2 hrs. per week)
LANGUAGE: English
DEGREES: IEM

Course overview

This course is an introduction to the main systems and components of an internal reciprocating combustion engine (ICE). The course focuses on the modelling the behavior of an ICE from their stationary curves obtained at test bench which entails to obtain the vehicle performance with a given engine. Engine emissions are also studied. The course also covers new powertrain as hybrid and electric vehicles.

Prerequisites

There are not any prerequisites needed to study the subject. However basic thermodynamic knowledge will be a good asset. For instance: properties estimation, energy balance, compressible flow, flow resistance, hydraulic circuits, heat transfer laws, heat exchangers.

Course contents

1. Basic engine design. Main components and systems. Key systems (cooling, lubricating). Engine glossary.
2. Basic Thermodynamics. Otto, Diesel and Atkinson cycles. Review of the classic P-V cycles. From ideal to reality. Basic ratios.
3. Engine performance. Modeling and prediction. Engine performance curves from fuel and air input. Simple engine model and simulations.
4. Link between ground and engines. Aerodynamic drag. Grading resistance. Rolling resistance. Vehicle performance predictions: maximum speed, acceleration, fuel consumption in a driving cycle.
5. Exhaust emissions (tail pipe). How pollutants are created. How to prevent or reduce. Greenhouse effect. Acid Rain.
6. Hybrid vehicles. Classification: Series, Parallel, Complex. Vehicles for the future: From micro hybrids to plug-in. Different architecture study: Petrol, diesel, hydraulic.

7. Electric vehicles. Current state of the art. Main components and technologies. Range prediction & calculation. Market solutions and today vehicles availability.

Textbook

- J.B. Heywood. Internal Combustion Engines Fundamentals. Mc Graw-Hill, 1988.

Grading

The overall grade is obtained as follows:

- Final exam 50%.
- Mid-term exam 25%.
- Continuous evaluation 25%. It includes case solving, problems and team work presentations.