DIM-SAP-433 Automotive Engines

SEMESTER: Spring

CREDITS: 3 ECTS (2 hrs. per week)

LANGUAGE: English

DEGREES: SAPIENS program

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, hybrid, turbines, etc...
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:

- ORDINARY:
    - Final exam 50%.
    - Continuous evaluation 50%. It includes case solving, lab practices, problems and teamwork presentations.
- EXTRAORDINARY:
    - Retake Exam 50%
    - Continuous evaluation 50%. It includes case solving, Lab. practices and problems, and teamwork presentations.

Use of AI

The use of AI to create entire works or relevant parts, without citing the source or the tool, or without explicit permission in the assignment description, will be considered plagiarism and will be regulated in accordance with the University General Regulations.

The use of Artificial Intelligence is permitted exclusively for the completion of the continuous evaluation. Therefore, Level 2 of the Evaluation Scale by Perkins et al. (2024) is established: 'AI may be used for pre-task activities such as brainstorming, outlining, and initial research. This level focuses on using AI for planning, synthesis, and idea generation, but assessments should emphasize the ability to develop and refine these ideas independently.' That is, the student may use AI for planning, developing ideas, and conducting research, but the Report and the presentations must demonstrate how these ideas have been developed and refined.