COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

GUÍA DOCENTE
2025 - 2026

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura

Nombre completo	Automotive Engines
Código	DIM-SAP-433
Cuatrimestre	Semestral
Créditos	3,0 ECTS
Carácter	Obligatoria
Departamento / Área	Departamento de Ingeniería Mecánica

Datos del profesorado

Profesor

Nombre	Juan Norverto Moriñigo
Departamento / Área	Departamento de Ingeniería Mecánica
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DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

This subject has been designed to complete the student knowledge about automotive engines, inside the Electromechanical engineer profile, going deep with the concepts already studied in other subjects in previous terms belonging to Thermal Engineering.

At the end of the season, the students will be able to predict engine performances, their relationship with vehicles and the response in a real journey with variable loads. Also emission regulations will be reviewed and the strengths and weaknesses of electrical / hybrid vehicles will be studied and compared with the same vehicles propelled with internal combustion engines.

This subject will explore both theory and praxis, so numerical models will be used to solve the basic equations of the internal combustion engines.

Prerrequisitos

There are not any pre requirement needed to study the subject. However basic thermodynamics knowledge will be a good asset. Example of this:

Thermodynamics

- Properties estimation.
- Energy balance.

Fluid Mechanics

- Compressible flow.
- Drag resistance.

- Hydraulic circuits

Heat transfer

- Heat transfer laws
- Heat exchangers

Competencias - Objetivos

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

1. RECIPROCATING ENGINES

Unit 1. Basic engine design

1. Main components and systems.
2. Key systems (cooling, lubricating).
3. Engine glossary.

Unit 2. Basic Thermodynamics

1. Otto, Diesel and Atkinson cycles.
2. Review of the classic P-V diagrams. From idel to reality. Basic ratios.

Unit 3. Engine performance

1. Nideling and prediction.
2. Engine performance curves from fuel and air input.
3. Simple engine model and simulations.

Unit 4. Link between ground and engines

1. Aerodynamic drag. Grading resistance. Rolling resistance.
2. Vehicle performance prediction: Maximum speed, acceleration, fuel consumption in a driving cycle.

Unit 5. Exhaust emissions (tail pipe)

1. How pollutants are created.
2. How to prevent or reduce. Greenhouyse affect. Acid Rain.

2. OTHER POWERTRAINS

Unit 6. Hybrid vehicles

1. Classification: series, parallel, complex.
2. Vehicles for the futures. From micro hybrids to plug-in.
3. Different architecture study. Petrol, diesel, hybrids, turbines...

Unit 7. Electric vehicles

1. Current state of the art.
2. Main components and technologies.
3. Range prediction & calculation.
4. Market solutions and today vehicles availability.

METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

Both In-class and distance teaching are developed to imply the students within the learning activities. The subjects are developed to keep the student attention and following the competencies acquisition by the students. Student activities are key factors to develop this course.

Metodología Presencial: Actividades

Life presentations. The teacher will explain basic concepts for every theme showing the more important aspects. Special attention to be paid with equations and how to use. Examples will be presented, discussed and solved to complete the understanding.

In class case discussion and problem solving. Students will discuss the cases and problems proposed by the teacher. Cases will be open challenges that can be analyzed and solved by the use of the concepts already presented in class.

Team Work presentations. The teacher will ask for team works of any proposed matter. Students will have to look for additional documentation to what was shown in class. Students must justify their conclusions and add value with their engineering mind. These works will be public presented in class.

Metodología No presencial: Actividades

Self-learning on the concepts presented in class. Material to be used are slides, multimedia files, personal and teacher notes, recommended books and magazines.

Cases study. To be revised and updated with the rest of information given in the subject.

Team Works. Preparation and presentation of team Works. Students must find the information sources to create outstanding works.

RESUMEN HORAS DE TRABAJO DEL ALUMNO

STUDENT SCHEDULE SUMMARY (Hours)			
LIVE			
Teacher Lessons	**Case discussion**	**Presentations**	**Evaluation**
10	5	10	5
DISTANCE			
Self study on theory	**Self work on cases**	**Prepare for Examination**	**Prepare for presentations**
20	20	10	10

CRÉDITS ECTS:	**3 (90 hours)**

EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

- **End of term exam**
  - Cocepts understanding
  - Use of concepts to solve real cases
  - Problem solving solution analysis and results interpretation
  - Weight: 50%

- **Continuous evaluation: case solving, Problems and team work presentations**
  - Cocepts understanding
  - Use of concepts to solve real cases
  - Presentation and written communication
  - Weight: 50%

Calificaciones

The score for the **ordinary summon** will be obtained by:

- 50% comes from exams scoring. End of term exam is 50% and mid-term is 25% of the total.
- 50% comes from continuous evaluation.

Extraordinary summon

- 50% from the score obtained in continuous evaluation.

50% from the extraordinary summon exam.

AI is allowed exclusively in the TEAM WORK. Therefore, the Level 2 of the Assessment Scale of 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 the effective use of AI for planning, synthesis, and ideation, but assessments should emphasise the ability to develop and refine these ideas independently." That is, the student may use AI for planning, idea development, and research. The final submission should show how the student has developed and refined these ideas.

PLAN DE TRABAJO Y CRONOGRAMA

Actividades	Fecha de realización	Fecha de entrega
Reading of multimedia files to be showed in class (Slides)	Before lesson	
Study on the slides showed in class	After lesson	

Study with additional information coming from other sources: Hand written notes, books, etc	After lesson	
Problem solving	Before lesson	
Solved problems understanding.	After lesson	
Presentation, cases, problems preparation as part of continuous scoring	At the end of the unit	
Exam preparation	One week before	

BIBLIOGRAFÍA Y RECURSOS

Bibliografía Básica

- Internal_Combustion_Engines_Fundamentals. J.B. Heywood

Bibliografía Complementaria

- Combustion Engines Development - G. Merker, et al., (Springer, 2012) BBS
- Automotive Fuel and Emission Ctl Systems 3rd ed - J. Halderman, J. Linder (Pearson, 2012) BBS
- Modern_Electric_Hybrid_Electric_and_Fuel_Cell_Vehicles