



UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA



LBG Valencia

Spring Course 2015:

Warm me up,
my engine is ready!

Syllabus & Prematerials



Course Overview

The course's objective is to give a short overview on different aspects of reciprocating internal combustion engines. The course is structured in the following units:

TOPIC	SESSIONS	LECTURER
1. ENGINE FUNDAMENTALS	CONCEPTS	JJ LOPEZ
	ENGINE TESTING	J MARTIN
2. AIR MANAGEMENT	FUNDAMENTALS	R NOVELLA
3. COMBUSTION	SI ENGINE	JM GARCIA-OLIVER
	CI ENGINE	A GARCIA
4. EMISSIONS	FUNDAMENTALS	JV PASTOR
	MEASURING EQUIPMENT	S MOLINA/JM PASTOR
5. ENGINE CONTROL	FUNDAMENTALS	B PLA

Alongside with the lectures, the course will additionally include a Case Study, an External Visit, Practical Laboratory Sessions and a Final Evaluation, all of which will be described more thoroughly in the following document.

Description of Academic Content

1. ENGINE FUNDAMENTALS

Lecturer	JJ LOPEZ, J MARTIN
Number of working hours	3.0
Type of activity	Lecture + Lab exercise
Description	<p>The first unit will be devoted is an introduction, with definition of engine relevant nomenclature and classifications.</p> <p>Two activities will be carried out:</p> <ul style="list-style-type: none">- A formal lecture, with the explanation of relevant definitions and concepts.- A lab exercise, where students will learn about engine testing procedures.

2. AIR MANAGEMENT

Lecturer	R NOVELLA
Number of working hours	1.5
Type of activity	Lecture
Description	<p>This unit will be devoted to understand the fundamentals of air management. The following concepts will be presented:</p> <ul style="list-style-type: none">- Quantitative parameters for the characterization of the engine air breathing.- Factors affecting volumetric efficiency.- Engine supercharging/turbocharging.- EGR.

3. COMBUSTION

Lecturer	JM GARCIA-OLIVER, A GARCIA
Number of working hours	3.0
Type of activity	Lecture
Description	<p>This unit will be deal with the analysis of the combustion process in reciprocating engines. Two lectures will be delivered, the first one of a Spark Ignition Engine, the second one on the Compression Ignition Engine. At each lecture, focus will be done on the following aspects:</p> <ul style="list-style-type: none"> - Phenomenological description of the combustion process. - Engine parameters acting on the combustion process.

4. EMISSIONS

Lecturer	JV PASTOR, S MOLINA, JM PASTOR
Number of working hours	3.0
Type of activity	Lecture + Lab visit
Description	<p>This unit will deal with the problems raised by exhaust emissions in internal combustion engines. Work will consist of two sub-sessions:</p> <ul style="list-style-type: none"> - A lecture, where emission formation fundamentals will be presented, as well as strategies to reduce engine emissions. - A lab visit, where the students will visit CMT testing and research facilities, and where special focus will be done on exhaust measurement equipment.

5. ENGINE CONTROL

Lecturer	B PLA
Number of working hours	1.5
Type of activity	Lecture
Description	<p>This unit will cover the topics related with the management of the main engine systems and processes, namely the combustion and air management processes. The contents are scheduled as follows:</p> <ul style="list-style-type: none"> - A brief description of the historical evolution in the control of Internal Combustion Engines (ICE) is made. - A series of fundamental control concepts are reviewed or introduced for those without previous formation in such a subject. - The core of the lesson deals with the description of the control system in the ICEs, introducing the most usual sensors, actuators, control variables and control strategies. - Finally, the last part of the seminar will cover the description of the engine calibration process and an example of advanced control applied to ICEs.

6. CASE STUDY (I)

Lecturer	To be confirmed
Number of working hours	2.0
Type of activity	Case Study
Description	<p>This unit will be devoted to a practical case study of real vehicle and stationary engines. Based on the comparison of different engine models groups will discuss similarities and differences.</p>

7. CASE STUDY (II)

Lecturer	To be confirmed
Number of working hours	2.0
Type of activity	Case Study
Description	This unit will be devoted to a practical case study of real vehicle and stationary engines. Based on one single model, groups will explore advanced engine parameters.

8. EXTERNAL VISIT

Lecturer	Lucas Mestre
Number of working hours	3.0
Type of activity	Visit
Description	This unit consist of a visit to our local Formula Student group. The activity will include a presentation of their team and working methods as well a visit of their workshop.

9. EVALUATION

Lecturer	To be confirmed
Number of working hours	3.0 + 1.5
Type of activity	Evaluation
Description	The final unit will consist of an Evaluation through an oral exposition by groups. Participants will have 3.0h to prepare the evaluation and all groups will present their projects within 1.5h.

Academic Schedule

	Tuesday 7th	Wednesday 8th	Thursday 9th	Friday 10th
8:00 - 8:30	Wake-up & Breakfast			
8:30 - 9:00				
9:00 - 9:30	Lecture 1 ENGINE FUNDAMENTALS	Lecture 4 COMBUSTION - CI ENGINE	Labs + CMT visit - ENGINE TESTING - EMISSION MEAS.	Preparation for Evaluation
9:30 - 10:00				
10:00 - 10:30				
10:30 - 11:00	Coffee Break			
11:00 - 11:30	Lecture 2 AIR MANAGEMENT	Lecture 5 EMISSION FORMATION	Labs + CMT visit - ENGINE TESTING - EMISSION MEAS.	Preparation for Evaluation
11:30 - 12:00				
12:00 - 12:30				
12:30 - 13:00	Coffee Break			
13:00 - 13:30	Lecture 3 COMBUSTION - SI ENGINE	Lecture 6 ENGINE CONTROL		Evaluation
13:30 - 14:00				
14:00 - 14:30				
14:30 - 15:00	Lunch			
15:00 - 15:30				
15:30 - 16:00	Case study (I)	Case study (II)	Company Visit - FSUPV	Closing
16:00 - 16:30				
16:30 - 17:00				
17:00 - 17:30				
17:30 - 18:00				
18:00 - 18:30				

Prematerials

- Taylor, C. F. *The Internal Combustion Engine in Theory and Practice*. Vol. 1, and 2. Cambridge, MA: M.I.T. Press, 1966 and 1968.

Reissued in paperback in 1977, and in 1985 as Second Edition with minor modifications. An advanced text with extensive material on engine design practice of the 1950s and 60s.

- Stone, R. *Introduction to Internal Combustion Engines*. MacMillan Publishers, Ltd., 1985. 2nd ed. 1992.

An introductory text appropriate to a survey undergraduate course on engines.

- Bosch. *Automotive Handbook*. 9th ed. Published by Robert Bosch GmbH. Warrendale, PA: Distributed by SAE, 2014.

A concise and useful summary of technical data on engine and vehicle components.

- Watson, N., and M. S. Janota. *Turbocharging the Internal Combustion Engine*. New York: John Wiley & Sons, 1982.

An extensive and excellent professional reference text on turbochargers, and turbocharged engine performance.

- Blair, G. *The Basic Design of Two-Stroke Engines*. Warrendale, PA: Society of Automotive Engineers, 1990.

A monograph with simple programs focused on two-stroke gasoline engine design issues and their underlying principles.

- Cummins, Lyle. *Internal Fire: The Internal Combustion Engine 1673 - 1900 Revised Edition*. 2nd ed. Warrendale, PA: Society of Automotive Engineers, 1976.

Excellent and readable history of the internal combustion engine by the son of the founder of the Cummins Engine Company.

- *A History of the Automotive Internal Combustion Engine*. Warrendale, PA: Society of Automotive Engineers special publication, SP-409, 1976.

A set of four SAE papers reviewing the history of IC engine developments.