

Course guide 220122 - DV - Vehicle Dynamics

Last modified: 05/07/2024

Unit in charge: Teaching unit:	Terrassa School of Industrial, Aerospace and Audiovisual Engineering 724 - MMT - Department of Heat Engines.		
Degree:	BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject). BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).		
Academic year: 2024	ECTS Credits: 3.0	Languages: Catalan	
LECTURER			

Coordinating lecturer:	Bermejo Plana, David
Others:	Bermejo Plana, David

TEACHING METHODOLOGY

The teaching of the subject is organized in three methodological blocks:

• Face-to-face sessions in the classroom with theory classes (lectures) and application (examples and problems).

In the face-to-face sessions in the classroom, the teaching staff in charge will present the contents of the course, introducing the theoretical bases of the subject, concepts, methods and resolution procedures and results, illustrating them through convenient examples, visual material and proposing to the students, when considered, exercises and problems to solve.

Additionally, teachers will regularly propose activities to understand and consolidate the concepts worked on in the classroom.

• Practical face-to-face sessions, which may include specific lessons on the use of computer software, conferences and talks, seminars, laboratory and/or workshop practices, presentation of work/projects and visits to companies.

Conferences, talks, seminars, laboratory/workshop practices, presentation of work and visits to companies will be conveniently announced through ATENEA.

• Independent study and group work through carrying out different activities.

In group work, students will have to collaborate together in small groups on a common goal. During the activity, students create knowledge from the interaction between peers, instead of the classic teacher-student transfer, students are responsible for both their classmates' learning and their own, and the role of the teacher is that of a facilitator, that is, That is, it develops the structure, facilitates the context and provides the learning space. Students are expected to interact, discuss, contrast points of view and solve the problem together.

LEARNING OBJECTIVES OF THE SUBJECT

Know the different systems and components of the car. Know the principles and management of braking. Analyze the dynamics of the car. Study the behavior of the tires, steering, suspension and vehicle design on its stability.

STUDY LOAD

Туре	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h



CONTENTS

Issue 1: Introduction to vehicle dynamics

Description:

- 1.- The automobile and definitions of interest
- 2.- Brief history of the automobile
- 3.- Masses and dimensions of the vehicle
- 4.- Fundamental principles of application
- 5.- Dynamic loads on the axles

Full-or-part-time: 4h

Theory classes: 3h Self study : 1h

Issue 2: Acceleration and braking performance

Description:

- 1.- Limit acceleration according to power
- 2.- Limit acceleration according to traction capacity
- 3.- Basic equations in braking
- 4.- Forces during braking
- 5.- Braking maneuver
- 6.- Friction between the wheel and the pavement

Full-or-part-time: 15h

Theory classes: 6h Self study : 9h

Issue 3: Road loads and ride

Description:

- 1.- Aerodynamic drag
- 2.- Rolling resistance
- 3.- Excitation sources
- 4.- Vehicle response properties
- 5.- Perception of ride

Full-or-part-time: 15h

Theory classes: 6h Self study : 9h

Issue 4: Steady-state cornering

Description:

- 1.- Introduction to cornering
- 2.- Low-speed turning
- 3.- High-speed cornering
- 4.- Suspension effects on cornering

Full-or-part-time: 15h

Theory classes: 6h Self study : 9h



Issue 5: Suspensions

Description:

- 1.- Solid axle
- 2.- Independnet suspensions
- 3.- Anti-suqat and andti-pitch suspension geometry
- 4.- Anti-dive suspension geometry
- 5.- Roll centre analysis

Full-or-part-time: 8h 40m Theory classes: 3h Self study : 5h 40m

Issue 6: The steering system

Description:

1.- Introduction to steering systems

- 2.- Steering system forces and moments
- 3.- Influence of front-wheel drive drive
- 4.- Influence of four-sheel steer

Full-or-part-time: 8h 40m

Theory classes: 3h Self study : 5h 40m

Issue 7: Tyres

Description:

- 1.- Tyre construction
- 2.- Tractive properties
- 3.- Cornering properties
- 4.- Combined braking and cornering

Full-or-part-time: 8h 40m Theory classes: 3h Self study : 5h 40m

GRADING SYSTEM

The subject grading system is structured in the following blocks:

1) Final exam (P). Weight 50%

- 2) Group work and laboratory practices (T). Weight 20%
- 3) Conceptualization and resolution of challenges (R). Weight 30%

For students who do not pass the final exam (P), a renewal exam will be held at the end of the semester on a day and time to be agreed upon by the School and the teaching team.

Guidelines for the renewal exam:

- \bullet Only students who have failed the final exam (P < 5.0) can appear.
- The maximum grade is limited to 6.0 out of 10.0.

• The final mark corresponding to the final exam (P) will be the highest obtained by the student between the two exams (ordinary exam and re-examination).



BIBLIOGRAPHY

Basic:

- Heisler, Heinz. Advanced vehicle technology [on line]. 2nd ed. Oxford: Butterworth-Heinemann, 2002 [Consultation: 13/05/2022]. A vailable on:

https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=2967 57. ISBN 0750651318.

- Parraga, Julián. Automoción 1. Madrid: Ediciones del Castillo, 1979. ISBN 8421901680.

- Gillespie, Thomas D. Fundamentals of vehicle dynamics. Warrendale: Society of Automotive Engineers, 1992. ISBN 1560911999.

- Wong, Jo Yung. Theory of ground vehicles. 4th ed. Hoboken: Wiley, 2008. ISBN 9780470170380.