Course guide

330534 - DV - Vehicle Dynamics

Unit in charge: Manresa School of Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.
Degree: BACHELOR’S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Compulsory subject).
Academic year: 2023
ECTS Credits: 6.0
Languages: Catalan

LECTURER

Coordinating lecturer: Català Calderón, Pau
Others: Peña Pitarch, Esteban

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

Generical:
CG11. Ability to write and develop projects for vehicles and/or their components.

Transversal:
2. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
05 TEQ N3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

TEACHING METHODOLOGY

- Master class or conference.
- Problem solving and case study.
- Project, activity or work of reduced scope.
- Project or work of wide scope.
- Evaluation activities.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, students must be able to:
- To apply correctly the fundamental concepts of the statics, kinematics and dynamics of the rigid solid and to be able to apply them to practical cases of automotive engineering.
- Know the different auxiliary mechanisms of a vehicle, as well as be able to carry out its design.
- Apply the basic concepts of the kinematics and dynamics of a vehicle and be able to apply them to practical cases in automotive engineering.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
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Total learning time: 150 h

CONTENTS

1. Introduction to vehicle dynamics

Description:

Related activities:
PROB, SIM, PAR, EP1, EFINAL

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 4h
Self study: 12h

2. Wheel dynamics. Tires

Description:

Related activities:
PROB, SIM, PAR, EP1, EFINAL

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study: 6h

3. Longitudinal dynamics

Description:
Maximum acceleration. Engine power. Maximum acceleration. Tractor capacity driving wheels.

Related activities:
PROB, SIM, PAR, EP1, EFINAL

Full-or-part-time: 40h
Theory classes: 8h
Practical classes: 8h
Self study: 24h
4. Braking performance

Description:

Related activities:
PROB, SIM, PAR, EP2, EFINAL

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 4h
Self study: 12h

5. The steering system

Description:

Related activities:
PROB, SIM, PAR, EP2, EFINAL

Full-or-part-time: 32h
Theory classes: 6h
Practical classes: 6h
Self study: 20h

6. Suspension system

Description:
Suspension system. Roll Centers and roll axis. Study of the rolling motion of a vehicle.

Related activities:
PROB, SIM, PAR, EP2, EFINAL

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 4h
Self study: 12h

7. Vibration analysis

Description:

Full-or-part-time: 8h
Theory classes: 2h
Practical classes: 2h
Self study: 4h
## ACTIVITIES

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Full-or-part-time</th>
<th>Theory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial Exam 1</td>
<td>Assessment of acquired knowledge</td>
<td>44h</td>
<td>2h</td>
<td>42h</td>
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<tr>
<td>Delivery</td>
<td>Delivered exam</td>
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<tr>
<td>Partial Exam 2</td>
<td>Assessment of acquired knowledge</td>
<td>50h</td>
<td>2h</td>
<td>48h</td>
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<tr>
<td>Delivery</td>
<td>Delivered exam</td>
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<tr>
<td>Final Exam</td>
<td>Assessment of acquired knowledge</td>
<td>93h</td>
<td>3h</td>
<td>90h</td>
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<tr>
<td>Delivery</td>
<td>Delivered exam</td>
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<tr>
<td>Problems delivery</td>
<td>Delivery of technical reports explaining the resolution of problems related to real cars.</td>
<td>16h</td>
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<tr>
<td>Delivery</td>
<td>Technical report</td>
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Simulation Report

Description:
Delivery of a technical report explaining the results obtained by using an MBD simulation software of a complete vehicle and some of its mechanical subsystems. These simulated results must be contrasted with analytical values obtained through the theoretical content presented in the subject.

Delivery:
Technical report and simulation files.

Full-or-part-time: 26h
Practical classes: 10h
Self study: 16h

Class participation

Description:
attendance and participation in class and laboratories. Online tests can be proposed to be solved by the students of the content explained in class.

Delivery:
Class participation and tests

Full-or-part-time: 1h
Theory classes: 1h

GRADING SYSTEM

- PROB: Delivery of proposed problems (10%).
- SIM: Simulation report (15%).
- PAR: Class attendance and participation (5%).
- EP1: Partial exam 1 (35%).
- EP2: Partial exam 2 (35%).
- FINAL: Recovery exam (70%).

The final grade (NFINAL), rounded to the tenth, will be the next weighted average.

NFINAL = max (70% · EFINAL, 35% · EP1 + 35% · EP2) + 10% · PROB + 15% · SIM + 5% · PAR.

Students who fail to pass the subject in part (EP1, EP2) or those who want to improve their qualification, they will have a second chance with a new final test (EFINAL).

EXAMINATION RULES.

- Late deliveries will not be accepted (SIM, PROB). Deliveries must be made via the ATENEA campus.
- In the delivery any total or partial copy of solutions will suppose the suspension to the activity. The student must ensure the privacy and security of their data.
- The structure and rules of the exams of the subject (EP1, EP2, EFINAL) are the following:
  Duration: 2 h - 3 h
  Part of theory (3 points). Test questions and open-ended questions. No form or notes.
  Part of problems (7 points). Between one and three problems. With form and / or notes.
**BIBLIOGRAPHY**

**Basic:**

**RESOURCES**

**Other resources:**
Class presentations and MBD simulation software with specific toolkits for vehicle dynamics.