220051 - Mechanics II

Degree competences to which the subject contributes

- To have a good command of the determination of the equation of motion of a mechanical system and know the analytical methods that allow this obtention.
- To be able to understand the vibratory behaviour of a mechanical system in the free case and subjected to different kinds of excitation and, furthermore, know the mathematical expressions and the calculation procedures that allow to address a problem like this.
- To know the experimental techniques used to measure the mechanical vibration in structures and how to use this experimental data to dynamically characterise the particular mechanical system.
- To know the passive control techniques that allow to control the dynamic behaviour of a particular mechanical system.

Prior skills

To properly tackle the present subject, the student should have a solid basis on Newtonian mechanics (statics, kinematics and dynamics) and on the obtention of the independent degrees of freedom of a mechanical system.

Requirements

Regarding to the experimental laboratory sessions, which are face-to-face sessions, the attendance is mandatory for the students.

Degree competences to which the subject contributes

Specific

- CE20. GrETA/GrEVA - Adapted and applied to engineering knowledge: fracture mechanics and continuum approaches dynamic fatigue of structural instability and aeroelasticity.

Teaching methodology

The subject is structured in:
- Large group sessions in which the case to be solved is exposed, the theory that rules the phenomena and the solving resolution.
- Small group sessions linked with the laboratory: Sessions of experimental laboratory, where students work with real cases with the finality of releasing the most common measure processes and showing the theoretical concepts of the big group lessons.
- Small group sessions linked with the non-classroom laboratory sessions: numerical models able to represent and simulate real problems will be studied.

Learning objectives of the subject

- To have a good command of the determination of the equation of motion of a mechanical system and know the analytical methods that allow this obtention.
- To be able to understand the vibratory behaviour of a mechanical system in the free case and subjected to different kinds of excitation and, furthermore, know the mathematical expressions and the calculation procedures that allow to address a problem like this.
- To know the experimental techniques used to measure the mechanical vibration in structures and how to use this experimental data to dynamically characterise the particular mechanical system.
- To know the passive control techniques that allow to control the dynamic behaviour of a particular mechanical system.
## Content

**Module 1: Virtual work method.**

**Learning time:** 22h  
Theory classes: 7h  
Self study: 15h

**Description:**

**Module 2: Lagrange equations.**

**Learning time:** 20h  
Theory classes: 5h  
Self study: 15h

**Description:**

**Module 3: Vibrations of one-degree-of-freedom systems**

**Learning time:** 49h  
Theory classes: 16h  
Laboratory classes: 8h  
Self study: 25h

**Description:**

**Module 4: Vibrations of N-degrees-of-freedom systems**

**Learning time:** 59h  
Theory classes: 18h  
Laboratory classes: 6h  
Self study: 35h

**Description:**
Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>LARGE GROUP</strong></td>
<td>63h</td>
<td>Theory classes: 42h</td>
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<tr>
<td></td>
<td></td>
<td>Self study: 21h</td>
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<tr>
<td><strong>SMALL GROUP</strong></td>
<td>28h</td>
<td>Laboratory classes: 14h</td>
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<td></td>
<td></td>
<td>Self study: 14h</td>
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<tr>
<td><strong>MIDTERM EXAM</strong></td>
<td>19h 20m</td>
<td>Theory classes: 1h</td>
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<td>Self study: 18h 20m</td>
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<tr>
<td><strong>FINAL EXAM</strong></td>
<td>30h 50m</td>
<td>Theory classes: 2h 20m</td>
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<td></td>
<td>Self study: 28h 30m</td>
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<tr>
<td><strong>EXAM OF LABORATORY SESSIONS</strong></td>
<td>8h 50m</td>
<td>Theory classes: 0h 40m</td>
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<td>Self study: 8h 10m</td>
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Qualification system

The final mark of the subject can be computed from the following expression: 0.2*MA+0.1*VA + 0.175*Lab + 0.175*ELab + 0.35*EF

MA: Analytical Mechanics exam
VA: Analytical Vibrations exam
EF: Final exam (Numerical vibrations)
Lab: Reports from the Laboratory sessions.
ELab: Laboratory sessions Exam.

If mark (EF) > mark (VA) then mark (VA) rises to mark (EF)

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.
Regulations for carrying out activities

All the exams must be solved individually. The use of any complementary material in the exam is permitted. In contrast, it is forbidden the use of mobile phones, smartphones or any other system that enables the communication between students.

Regarding to the reports from the laboratory sessions, each group must present a unique report for each lab sessions, always written in the basis of the specific writing regulations for technical reports that will be provided when the course begins.

Bibliography

**Basic:**


**Complementary:**
