# Curricular Unit Form (FUC)

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| Course: | **SECOND CYCLE IN MECHANICAL ENGINEERING** | | | | | |
| Curricular Unit (UC) | **Mechanical Vibrations** | | | Mandatory | **X** | |
| | | | | Optional | | |
| Scientific Area: | **Manufacturing and Mechanical Design** | | | | | |
| Year: **1** | Semester: 1st | ECTS: 6,5 | | Total Hours: **4,5** | | |
| Contact Hours: | T: | TP:**67,5** | PL: | S: | OT: | TT: |
| Professor in charge | | Academic Degree /Title | | Position | | |
| **Inês de Carvalho Jerónimo** | | **PhD** | | **Invited Assistant Professor** | | |

T- Theoretical ; TP – Theory and practice ; PL – Laboratory ; S – Seminar ; OT –Tutorial ; TT – Total of contact hours

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| Entry into Force | Semester: **Winter** | Academic Year: **2016/2017** |

**Objectives of the curricular unit and competences** (max. 1000 characters)

The goal of this course is to understand the physical phenomenon of vibration by comprehending how to measure, analyze, and control mechanical vibrations. The aim of the course is to for the student to be able to predict the dynamic behavior of mechanical systems and structures and design accordingly.

The students acquire competences in design, control and prediction of vibrational behavior of mechanical systems.

**Syllabus** (max. 1000 characters)

1. Fundamentals of Mechanical Vibrations
   a. Mechanical Vibrations
   b. Vibration Analysis
   c. Models of Vibrational Systems
2. Single Degree-of-Freedom Systems
   a. Free Vibration
   b. Forced Vibration
3. Multiple Degree-of-Freedom Systems
   a. Natural Frequency and Vibration Modes
   b. Free Vibration
   c. Forced Vibration

4. Vibration Control
    a. Balancing of Rotating Machines
    b. Vibration Isolation
    c. Vibration Absorbers
5. Vibration Measurement
    a. Transducers
    b. Acelerometers
    c. Aplications of vibration measurement

**Demonstration of the syllabus coherence with curricular unit's objectives** (max. 1000 characters)

This course aims at teaching the vibrational behavior of mechanical systems by using discretized models with mass, spring and viscous dampers. Concepts such as natural frequency, resonance, free and forced vibration, and transmissivity are comprehended by the use of single degree-of-freedom systems. Systems of multiple degres-of-freedom are used to transmit knowledge on vibration modes and operational deformation of mechanical systems.

With the knowledge acquired in this course, it is possible to identify the dynamic properties of the system and to determine its behavior. It is possible to design mechanical systems to obtain a desired dynamic behavior and identify and solve dynamic problems, such as resonance, vibration isolation and absorption.

**Teaching methodologies (including evaluation)** (max. 1000 characters)

The course is taught using lectures supported by classes where exercises are solved. After each concept is taught, several practical examples are used to improve the learning. Several demonstrations will be performed in the laboratory for better understanding of the concepts in a real scenario.

The assessment is done by proposed work during the semester (30%) and a final exam (70%).

**Demonstration of the teaching methodologies coherence with the curricular unit's objectives** (max. 3000 characters)

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| The theoretical concepts are supported by laboratory demonstrations as well as dynamic simulations and mandatory practical exercises so that students are able to comprehend the characteristics of movement. |

| **Main Bibliography** (max. 1000 characters) |
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| MECHANICAL VIBRATIONS, Singiresu S. Rao, 3rd ed. 1995, Addison-Wesley.<br>ENGINEERING VIBRATION, Daniel Inman, 2nd ed. 2001, Prentice Hall.<br>SHOCK AND VIBRATION HANDBOOK, Harris C., Crede, C., , McGraw-Hill. |