

## 30150 - Ballistics

### Información del Plan Docente

<b>Academic Year</b>	2017/18
<b>Faculty / School</b>	179 - Centro Universitario de la Defensa - Zaragoza
<b>Degree</b>	457 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering
<b>ECTS</b>	6.0
<b>Year</b>	4
<b>Semester</b>	First semester
<b>Subject Type</b>	Optional
<b>Module</b>	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

There are two kind of activities in the course. The class activities are:

- Lectures
- Problem solving classes
- Computer lab sessions
- Essay presentations

Homework:

- Group activities and essays
- Practical assesments
- Self-study

Key dates (exams and deadlines) will be announced by the teacher in class and in the moodle platform.

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

#### 4. Assessment (1st and 2nd call)

##### 4.1. Assessment tasks (description of tasks, marking system and assessment criteria)

#### 5. Methodology, learning tasks, syllabus and resources

##### 5.1. Methodological overview

The learning process designed for course is based on the following items:

- Lectures
- Theoretical essays and practical assessments, complemented by real experiments
- Computer lab sessions where students should show their knowledge of the theoretical bases of the course
- Active learning: solving problems and studying topics posed by the teacher

##### 5.2. Learning tasks

The learning activities are detailed in the section 1.2

##### 5.3. Syllabus

Interior Ballistic

1. Interior ballistic elements.
2. Fuzes, bombs and multipliers.
3. Interior ballistic in ordnance.

Exterior Ballistic

1. Vacuum ballistic.
2. Projectile equation in atmosphere.
3. Aerodynamic drag.
4. Point mass model and point mass modified model.
5. Ballistics corrections.
6. Rigid body model.
7. Dispersion Measures.
8. Initial velocities.
9. Shooting table.

Terminal Ballistic

1. HE projectile effects
2. AP projectile effects
3. Special projectile effects
4. Nato Indirect Fire Appreciation Kernel

##### 5.4. Course planning and calendar

The schedule of lectures and assessment tasks and essays submission deadlines will be announced by the professor in class and on the moodle platform.

##### 5.5. Bibliography and recommended resources

- ACART- MT-074. Balística interior, municiones, explosivos y normativa. Tomo I
- Fundamentos técnicos del tiro de Artillería M-3-3-6
- Cucharero, F. Balística exterior. Ministerio de Defensa, Madrid, 1992
- ACART- MT-074. Balística interior, municiones, explosivos y normativa. Tomo II
- ACART-FM-002. Bocas de fuego
- ACART-VA-046
- Manual Técnico MT7-311

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- Proceedings of the 27th International Symposium on Ballistics. Freiburg, Germany, 2013
- [Proceedings of the 23rd International Symposium on Ballistics](#) . Tarragona, Spain, 2007
- McCoy, Robert. Modern exterior ballistics: The launch and flight dynamics of symmetric projectiles / Robert McCoy. Atglen, Pennsylvania : Schiffer Publishing, 1999