Course guides
820004 - F1FM - Physics I: Fundamentals of Mechanics

Unit in charge: Barcelona East School of Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree:
- BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).
- BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR’S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR’S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2020  ECTS Credits: 6.0  Languages: Catalan, English, Spanish

LECTURER

Coordinating lecturer:
- MARTA ALARCON JORDAN
- GERMINAL CAMPS ANAYA

Others:
- Primer quadrimestre:
  - MARTA ALARCON JORDAN - M81, M82, M83, M84, T21, T22, T23, T24
  - ARACELI AZNAR LUQUE - M61, M62, M63, M71, M72, M73, T11
  - MARTI BELTRÁN GONZÁLEZ - M24, M34, M51, M52, M53, M74, T14, T24, T91, T92, T93
  - SALIM BENADOUDA IVARS - M31, M32, M33, M41, M42, M43, M81, M82, M83
  - MURIEL BOTEY CUMELLA - M51, M52, M53, M54
  - PERE BRUNA ESCUER - M41, M42, M43, M44
  - GERMINAL CAMPS ANAYA - M21, M22, M23, M25, M44, M84
  - DANIEL CRESPO ARTIAGA - M51, M52, M53, M54
  - ANTONIO FERNANDEZ MARTINEZ - T21, T22, T23
  - MIGUEL ÁNGEL GUTIÉRREZ ANTUÑANO - M54, M64, T84, T85, T94
  - MANUEL LINARES ALEGRET - M71, M72, M73, M74, T91, T92, T93, T94
  - ROBERTO MACOVEZ - T11, T12, T13, T14, T15, T81, T82, T83, T84, T85
  - DANIEL MALAGARRIGA GUASCH - T81, T82, T83
  - DAVID MERINO ARRANZ - M14
  - LUIS CARLOS PARDO SOTO - M61, M62, M63, M64
  - TRINITAT PRADELL CARA - M21, M22, M23, M24, M25, M31, M32, M33, M34
  - LAURA RODRIGUEZ SUÑE - M11, M12, M13, T15
  - GLÒRIA SALA CLADELLAS - M11, M12, M13, M14, T91, T92, T93, T94
  - SOFIA VALENTI - T12, T13

- Segon quadrimestre:
  - MARTA ALARCON JORDAN - M31, M32, M33, M34, T11, T12, T13, T14
  - ARACELI AZNAR LUQUE - M14, M22, M23, M24, M34
  - SALIM BENADOUDA IVARS - M11, M12, M13, M31, M32, M33
  - PERE BRUNA ESCUER - M21, M22, M23, M24
  - DANIEL CRESPO ARTIAGA - T13
  - ANTONIO FERNANDEZ MARTINEZ - T11, T12
  - ELIAS MARTINEZ MORENO - T14, T21, T22, T23, T24
  - LUIS CARLOS PARDO SOTO - M11, M12, M13, M14, M21, T21, T22, T23, T24
  - GLÒRIA SALA CLADELLAS - T21, T22, T23, T24
DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.

Transversal:
2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

TEACHING METHODOLOGY

Teaching methodology used: exposition 30%, individual work 60 %, group work 6%, guided activities 4%.

LEARNING OBJECTIVES OF THE SUBJECT

Training the student through the acquisition of a working method and providing some knowledge of the principles and basic concepts of Mechanics, so that he/she can apply them to solve problems in the engineering field.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>51,0</td>
<td>34.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>9,0</td>
<td>6.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Subject 1: Introduction

Description:

Specific objectives:
Knowing the meaning of the dimensions of a physical magnitude. Knowing the uncertainty associated with experimental measurements and knowing how to calculate the propagation of uncertainty. Learning how to draw graphical representations of experimental data and how to make linear regressions.

Related activities:
Laboratory sessions:
all laboratory session in both terms

Related competencies:
CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.
05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 11h 12m
Theory classes: 3h 24m
Laboratory classes: 1h
Self study: 6h 48m
Subject 2: Particle kinematics

Description:

Specific objectives:
Modeling the motion for a particle, determining the equations of motion from its acceleration and initial conditions. Characterizing the linear and circular motion. Knowing the crucial role of the simple harmonic motion since for its wide application in the study of diverse physical phenomena. Establishing the concept of frame of reference to understand the relative character of the movement.

Related activities:
Laboratory session:
Simple pendulum (spring term)

Related competencies:
CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.

Full-or-part-time: 21h 24m
Theory classes: 6h 48m
Practical classes: 1h
Self study: 13h 36m

Subject 3: Particle dynamics

Description:

Specific objectives:
Understanding the concepts of force and mass and knowing Newton’s laws of motion. Acquiring the ability to apply the Newton’s laws to solve problems that include various particles. Knowing how to establish the conditions for the static equilibrium of a rigid body and solving problems of equilibrium of the rigid body. Knowing the differences between inertial and non-inertial frames of reference.

Related activities:
Laboratory session:
Equilibrium forces (spring term)

Related competencies:
CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.

Full-or-part-time: 28h
Theory classes: 9h
Laboratory classes: 1h
Self study: 18h
### Subject 4: Work, energy and power

**Description:**

**Specific objectives:**
Understanding the physical concepts of work, power and energy. Identifying conservative forces and obtaining the corresponding potential energy associated with them. Problem-solving applying the work-kinetic energy theorem work and work-energy theorem. Knowing how to apply the law of conservation of mechanical energy.

**Related activities:**
Laboratory session: Pulleys (fall term)

**Related competencies:**
CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.
05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Full-or-part-time:** 11h 12m
- Theory classes: 3h 24m
- Laboratory classes: 1h
- Self study: 6h 48m

### Subject 5: Dynamics of systems of particles

**Description:**

**Specific objectives:**
Describing the movement of the center of masses of systems of particles. Knowing to formulate and to apply the principles of conservation of the amount of movement and of the mechanical energy of systems of particles. Applying the theorems of conservation in the study of collisions and explosions.

**Related activities:**
Laboratory session: Collisions (fall term)

**Related competencies:**
CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.

**Full-or-part-time:** 26h
- Theory classes: 8h
- Laboratory classes: 2h
- Self study: 16h
### Subject 6: Planar rigid bodies


**Specific objectives:** Knowing the Newton's second law for rotation and its application to solve problems. Knowing how to characterize the planar motion: coplanar translation and rotation about a fixed axis. Knowing the dynamics of the flat movement and knowing how to apply it to solve problems. Knowing and applying the angular momentum conservation in problem-solving.

**Related activities:**
- Laboratory sessions: Rotation (spring term)
- Ballistic pendulum (fall term)

**Related competencies:**
- CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.
- 05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Full-or-part-time:** 35h
- Theory classes: 11h
- Laboratory classes: 2h
- Self study: 22h

### Subject 7: Oscillations and waves


**Specific objectives:** Identifying the condition for simple harmonic motion in terms of acceleration. Understanding the wave concepts of propagation of energy and momentum. Knowing how to describe harmonic waves. Understanding interference phenomena, in particular, standing waves.

**Related activities:**
- Laboratory sessions: Standing waves on strings (fall term)
- Sound waves (spring term)

**Related competencies:**
- CEB-02. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.
- 05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Full-or-part-time:** 11h 12m
- Theory classes: 3h 24m
- Laboratory classes: 1h
- Self study: 6h 48m
GRADING SYSTEM

MARK M1:
- Laboratory: 15%
- Test 1: 20%
- Test 2: 25%
- Test 3: 20%
- Problems: 20%

MARK M2:
- Laboratory: 20%
- Test 3: 40%
- Problems: 40%

FINAL GRADE = maximum (M1 ; M2)
THERE IS NO REASSESSMENT EXAM

EXAMINATION RULES.

In all exams, students can use a pocket calculator. Besides, a physics formula sheet will be provided in the Problems' exam.

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Hyperlink:
- Curso Interactivo de Física en Internet
  http://www.sc.ehu.es/sbweb/fisica/default.htm
- La baldufa: un entorn per a l'aprenentatge de la física.
  http://baldufa.upc.edu/