Course guide
200021 - FIS - Physics

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.
Degree: BACHELOR’S DEGREE IN MATHEMATICS (Syllabus 2009). (Compulsory subject).
Academic year: 2022 ECTS Credits: 7.5 Languages: Catalan

LECTURER
Coordinating lecturer: JUAN JOSE SANCHEZ UMBRIA
Others:
Segon quadrimestre:
ALVARO MESEGUER SERRANO - M-A
JUAN JOSE SANCHEZ UMBRIA - M-A

PRIOR SKILLS
Calculus in one and several variables: derivation and integration. Linear Algebra.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.

General:
5. CB-2. Know how to apply their mathematical knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader or multidisciplinary contexts related to Mathematics.
6. CB-3. Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements.
7. CG-1. Show knowledge and proficiency in the use of mathematical language.
10. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
12. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
11. SELF-DIRECTED LEARNING. Detecting gaps in one’s knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one’s knowledge.

TEACHING METHODOLOGY
The teaching activity is divided into three hours of theory (description and development of the topics presented in the syllabus) and two hours devoted to solving exercises as direct applications of the theory. This division is approximated and flexible. Students will have access to summaries or slides of each topic and a collection of related exercises that will be available in the web. During the problems sessions representative selected exercises will be solved.
LEARNING OBJECTIVES OF THE SUBJECT

Knowledge of the kinematics and dynamics of particles and rigid bodies.
Knowledge of the kinematic and dynamics in accelerated systems.
Understanding the concepts of field, work and energy.
Understanding and knowing how to apply the conservation laws.
Knowledge on the electric and gravitational fields.
Knowledge of the conduction laws and electrical circuits.
Knowledge of the magnetic fields.
Knowledge of Maxwell’s equations in the vacuum.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>112.5</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30.0</td>
<td>16.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>45.0</td>
<td>24.00</td>
</tr>
</tbody>
</table>

Total learning time: 187.5 h

CONTENTS


Description:
Position, velocity and acceleration vectors. Intrinsic components of the acceleration. Curvature, torsion and Frenet trihedral.

Full-or-part-time: 22h 30m
Theory classes: 6h
Practical classes: 3h
Self study: 13h 30m

2. Dynamics of particles and systems of particles.

Description:
Inertial and non-inertial systems. Newton’s laws. Movement of the center of mass of a system of particles. Description of some types of forces. Friction forces. Movement in non-inertial frames. Inertial forces and geophysical and astrophysical effects.
Integration of the equations of motion. Reduction to quadratures. Dimensions and units. Dimensional analysis.

Full-or-part-time: 22h 30m
Theory classes: 5h
Practical classes: 4h
Self study: 13h 30m
### 3. Momentum. Angular momentum and energy.

**Description:**

**Full-or-part-time:** 25h
Theory classes: 6h
Practical classes: 4h
Self study: 15h

### 4. Kinematics and dynamics of a rigid body.

**Description:**

**Full-or-part-time:** 25h
Theory classes: 6h
Practical classes: 4h
Self study: 15h

### 5. Electrostatics.

**Description:**

**Full-or-part-time:** 22h 30m
Theory classes: 5h
Practical classes: 4h
Self study: 13h 30m

### 6. Electrical conduction.

**Description:**

**Full-or-part-time:** 20h
Theory classes: 5h
Practical classes: 3h
Self study: 12h
7. Magnetostatics.

Description:

Full-or-part-time: 25h
Theory classes: 6h
Laboratory classes: 4h
Self study: 15h

8. Maxwell’s equations.

Description:

Full-or-part-time: 25h
Theory classes: 6h
Practical classes: 4h
Self study: 15h

GRADING SYSTEM
The subject is divided into two parts, Mechanics and Electromagnetism. There will be two partial exams, one on each part, and regular final exam. The grade of the subject shall be one of the following:
(a) The average of the two partial exams.
(b) The final exam score, which will be mandatory for students whose mark (a) is less than 5, and optional for those whose mark (a) is equal or greater than 5 (in this case the mark of (a) is waived).
There will be an extraordinary exam in July for students who have failed the subject in the regular call.

BIBLIOGRAPHY

Basic:
  https://web-s-ebcsohost-com.recursos.biblioteca.upc.edu/ehost/ebookviewer/ebook?sid=50467605-d9e7-4542-9a6-406be93984e1%40redis&vid=0&format=EB. ISBN 189138922X.

Complementary:
**RESOURCES**

**Other resources:**
- Slides on Mechanics (available through "Atenea").
- Notes on Electromagnetism (available through "Atenea").
- Suggested exercises (available through "Atenea").