**Course guide**

**240016 - 240016 - Basic Physics I**

Unit in charge: Barcelona School of Industrial Engineering  
Teaching unit: 721 - FEN - Department of Physics and Nuclear Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023  
ECTS Credits: 6.0  
Languages: Catalan, Spanish

**LECTURER**

Coordinating lecturer: Berart Diez, Sergio  
Others: Canales Gabriel, Manel  
Levit Valenzuela, Rafael  
Salud Puig, Josep  
Sempau Roma, Josep  
Talavera Sanchez, Pedro

**TEACHING METHODOLOGY**

During the course, continuous evaluation tests will hold, which will be used to evaluate and guide each student with respect to the success in acquiring the required competencies and capacities.

During the academic period practical laboratory sessions will take place. Each laboratory session will consist in a first part, where students learn, and a second part, where they will perform experimental measurements and analyse the data. At the end of the course, a test will take place, in order to evaluate the way they take and analyse experimental data.

Finally, evaluation tests, of those competencies and capacities acquired during the course, will take place at the end of the learning period. These tests have a relative significance as it is detailed in the "Qualification system" section.

**LEARNING OBJECTIVES OF THE SUBJECT**

- Acquiring the capacity to correctly interpret and apply fundamental laws of mechanics.
- Identifying a common methodology in the description of different mechanical phenomena, no matter if it is a single particle's movement or a solid object.
- Efficient use of graphic language to solve and interpret problems.
- Acquiring ability to execute measures and after treating the obtained data.
- Solving problems on simple mechanical applications.
- Having the capacity to identify each magnitude that appears in different formulas.
- Having the capacity to express magnitudes in the International System units.
- Having the capacity to choose a problem's fastest and simpler resolution option.
- Having the capacity to correctly use vector notation when necessary.

**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes</td>
<td>52,0</td>
<td>34.67</td>
</tr>
<tr>
<td>Laboratory classes</td>
<td>8,0</td>
<td>5.33</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 150 h
## CONTENTS

### Topic 1: Introduction and kinematics of the point

**Description:**
1) Brief instructions to solve problems in physics.
2) Units, order of magnitude estimation and dimensional analysis.
3) Vectors. Vector fields and geometric approach to vectors.
4) Basic operations with vectors.
5) Experimental data measure and treatment.
6) Unidimensional movement. Translational kinematics.
8) Geometric concepts of the derivative and the integral. Brief review of Integration.

**Full-or-part-time: 21h 15m**
- Theory classes: 5h
- Practical classes: 2h 30m
- Laboratory classes: 1h
- Self study: 12h 45m

### Topic 2: Dynamics of a single particle

**Description:**
1) First and Second Newton’s laws.
2) Force and momentum.
3) Torque and angular momentum.
4) Important forces.

**Full-or-part-time: 21h 15m**
- Theory classes: 3h 45m
- Practical classes: 3h 45m
- Laboratory classes: 1h
- Self study: 12h 45m

### Tema 3: Work and energy

**Description:**
1) Work.
2) Kinetic energy.
3) Potential energy.
4) Mechanical energy.
5) Work of non-conservative forces.

**Full-or-part-time: 18h 45m**
- Theory classes: 3h 45m
- Practical classes: 3h 45m
- Self study: 11h 15m
**Topic 4: Dynamics of N particles**

**Description:**
1) Third Newton's law.
2) Center of mass.
3) Momentum, torque and angular momentum.
4) Energy.
5) Collisions.
6) Bonds and ideal reactions.
7) Conservative systems.

**Full-or-part-time:** 28h 45m
Theory classes: 6h
Practical classes: 5h 30m
Self study: 17h 15m

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**Topic 5: The rigid body**

**Description:**
1) The rigid body.
2) Rigid body kinematics.
3) Rigid body Dynamics (2D).
4) Translational and angular kinetic energies.
5) Rigid body statics.

**Full-or-part-time:** 31h 15m
Theory classes: 4h 30m
Practical classes: 6h
Laboratory classes: 2h
Self study: 18h 45m

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**Topic 6: Small oscillations**

**Description:**
1) Small oscillations near the equilibrium.
2) Simple harmonic motion.
3) Damped harmonic motion.
4) Forced harmonic motion.

**Full-or-part-time:** 28h 45m
Theory classes: 4h 30m
Practical classes: 5h
Laboratory classes: 2h
Self study: 17h 15m
GRADING SYSTEM

NTOT = MAX(0.6 NEF + 0.3 NAC + 0.1 NLAB; 0.9 NEF + 0.1 NLAB)

NTOTR = 0.9 NEFR + 0.1 NLAB

NTOT: Subject’s final mark.
NTOTR: Subject’s final mark (re-evaluation).
NEF: Final exam mark.
NEFR: Final exam mark (re-evaluation).
NAC: Continuous tests’ average mark.
NLAB: Laboratory test mark.

EXAMINATION RULES.

Continuous tests will consist of a brief set of questions.
Final exam will consist of 2 parts. The first one will be a multiple choice test with closed questions (no justification needed). In the second part, each student will have to solve a series of exercises reasoning each answer.
Laboratory test will consist of a brief set of questions about how to measure and analyse experimental data.

BIBLIOGRAPHY

Basic:

RESOURCES

Hyperlink:
- Apunts de Mecànica fonamental (Manel Canales). https://upcommons.upc.edu/handle/2117/334815 - Classes virtuals de Mecànica fonamental (Xavier Jaén). Resource