SHORT DESCRIPTION AND JUSTIFICATION

Physics represents an essential part of any technical degree, as altogether with Mathematics is the foundation for the development of any scientific knowledge.

The subject aims to expose the student to the main physical models, with a problem-solving mind that leads to the appropriate techniques required to solve all assigned models, including the ability to make reasonable assumptions. The subject includes the following contents: units and physical magnitudes, mechanics of (non-deformable) solids and liquids, electromagnetism, waves and optics.

COMPETENCES

- That students demonstrate knowledge in the area of study, which is mostly constructed on the grounds of the general secondary education (high school). Even though this knowledge is usually at the level of advanced textbooks, it also includes some of the corresponding state-of-the-art. (CB1)
- That students have the ability to gather and interpret relevant data (normally within their area of study) to think over and make judgments on relevant social, scientific or ethical issues. (CB3)
- Be able to understand and apply basic knowledge of Mathematics, Chemistry, Physics and Biology to the field of Biotechnology. (E1)

PREVIOUS REQUIREMENTS *

Acquired competences from previous courses. It is recommended to have studied Physics and Mathematics during high school, as well as to have taken the Physics paper in the university access examination (Spanish PAAU or the equivalent in other countries).

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CONTENTS

1. Introduction.
   1.2. Parts of Physics.
   1.3. Physical measurements. Physical magnitudes and unit system.
   1.4. Dimensional analysis.
   1.5. Uncertainty in measuring. Errors and error propagation.
   1.6. Mathematics tools for Physics (System of coordinates; Vector algebra; Derivation and integration).

2. Kinematics.
   2.1. Movement and reference frames (Position, displacement and trajectory; Velocity and speed; Acceleration; Intrinsic components of acceleration).
   2.2. Types of movement (Non-accelerated motion in a straight line; accelerated motion in a straight line; Free fall and vertical throw; uniform circular motion).
   2.3. Composition of movements. Superposition Principle (Parabollic movement; horizontal throw).

3. Dynamics.
   3.1. Point Dynamics.
   3.2. Force concept and its measurement. Hooke’s law.
   3.3. Linear momentum and its conservation.
   3.4. Newton’s laws (First law or Inertia Principle; Second law; Third Law or Action-Reaction Principle).
   3.5. Dynamics of straight line movement. Apparent weight.
   3.6. Friction forces. Friction coefficient.
   3.7. Dynamics of circular movement.

4. Work and energy.
   4.1. Work done by a force.
   4.2. Energy. Relationship with work.
   4.3. Kinetic energy and work. First work-energy theorem.
   4.5. Second work-energy theorem. Conservation of the mechanical energy.
   4.6. Power and work.

5. Fluid mechanics.
   5.1. Hydrostatics (Liquid properties. Density; Pressure. Pascal’s principle; Fundamental equation of hydrostatics; Buoyancy. Archimedes’ principle; Surface tension and capillarity).
   5.2. Hydrodynamics (Equation of continuity; Bernoulli’s equation; Viscosity. Poiseuille’s law; Turbulence. Reynolds number).

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   6.3. Electric field. Force lines.
   6.5. Potential energy and electric potential. Equipotential surfaces.

7. Continuous electric current.
   7.1. Electric current. Microscopic model of the current.
   7.2. Resistance and electric resistivity. Ohm’s law.
   7.3. Electric energy. Joule effect.

   8.2. Magnetic force (Point charge. Lorentz’s law; Movement of a point charge in a magnetic field; Current-carrying conductor. Laplace’s law).
   8.3. Magnetic field (Biot-Savart’s law. Magnetic permeability; Magnetic interaction between two parallel conductors; Ampère’s law).

   9.1. Waves (Definition and types; Wave movement. Magnitudes; Armonic waves. Simple harmonic motion).
   9.2. Electromagnetic waves (Maxwell’s electromagnetic synthesis; Electromagnetic spectrum).

10. Geometric Optics.
    10.2. Reflection and refraction. Snell’s law.
    10.4. Lenses. Light convergence and divergence.
    10.5. Optical instruments. Microscope.
METHODOLOGY

LEARNING ACTIVITIES *

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>ECTS Credits</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>1.7</td>
<td>B1, E1</td>
</tr>
<tr>
<td>Case and Problem-Solving Sessions</td>
<td>0.4</td>
<td>B3, E1</td>
</tr>
<tr>
<td>Seminars</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Practical and Lab Work</td>
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<td>-</td>
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<tr>
<td>Presentations</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Personal Study</td>
<td>3.5</td>
<td>B3, E1</td>
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<tr>
<td>Assessment Tasks (Exams, Continuous Assessment...)</td>
<td>0.4</td>
<td>B1, B3, E1</td>
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<tr>
<td>TOTAL</td>
<td>6.0</td>
<td>B1, B3, E1</td>
</tr>
</tbody>
</table>

TEACHING METHODOLOGY

It is based on the next activities:

- **Lectures** - Presentation and explanation of contents by a teacher (possibly including demonstrations).

- **Case and Problem-Solving Sessions** - Resolution of exercises and problems, and exposition / discussion of cases by a teacher with the active participation of students.

- **Seminars** - Period of instruction carried out by a teacher with the aim of reviewing, discussing and resolving doubts about the materials and topics presented in the lectures and in the case and problem-solving sessions.

- **Personal study activities** - Personal work of the student necessary to acquire the competences of each subject matter, and to assimilate the knowledge exposed in lectures and case and problem-solving sessions, using the recommended reference materials. They also include the preparation of tasks related to the other activities, and the preparation of exams.

- **Assessment Tasks** - Oral and / or written tests made during the academic period of a course, or once it has finished (final exams, follow-up controls).

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ASSESSMENT METHODS *

<table>
<thead>
<tr>
<th>Assessment methods</th>
<th>Weight</th>
<th>Competences</th>
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</thead>
<tbody>
<tr>
<td>Final Exam</td>
<td>40%</td>
<td>B3, E1</td>
</tr>
<tr>
<td>Midterm Exam/s</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Continuous Assessment Activities</td>
<td>50%</td>
<td>B1, B3, E1</td>
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<tr>
<td>Reports and Presentations</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lab or Field Work</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Projects</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Host Student Evaluation</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Participation</td>
<td>10%</td>
<td>B1, E1</td>
</tr>
</tbody>
</table>

LEARNING OUTCOMES

- The student must show a theoretical basis of the main physics concepts (B1, B3, E1) [Final Exam, Continuous Assessment Activities].
- The student must show basic problem comprehension and solving skills (B1, B3, E1) [Final Exam, Continuous Assessment Activities, Participation].
- The student must correctly use the calculation and bibliographic tools applied to physical problems related with Chemistry, Biosciences and Chemical Engineering (B1, B3, E1) [Continuous Assessment Activities, Participation].

QUALIFICATION

Formative evidences: The final mark calculation will be based on the next elements:

(i) 5 questionnaires every two units, approximately; they will be done in class hours, yielding a mark CU. This mark will be the weighted average of all questionnaires:

\[ CU = 0.10 \times CU_1 + 0.15 \times CU_2 + 0.20 \times CU_3 + 0.25 \times CU_4 + 0.30 \times CU_5 \]

where \( CU_1, CU_2, CU_3, CU_4 \) and \( CU_5 \) are the final marks of each questionnaire.

(ii) 1 mid-term exam, yielding a mark CO.

(iii) 1 final exam, yielding a mark EF.

(iv) 1 participation mark PA. This mark will take into account: lecture assistance, seminar assistance, participation during class hours and/or participation in other follow-up activities to be delivered during the semester (either in person or virtual).

Calculation of the final mark: The final mark (NF) will be calculated according to:

\[ NF = 0.3 \times CU + 0.2 \times CO + 0.4 \times EF + 0.1 \times PA \]

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Requirements to pass the subject:

(i) To estimate the final mark, the minimum EF mark should be 3.5 over 10.
(ii) If NF is equal or greater to 5.0, the Student passes the subject; otherwise, the Student fails to pass the subject. As final mark, the Student’s file will show the lowest of all marks among CU, CO and/or EF.
(iii) If the Student fails on first instance, he/she has another chance to pass the subject through a second call (reset) exam. In such case, the final mark (NR) will be given by:

\[ NR = 0.2 \times CU + 0.1 \times CO + 0.6 \times ER + 0.1 \times PA \]

If NR is equal or greater to 5.0, the Student passes the subject; otherwise, the Student fails to pass the subject. As final mark, the Student’s file will show the lowest of all marks among CU, CO and/or ER.

ASSESSMENT OF THE COMPETENCES

To assess the competences, the marks of questionnaires (CU), mid-term exam (CO) and final exam (EF) will be used:

- Competence B1: 80% CO + 20% CU.
- Competence B3: 70% EF + 30% CU.
- Competence E1: 20% CO + 30% EF + 50% CU.

BIBLIOGRAPHY

- S. Burbano de Ercilla, E. Burbano y C. Gracia, "Física General". Ed. MIRA (Edición XXXI).

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FUNDAMENTALS OF PHYSICS

SUBJECT MATTER: Physics
MODULE: Basic
PROGRAM: Degree in Biotechnology

DOCUMENT HISTORY

PREVIOUS REVISIONS
April 16th 2013, Dr. Alberto Balfagón Costa.
September 9th 2013, Dr. Alberto Balfagón Costa.
September 5th 2014, Dr. Alberto Balfagón Costa.
July 15th 2015, Dr. Damián Monllor Satoca.
July 12th 2016, Dr. Damián Monllor Satoca.
May 31st 2017, Dr. Damián Monllor Satoca.

CURRENT REVISION
July 26th 2018, Dr. Damián Monllor Satoca.

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